observation in North Carolina;¹ accordingly, from a geographic or climatologic standpoint, there is no reason why a certain number of cases should not also exist in this state.

The part played by corn-meal in the etiology of this malady is, of course, still a matter of conjecture. But it does seem to me a point worth consideration that this patient had noticed that the eating of corn-bread always disagreed with him, so much so that he avoided eating it as much as possible and, furthermore, attributed his present condition to this article of food. Moreover, his father and two of his brothers were similarly affected by a corn-meal diet and, likewise, always avoided it. None of them, however, so far as the patient has any knowledge, were ever affected with any cutaneous disturbances similar to his. It would manifestly be very interesting to know if any of the other cases that have been reported can furnish anything to corroborate or disprove the conclusions this case might tend to establish. I am aware, however, of the fact that a case has been reported in which the patient denied ever having eaten corn-bread, corn-flakes, or hominy.

If corn-meal and its consumption has any etiologic relation to pellagra and if wheat retains its present high price, we may certainly expect an increasing number of these cases to appear, particularly, in certain regions of our country where the people are exceedingly poor and where wheat is not a staple product.

PELLAGRA

ITS OCCURRENCE IN THE COOK COUNTY INSTITUTIONS

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In the following paper I wish to report the occurrence of pellagra in fourteen patients of the Cook County Institutions, Dunning, Ill. Eleven were inmates of the Hospital for the Insane, one of the Hospital for Consumptives and two of the Infirmary.

The first case was observed in August, 1908, when the diagnosis of pellagra was as yet not made. With the subsequent occurrence of three other cases presenting the same symptomatology, course and fatal outcome, not being familiar with the occurrence of pellagra in the United States, we came to the conclusion that we were dealing with a clearly defined disease. A clue to the nature of these cases was offered in the description of pellagrous insanity in Bianchi's "Psychiatry." From the onset, the next case was thought to follow closely the description of Italian pellagra, but it was not until the inquiry of the South Carolina State Board of Health was addressed to us that the diagnosis of pellagra was definitely made.

In view of the prevalence of pellagra in the Southern states of North Carolina, South Carolina, Georgia, Alabama, Tennessee, etc., and in view of the fact that this disease existed in those states for twenty or thirty years before being properly diagnosed, the importance of its recognition in other parts of the United States is self-evident.

The reports of its occurrence in the Northern states, as accurately as can be determined from the literature and from replies to letters of inquiry concerning its prevalence addressed by C. F. Williams, Secretary, South Carolina State Board of Health, to the superintendents of the state hospitals in the United States, have been limited to the following:

Two cases reported by Gray of Utica, N. Y., and Tyler of Somerville, Mass., in 1864.

Two cases reported by Thayer of Baltimore, Md., in 1909.

One case in Pennsylvania.

Few cases in New York.

One or two cases in Maryland.

This relative infrequency of pellagra in the Northern states gives special importance to its occurrence in Illinois.

Following the numerous recent reports on this condition, the description of the disease and the report of the Cook County cases will be made as concise as possible.

Pellagra was probably first recognized in Spain in 1735, when it was described by G. Casal, who termed the condition *mal de rosa*. It appeared in Italy in 1750. In 1771 Frappoli called attention to this condition in Lombardy, where the peasants called it *pell' agra*. About 1810 Marzari called attention to the relation between maize and pellagra, and in 1844 Balardini first suggested that the disease might be due to the ingestion of diseased corn, which view has been confirmed and upheld by Lombroso.

The disease is prevalent in Roumania and Italy; in the latter there are about 100,000 patients, of which, according to Tuczek, 10 per cent. are mentally affected. In Roumania there are about 30,000 cases. The disease is also found in Spain and Upper Egypt, and cases are reported in Austria, Servia, Bulgaria, Africa, Mexico, South America, and lately in the United States.

The first to report pellagra in the United States were Gray of Utica, N. Y., and Tyler of Somerville, Mass., in 1864. Since that time there have been but few reports on this condition until recently. Since the report of Searcy of Alabama in 1907, there have been numerous contributions to the literature. Dr. C. H. Lavinder¹ has reported to the Surgeon-General a conservative estimate of 1,500 cases in the South since 1906.

Aside from the predisposing cause of alcoholism, previous illness, poor hygienic surroundings, poverty, venereal excess, etc., it is the accepted opinion of most Italian students that pellagra is a disease caused by the eating of spoiled maize, constituting an intoxication from the toxin produced by the growth of fungi in corn. There has lately been dissenting theories introduced, among the strongest of which is Sambon's, who presents numerous points against the maize theory. Suffice it to say that the etiology and the pathogenesis of pellagra is as yet an open question, but that corn may bear the same relation to pellagra as swamps do to malaria and yellow fever.

The pathology is not characteristic and may shortly be said to consist of changes of cachexia, such as wasting of the adipose and muscular tissue, fragilitas ossium, atrophy, fatty degeneration of the heart, liver, kidney and spleen, abnormal pigmentary deposits in the ganglionic cells, muscles of the heart, spleen and liver. Changes in the intestines consisting of atrophy of the muscular coat, hyperemia and ulceration.

The nervous system shows at times hyperemia, at other times anemia and edema, inflammatory changes in the coverings, degeneration in the lateral columns in the dorsal region and of the posterior columns in the cervical region. Lombroso says that the spinal cord changes remind one of incipient tabes.

The skin lesion shows (1) congestion, (2) thickening pigmentation, (3) atrophic thinning.

1. Lavinder, C. H.: Public Health Reports, June, 1909, *xxiv*, No. 25.

Of the symptoms, those belonging to the alimentary tract, skin and nervous system are the most prominent, but will here be but briefly considered. The disease usually begins with gastrointestinal disturbances, followed by erythema of the skin, and later by nervous manifestations. The gastrointestinal disturbance manifests itself by nausea, sometimes vomiting, ptialism, loss of appetite and, most important, by diarrhea. Stomatitis is one of the most marked and constant symptoms. The mucous membrane is red, aphthous ulcers develop and patches of macerated epithelium exfoliate, leaving a raw surface beneath.

The cutaneous symptoms are characteristic; the lesion consists essentially of an erythema appearing symmetrically and usually on the exposed parts of the body, especially the extensor surfaces, backs of the hands, forearms, neck, etc. It begins with redness and some puffiness. The redness becomes more cyanotic and is sharply demarcated. The surface of the skin becomes dry, harsh and scaly, exfoliating in flakes or scales. In some cases bullæ occur and with severe desquamation leave large denuded surfaces. The skin afterward assumes a dark color, from plum to brownish black; cracks and fissures form. After desquamation the skin appears thin and atrophied, with superficial wrinkles, at times having an appearance of striæ. The lesion is always sharply demarcated and on the hand usually leaves the distal phalanges uninvolved, ending at about the middle third of the forearm, seldom extending to the flexor surface.

Among the mental and nervous symptoms may be mentioned vertigo, neuralgia, partial paralysis, tetany-like conditions, tremors with variability of deep reflexes from increased to diminished and lost. Psychical manifestations usually take the form of melancholia, but maniacal attacks may occur.

Fig. 1.—Hands of patient 13.

The disease is essentially of chronic nature, in some cases lasting for twenty years, interspersed with spring exacerbations; it is met with in acute and chronic conditions. The acute, which is most commonly observed in the United States, is often fatal, running its course in a few weeks, but probably should not be called "acute pellagra" inasmuch as it is possible that it is but an acute exacerbation of a chronic process.

In the diagnosis of this condition there may be considered the various grain and food poisonings, lichen and similar skin lesions, scurvy, leprosy and beriberi, etc.

The prognosis is usually serious and the mortality in the United States unusually high.

The treatment up to date has been of little avail. Removal of corn from the diet and substitution of a nutri-

tious diet of medicinal remedies—all have been of small benefit. Arsenic, quinin, strychnin and iron have been used; of late atoxyl has been vaunted as a cure, but the probability is that it, too, is of little avail.

From the cases arising in this institution the following interesting facts may be determined:

The entire number was fourteen:

Females, 10; all insane.

Males, 4; 1 insane; 2 in the poorhouse, 1 in the hospital for tuberculosis.

The duration of the fatal cases averaged 37 days.

The duration in the remaining cases averaged 34 days.

The nativity was as follows:

United States	5
England	1
Ireland	3
Bulgaria	1
Germany	2
Denmark	1
Unknown	1

Fig. 2.—Patient 14.

Of those foreign, the Bulgarian was in this country six months. The others ranged from eight to thirty years. They had been confined in the institution from one to twelve years.

Their psychoses at time of admission were as follows:

Dementia paralytica	3
Alcoholic	1
Dementia præcox	2
Paranoia	3
Acute confusional	1
Melancholia	1

The symptomatology has been fairly uniform, all presenting the syndrome of stomatitis, dermatitis, and diarrhea. The cases had an onset with some malaise, indifference, and loss of appetite; they exhibited during the course some ptialism, progressive weakness, choreiform movements, mental symptoms of depression to stupidity, and increasing dementia, refusal to eat, and in some cases dysarthria and dysphagia. Of the patients who died, one died of apoplectic convul-

sions of dementia paralytica, one in a low muttering delirium, associated with stupor and choreiform movements, one of respiratory failure, one probably of pneumonic tuberculosis, and one of inanition of carcinoma of the stomach; the others of exhaustion.

The treatment in the first six fatal cases did not include arsenic. In the later cases arsenic was given hypodermically in the shape of Fowlers solution, omitting the compound tincture of lavender. The course in these later cases has not been so severe and the results are slightly promising.

The pathology of those cases in which we were able to obtain postmortem examinations will be described for the most part in gross as we have as yet not examined sufficiently fully the microscopic findings to report in this article.

CASE 1.—L. F., female, admitted May 29, 1907, aged 38, born in the United States. Physical condition on admittance good. Psychosis, paranoia. Previous history negative. Mental status previous to onset of pellagra that of systematized delusions of persecution by spirits and hallucinations of hearing.

May 6, 1908: Patient developed a dermatitis of hands, face and neck. With the onset of the skin condition the patient became irritable and suspicious and failed physically rapidly.

Aug. 15, 1908: Skin had become brawny and thickened, covered with whitish scales. Patient had become untidy.

Aug. 24, 1908: Patient developed a slight endocarditis. Breath was fetid; mouth and teeth well covered with scaly layer of putrid material. Patient had a slight evening fever; died of acute endocarditis.

CASE 2.—A. C., female, admitted 1903, aged 34, born in the United States. Former admission in 1902. Physical condition on admission good. Psychosis paranoia. Mental state that of systematized delusions and poor emotional control; vicious and revengeful. Until 1908 condition remained unchanged.

Oct. 23, 1908: Patient had been failing lately and had developed frequent attacks of diarrhea. A scaly condition of the hands had appeared. Patient was losing weight; had become untidy and greatly demented.

Oct. 29, 1908: Dermatitis was now well marked, symmetrical, hard, reddened and scaly, having sharply defined borders, appearing on the backs of the hands and neck. Patient refused food and had a severe stomatitis.

After presenting a progressive course of increasing weakness, diarrhea, stomatitis, with increasing dementia and untidiness, patient died on Nov. 19, 1908, of exhaustion.

CASE 3.—M. R., female, admitted May 24, 1906, aged 32, born in Ireland; physically, suffering with chorea; otherwise in good condition. Psychosis acute confusional insanity. Mental condition that of restless confusion.

Sept. 28, 1908: Patient had been failing in flesh lately; had become very destructive and much demented. Skin showed a dermatitis of hands and face which was symmetrical in distribution. After running a course of increasing weakness with diarrhea and dermatitis, patient died on Oct. 10, 1908, of exhaustion.

CASE 4.—M. A., female, admitted April 9, 1908, aged 45, born in the United States. Physical condition that of paresis. Psychosis dementia paralytica.

May 26, 1908: Patient failing mentally and physically; was generally weak, dull and apathetic.

Oct. 27, 1908: Patient had many stuporous attacks lately; had become very untidy. A symmetrical dermatitis developed on dorsal surfaces of the hands, which were hardened, pigmented and fissured. The face showed a marked seborrheic condition; a vaginitis was likewise present.

Nov. 11, 1908: Patient had developed a severe diarrhea and stomatitis; had irregularly occurring attacks of vomiting and was gradually failing.

Nov. 29, 1908: Patient had an apoplectiform convulsion of the right side; developed edema of the lungs and died.

CASE 5.—M. F., female, admitted March 1, 1897, born in Ireland. Physical condition on admission, good. Psychosis melancholia. History negative except for the patient having used a great amount of alcohol.

December, 1905: Physical condition good. Patient had numerous delusions of persecution.

Feb. 27, 1909: Patient had been failing in health lately and had become rather unsteady in her gait.

March 20, 1909: Patient had developed a dermatitis of both hands, the dorsal surfaces of which were symmetrically hardened and fissured. Patient was becoming more demented.

March 27, 1909: Patient was in a semistuporous condition; had marked dysarthria and dysphagia, marked stomatitis, teeth covered with sordes. Ptyalism was marked. Patient exhibited incoordinate movements of upper extremities and an inability to stand. There were no paralyses; knee-jerks were absent; plantar reflexes normal, abdominal reflexes absent. Pupils were equal; reacted to light and accommodation. Electrical reactions were unchanged.

March 31, 1909: Patient had been having a slight evening fever with rapid pulse which was compressible and irregular.

April 14, 1909: Patient developed a diarrhea. Dermatitis was more marked; the skin was fissured, desquamation taking place, exposing raw red surfaces.

April 19, 1909: Patient, after having failed rapidly and exhibiting marked incoordinate movements of arms and legs, died.

CASE 6.—L. C., female, born in United States, aged 40, admitted May, 1904. Psychosis dementia præcox. Previous history negative. Physical condition on entrance negative. Psychically a low grade idiot.

January, 1908: Patient in fair physical condition.

June 7, 1909: For the past two weeks patient had developed a dermatitis of both hands, face and neck, which began as an erythema, becoming hardened, scaling, leaving the exposed surface moist. The lesion was symmetrical, involving the dorsal surfaces of the hands and wrists and a butterfly-like involvement of the face spreading from the nose and one patch over each sternocleidomastoid. The patient was in poor general condition; had a general adenopathy. Heart and lungs negative. Nystagmus on lateral movements of the eyes. A double Oppenheim and Gordon but no Babinski. Knee-jerks were increased; a double ankle-clonus and knee-clonus were present. Active movements of both upper and lower extremities were negative. Passive movements were negative except for a double Kernig's sign.

June 9, 1908: Patient, after lying in a semicomatose condition for the past two days, died of respiratory failure, after having once been resuscitated by artificial respiration.

CASE 7.—E. S., female, born in Germany, admitted October, 1908, aged 28. Physical condition on admission good. Psychosis dementia præcox. General mental status previous to onset of pellagra that of depression, refusal to eat, and fear.

June, 1909: Patient had become more demented and was fed with great difficulty. Physical condition about the same.

July 5, 1909: Patient had developed a symmetrical dermatitis of the dorsums of both hands and wrists. The lesion over the hands consisted of a sharply demarcated thickening and redness and scaling, leaving a glazed surface exposed. There was a similar lesion over the back of the neck. A moderate stomatitis was present, consisting of excoriations with the presence of several small whitish ulcerations. The epithelium was piled up and desquamating. The tongue was red and glazed, the papillæ were prominent. Heart and lungs were negative. Patient had slight diarrhea and was very weak. Mentally, she was much depressed and cried a great deal.

July 12, 1909: Patient had during the past week been failing rapidly. The stomatitis was worse, the dermatitis stationary. Ptyalism was marked and dysphagia and dysarthria were present. Patient complained of burning pain extending from her throat to her stomach; had a slight evening fever.

Aug. 1, 1908: Patient was beginning to improve; stomatitis was less severe. The slight diarrhea that was present had disappeared and the skin lesion was fading away.

August, 1909: Patient continued to improve; diarrhea had disappeared, stomatitis subsided and patient was much more cheerful, taking nourishment willingly.

CASE 8.—F. S., female, born in the United States, admitted June, 1908; aged 30; married. Physical condition on admission good. Psychosis dementia paralytica.

June, 1909: Patient complained of pain in the stomach and loss of appetite; had a slight redness of the skin of the hands.

July, 1909: Patient had a symmetrical dermatitis of both hands, one patch on each side of the neck, moderate stomatitis and a slight diarrhea. After running a slight course of diarrhea, with progressing weakness, she began to improve, the depression being replaced by exaltation, the skin lesion disappearing and the stomatitis subsiding.

CASE 9.—M. O'D., female, admitted April, 1909, aged 32, born in England. Physical condition on admission poor; marked anemia. Psychical diagnosis, dementia paralytica. General mental condition before onset of pellagra, marked depression, confusion and emotional instability.

July 1, 1909: Patient had become very resistive; refused food, had failed physically.

July 5, 1909: Patient had developed a symmetrical dermatitis of both hands and wrists; a similar condition was present on the sides of the neck. There was a marked stomatitis; slight diarrhea was present. Knee-jerks were exaggerated. Patient refused food and had to be tube-fed. Lungs showed slight dulness in both apices with roughened breath sounds but no râles.

July 18, 1909: Patient was rapidly failing. Stomatitis was very severe. The skin lesion was, however, becoming less marked. All the glands were enlarged. The diarrhea had subsided. Patient remained resistive and refused food.

July 29, 1909: After having progressively failed, despite the improvement in the condition of the skin and mouth, patient had developed signs of a pneumonic infiltration of the right lung with high temperature, rapid respiration and rapid weak pulse, and died on Aug. 1, 1909.

Postmortem Examination.—An extremely emaciated woman. Inguinal glands enlarged; abdominal cavity free from fluid; adhesions surrounding gall-bladder extending to the pylorus, duodenum and transverse colon; adhesions between spleen and parietal peritoneum and between uterus and rectum. Left pleural cavity free from adhesions; right pleura firmly adherent to lung; pericardial cavity contained 15 c.c. of clear fluid; left heart contained a goose-fat clot. Heart practically negative. Lungs: Right upper lobe showed solidification, with old cavity formation. The wall of this was in some places gangrenous and in others cheesy; and the remainder of the lobe contained a large amount of fibrous tissue. The middle lobe and lower lobe showed marked consolidation. The left lung was emphysematous and contained patches of fibrosis. Liver showed some fatty changes. An accessory spleen was present; spleen showed scattered hemorrhage spots. Pancreas was negative. Kidneys were very pale, 260 gm.; glomeruli white and glistening. Stellate veins showed prominently; pyramids pale with considerable fibrous tissue. Aorta showed several ulcerated plaques in descending portion of the arch. Small intestines showed Peyer's patches to be rather plain. In the large intestine the mucosa was injected, otherwise negative. The mesenteric glands were enlarged. Left ovary cystic. Dura mater negative. Small amount of cerebrospinal fluid; no granulations in the fourth ventricle; very little edema of the pia mater. Along the posterior border of the dura from the third dorsal to the mid-lumbar was collection of half-organized material, yellowish in color, with several small hemorrhage spots.

CASE 10.—M. W., female, admitted March 8, 1908, aged 46, married, born in Germany. Physical condition on admission fair. Psychosis paranoïa. History negative.

Dec. 9, 1908: Patient showed on examination a partial heart-block and an infiltration of both apices. The sputum, however, did not show the presence of tubercle bacilli.

Aug. 6, 1909: Patient developed a symmetrical dermatitis of both hands, with the onset of malaise, loss of appetite and stomatitis. Patient also had a slight diarrhea.

Aug. 13, 1909: The patient was greatly improved. The skin lesion was clearing up and the stomatitis had disappeared.

CASE 11.—J. McC., male, admitted June 1, 1905, aged 40, born in Ireland; lived in the United States for twenty-two years. Physical condition on admission good. Psychosis alcoholic insanity. History negative, except for being an excessive alcohol user and having had caisson disease several times. Patient after admittance had an annual attack of diarrhea, not of great severity and lasting but a short time.

July 29, 1909: Following a slight attack of diarrhea, patient developed a slight redness and scaling over the knuckles of both hands. This lesion extended over the dorsal surfaces of both hands and, although not involving a great area, the distribution and its typical appearance left no doubt as to the diagnosis of pellagra.

Aug. 15, 1909: Patient was much better, the skin lesion was disappearing and the diarrhea had subsided.

CASE 12.—W. G., male, patient of the poorhouse, admitted 1902, aged 60, born in Denmark. Previous history negative.

May, 1909: Patient developed diarrhea which lasted off and on until July 15 when he noticed a scaling of the backs of both hands. For the following three weeks the diarrhea was of very severe nature; the dermatitis increased in severity and stomatitis developed.

Aug. 8, 1909: The dermatitis was symmetrical, involving the dorsal surfaces of both hands and wrists; there was scaling and thickening. The diarrhea was not so severe and patient was comfortable.

Aug. 21, 1909: Patient was up out of bed; the dermatitis had disappeared, leaving a slightly pigmented, scaly skin; diarrhea was absent.

CASE 13.—F. B., male, poorhouse patient, admitted Aug. 11, 1909, in a semicomatose condition, suffering with pellagra; aged 65; painter by occupation. Nativity unknown.

When admitted patient had a symmetrical involvement of both hands and arms by a dermatitis characterized by a brawny induration and redness with some scaling. The patient stated that previous to his admission he suffered with loss of appetite and abdominal pains. Since that time he had had loose but infrequent bowel movements, is failing rapidly and is in a very clouded state of mind. Besides the lesion on his hands there is a slight abrasion of skin over both ankles. He has marked rigidity in both upper extremities and his movements are decidedly incoordinate. Knee-jerks are exaggerated, elbow-jerks and wrist-jerks are exaggerated.

CASE 14.—S. J., male, patient in the Hospital for Consumptives; Bulgarian; in the United States seven months; admitted to the institution June 18, 1909; aged 38. About three weeks after admission to the hospital it was noticed that the patient had a symmetrical dermatitis of the dorsal surfaces of both hands and wrists which were red, rough and swollen. There was also present a well-marked stomatitis and salivation. The tongue was red and the papillae were prominent. The patient was suffering from carcinoma of the stomach and showed an abdominal scar from an operation. He could not retain his food and was rapidly failing.

He died Aug. 3, 1909, of inanition from carcinoma of the stomach.

Postmortem Examination.—This showed cyanotic induration of both lungs with areas of bronchopneumonia. The stomach, large and small intestines and the spleen and liver were matted together in a mass by old and very firm adhesions. When these were cut through, there was found a large medullary carcinoma of the stomach involving the larger part of the anterior and posterior surfaces and the curvatures of the stomach, and surrounding and almost occluding the pylorus. The liver, kidneys and intestines, heart and spleen were negative. The cerebrospinal system was likewise negative to the naked eye.

In conclusion, it may be proper to mention a few of the differences pointed out by Babcock² between the pellagra of the United States and the Italian pellagra; in the United States the notable points are:

1. Overwhelming number of women attacked.
2. Great mortality of the disease.
3. Invasion of unexposed portions of the body by the dermatitis.

Recognizing the futility of treatment and the prevalence and apparent progression of pellagra in the United States and realizing the enormous food value of corn, it can readily be seen that the subject is one of greatest

2. Babcock, J. W.: Jour. South Carolina Med. Assn., February, 1908, Vol. IV.

importance and deserves the deepest study and research. I am indebted to much of the recent literature on this subject for material for this report. A complete bibliography of the literature in the United States may be found in the Public Health Report of June 18, 1909.

I am indebted to Dr. Hamill and Dr. Moore for their kindness in permitting me to use their cases.

LAKE MICHIGAN WATER FOR DRINKING PURPOSES*

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Lake Michigan occupies a hole scooped out by glacial ice. It is not a natural valley, and in consequence the rivers which drain into it are short and discharge very little water. This is true of the south end and the west shore. On the east shore the St. Joseph, Grand, Muskegon and Manistee are fairly long and carry a fair volume of water. The first two of these drain rather populous areas and their waters reach the lake quite polluted. The banks are seldom sloping and the drainage of storm water does not run directly into the lake except for the distance of a few feet back from the water-line. These factors protect the lake against pollution and therefore argue for the use of its waters for drinking. It is a soft, fresh water and cold.

The other side is this: Counting Chicago, 2,000,000 people either live on the shores or so near thereto that their sewage reaches the lake after a short flow. Just now this population is increasing at the rate of 100,000 a year. In no single instance is any of this sewage properly treated before being discharged and in but few instances is it treated at all.

The tonnage of Lake Michigan shipping is very heavy. The ships carry both freight and passengers. The excursion business between Chicago, Milwaukee, St. Joseph, Benton Harbor and Michigan City is very heavy. A single ship will carry from a few hundred to a few thousand passengers, and the water intakes are usually steering points. Near the water intakes are the points of maximum discharge of feces and urine, as none of these ships have holding devices, or rules as to the closing of closets, and the zones around the intakes are not restricted navigation zones. These waters are more dangerous than salt waters, in that the same water is used for sewage, navigation and drinking purposes. They are less dangerous than ocean waters in that we do not have the shore and wharf pollution action of the tides. The soft waters differ from the salt waters in their action on sewage and different trade wastes. Our fresh water *per se* has no restraining action on the growth of bacteria nor does it modify the chemistry of materials deposited therein.

The Chicago sewage from the south line of Evanston to Eighty-fifth Street on the south now flows into the drainage canal and thence ultimately into the Gulf of Mexico. South of Eighty-fifth Street we now have about 150,000 people whose sewage flows into the Calumet River and then after a short flow into the lake. This sewage is not purified before it is discharged into the river. The same stream also discharges the sewage of Hammond, Ind. (20,000); Whiting, Ind. (10,000); East Chicago and Indiana Harbor (20,000); Gary, Ind.

(10,000). On account of the rapid growth of these just-over-the-line sources of contamination, it is safe to say that within five years the polluting population will be 200,000. If we add to that the Calumet Valley population in Illinois, in five years we have 400,000 people. For all of these reasons raw sewage must be kept out of Lake Michigan.

The normal water of Lake Michigan twenty miles from shore contains eight bacteria per c.c. and no colon bacilli. There are no uniform currents in the south end of Lake Michigan. The surface current always flows with the wind. A flow of five to seven miles is not enough to purify a large volume of sewage. The time required for a flow of this distance is not enough for purification. The oxygen content of the water is not high enough to purify in this length of time. The saprophytic bacteria are less and less active as the medium is diluted with fresh water. Though a sewage stream holds together quite definitely for three to five miles, wave action limits the efficacy of sedimentation. There is not much fauna and still less flora in these waters.

Generally speaking, these soils of the communities just mentioned are underlaid by a deep stratum of strong sulphosaline water unfit for general drinking purposes. The shallower soil strata do not yield water enough to sustain large populations. The streams to the west and south are altogether insufficient for water purposes. The streams on the east shore are highly polluted. There are no mountains or other high places even fairly satisfactory for water reserve purposes. The waters of Lake Michigan must furnish the drinking-water for these large and growing cities. Therefore the waters must be kept pure.

Chicago has had a typhoid death rate of over 175 per 100,000. Last year it fell to 15.5. That was the lowest in the history of the city. The first five months of this year are lower than the corresponding portion of last year or any other year. The typhoid death rate of the other Lake Michigan cities is high—higher than the American average. The Milwaukee average for five years (1904-1908) was 21.9 per 100,000; Michigan City goes to 40; Hammond, Whiting, East Chicago and Gary range around 70, and some years 90 to 140. These are illustrations of averages around the lake. Escanaba, Grand Rapids, in Michigan, and Sheboygan in Wisconsin average quite high. Waukegan and Racine are far above the average. Therefore the condition is not remote and to be dreamed about. It is immediate and to be acted on.

Lake Michigan is the common charge of the national government, the state governments of Wisconsin, Illinois, Indiana, Michigan, and also of the large centers of population located on the shores.

Acting on a conception of these responsibilities in May of 1908 the Mayor of Chicago asked for the appointment of members of the Lake Michigan Water Commission on the following basis:

Representatives.	
The Public Health and Marine-Hospital Service.....	1
The Engineering Corps of the War Department	1
The State of Wisconsin	1
Milwaukee	2
Illinois	1
Chicago	3
Indiana	1
Indiana cities, located on Lake Michigan	1
Michigan	1
Grand Rapids, Mich.....	1

The commission is now composed of Major Judson, Mr. Hill and Professor Sackett, engineers; Professors

*Read in the Section on Preventive Medicine and Public Health of the American Medical Association, at the Sixtieth Annual Session, held at Atlantic City, June, 1909.