nomena which are closely in accord with those seen in pathologic conditions of much greater moment. The most important, possibly, of these appearances is that of the evidence of residue—residual bismuth remaining in the stomach after the lapse of an empirical interval allowing, say, six hours to elapse, as a fair interval of time in which the stomach may empty itself. We shall get the Roentgen evidence of residue in the following conditions based, of course, upon either a deficiency in the peristaltic driving-power or the presence of an inhibitive influence at the portal of exit—the pylorus:

- a. Esophageal delay (not constant).
- b. Gastroparesis with atony (not constant).
- c. Gastrectasis (not constant).
- d. Carcinoma pylori (constant).
- e. Gastric ulcer callous or cicatrizing (generally constant).
- f. Old ulcer in the lesser curvature of the pars media (generally constant).
- g. Old ulcer of the lesser curvature of the pars pylorica (generally constant).
- h. Old pyloric stenosis due to ulcer or carcinoma on an old ulcer base (constant).

Holzknicht, who has carefully classified these instances in which residue occurs and even tabulates the shape of the residue with regard to its pathological significance, says, that a residue, after six hours, points indubitably to an organic obstruction at the pylorus. In so far as his observations have as yet shown him, the writer cannot quite agree with this literal statement. He would qualify his disagreement, however, by saying that, in a case of a nature apparently atonic, a residue after six hours would lead him to be extremely circumspect as regards the pylorus and to seek further evidence as to its patency.

These gastric conditions of ptosis and ectasis, together with the same situations involving the large intestine, have become of much clinical importance during the past few years. The day is past when nephroptosis was the most important subdivision of the pathological complex described by Glénard, especially from the surgical point of view. There has been a great deal of therapeutic good already done both surgically and medically through the information obtained by the rational and intelligent employment of the Roentgen rays diagnostically in this subdivision of Glénard's disease.

(To be continued.)

THE PREVENTION OF WATER-BORNE DISEASE IN LAKE AND RIVER TRAFFIC.

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To prevent the spread of water-borne diseases in lake and river traffic it is necessary to keep sewage-polluted water out of reach of the passengers and crew. The difficulty in effecting

this may be appreciated in considering the sources of supply available for use. What are the sources of water supply available for the use of passengers and crew? These may be classified as follows:

1. The lake or river itself.
2. Water tanks of the vessel.
3. Public water supply at ports of call.

RIVERS AND LAKES AS SOURCES OF SUPPLY.

The rivers and lakes used as highways of commerce are usually polluted to such an extent that their use in the raw state for drinking purposes is decidedly dangerous. The water of any of our navigable rivers is probably unfit for drinking without purification throughout its entire navigable length. The water in the Great Lakes because of the enormous storage is relatively pure at considerable distances from shore.

CHARACTER OF THE WATER OF LAKE SUPERIOR.

The water of Lake Superior is of excellent quality and safe for drinking purposes if it can be drawn from a point beyond the zone of pollution which surrounds the water front of the cities. Even here, however, the zone of pollution varies with the effects of storm and flood and of winds and currents, so that to be sure every day in the year of being outside of the ever-changing boundary of this polluted zone it would be necessary to go considerable distances from shore. In this deep lake the placing of such an intake would often present engineering difficulties and necessitate expenditures which would be in excess of the cost of other methods of rendering the water safe.

LAKE HURON AS A SOURCE OF WATER SUPPLY.

As a source of water supply Lake Huron is ideal. Its enormous storage capacity insures storage for years of the amount of water flowing into it. In other words, if all inflow were stopped it would take years for this great basin to empty itself by losing daily the present average daily flow through its only outlet, the St. Clair River. This fact of enormous storage, with the sedimentation and great dilution afforded, narrows the question of sewage pollution to one of local significance so far as Lake Huron is concerned.

Owing to the enormous volume of water in Lake Huron and to the small size of the communities situated thereon sewage pollution does not alter the general quality of the lake water, except for a few miles in the vicinity of the sewer outfalls. The sewage of the cities in the Saginaw Valley constitutes an exception. The polluted Saginaw River, emptying into Saginaw Bay, renders the waters of Saginaw Bay unfit for drinking purposes without treatment or filtration. This pollution at certain seasons would be evident because of currents and the shallowness of the bay for many miles. Outside of Saginaw Bay and Thunder Bay, in the vicinity of

Alpena's sewers, the water of Lake Huron receives only a negligible quantity of pollution, and should be of excellent quality.

LAKE MICHIGAN AS A SOURCE OF WATER SUPPLY.

Lake Michigan is 307 miles long and has a maximum width of about 118 miles. The maximum depth is 870 feet. The storage capacity is enormous, and its power to oxidize and purify organic matter can scarcely be overestimated. The effect of storage of Lake Michigan water is accentuated by the comparatively small outflow (an average of only 57,000 cubic feet per second through the Straits of Mackinac). For example, compared with Lake Huron, the area of water surface is nearly the same—over 22,000 square miles—and the maximum depth in Lake Michigan is about 100 feet deeper than that of Lake Huron. The outflow of Lake Huron at Port Huron is about 210,000 cubic feet per second, while the outflow from Lake Michigan is only about one-fourth as much. This means longer retention of polluted inflow from rivers and sewers and more opportunity for purification before discharge through the Straits at Mackinac. It would take Lake Michigan many years to empty itself at its present rate of outflow if all inflow were prevented. Under these circumstances the quality of Lake Michigan water must be good, provided we can get it far enough from the polluting inflow of rivers and sewers. Unfortunately, the zone of polluted water extends a considerable distance out into the lake from the water fronts of the cities and the mouths of the large rivers, and this zone of pollution has no constant boundaries because of currents due to wind and flood, but extends under unusual weather conditions far beyond the point which seems safe in quiet weather.

LAKE ERIE AS A SOURCE OF WATER SUPPLY.

The importance of Lake Erie as a source of public water supply cannot be overestimated. At present there is an urban population on the United States shore of a million and a half of people. The density of population is bound to increase, and scarcity of other adequate supplies makes the adjacent population dependent upon the lake for water supplies for all time to come. Lake Erie contains 17,500,000 million cubic feet of water, which affords storage for the water discharged into it for about 920 days.

This great natural reservoir, with capacity for 920 days' storage, assures a high degree of purification by natural agencies, such as dilution, aeration and sedimentation, besides affording the storage time necessary to permit of the natural death of pathogenic bacteria. The ability of the natural agencies operating in the lake to render sewage innocuous is very great, so that water at the center of the lake is comparatively pure.

Where the sewage in great quantity is poured into the lake, especially near the mouths of riv-

ers upon which large cities are situated, the zone of polluted water is wide and a greater distance toward the lake center must be traversed before pure water is secured. With the growth of urban populations on the lake shore, this zone of polluted water is continually widening, and waterworks intakes have been repeatedly moved farther out to secure better water. In the danger of polluted water entering waterworks intakes there is another factor besides the ever-widening zone of polluted water, viz. the action of currents, which renders the boundaries of the polluted zone extremely variable.

LAKE ONTARIO AS A SOURCE OF WATER SUPPLY.

Although Lake Ontario is the smallest of the Great Lakes in superficial area, it contains a much greater volume of water than Lake Erie, because of its greater depth. The maximum depth of Lake Ontario is 738 feet. The area of the water surface is 7,243 square miles. Allowing an average depth of 250 feet, the storage capacity of the lake would be 50,480,812,800,000 cubic feet. The discharge from the lake by the St. Lawrence River is about 250,000 cubic feet per second, or 21,600,000,000 cubic feet per day. At this rate of discharge, Lake Ontario would require 2,337 days or over six years to empty itself if all inflow were stopped. This is a conservative computation and it may be reckoned that given proportions of water contributed to the lake at the western end will have the benefit of over six years' storage before making their exit into the St. Lawrence River. This means that the water in Lake Ontario is capable of purifying an enormous amount of organic matter and that with the existing pollution the water should be pure outside of the zones of pollution surrounding the water fronts of cities and the mouths of large rivers.

The connecting rivers between the Great Lakes are all polluted by sewage, and their currents and length are such that natural purification is ineffective and does not render them safe as sources of supply without further treatment.

It will be apparent at once that water taken from the rivers without treatment is unfit for drinking purposes, and safe water can be consistently obtained from the lakes only by avoiding the shore pollution. This necessitates taking water many miles from shore, as the boundaries of the shore pollution are very variable owing to winds and currents.

It is a very difficult matter to restrain ignorant or careless individuals from drinking unfiltered surface water and numbers of the crew, and sometimes passengers on our river and lake steamers have no hesitancy in drinking water direct from the river or from the lake within a few miles of shore. These people cannot be restrained by law or regulation. The only remedy is a campaign of education showing the dangers of untreated surface supplies.

WATER TANKS OF VESSELS.

The water tanks of vessels may and often do contain polluted water. The river steamers often carry water obtained at some of the ports of call or may fill their tanks from the river itself. The lake steamers may secure their supplies from ports of call, but frequently take their supplies from the lake itself. They usually fill their tanks while in midlake where the water is comparatively pure. That they do not always do this is attested by at least one very serious outbreak of typhoid fever on a lake steamer.* It is said that this vessel filled its tanks in the Detroit River not far below the city of Detroit. If we permit the custom of filling tanks in midlake we must necessarily place implicit trust in the ships' officers. This has resulted in disaster, as cited above, and we never know when it may occur again, either due to ignorance or carelessness.

Another danger exists in the use of foul sea cocks and pipes. The great danger from this source was pointed out by Surgeon J. O. Cobb† of the U. S. Public Health Service.

It is frequently the custom to use the same system of sea cocks and pipes for drawing the polluted water from harbors and rivers while in port and for filling the water tanks in midlake.

PUBLIC WATER SUPPLIES OF PORTS OF CALL.

Not only are the public water supplies of ports of call frequently the source of supply for vessels, but they are also furnished to the interstate visitors who land in such ports.

In regard to public water supplies, the conditions which make disaster possible where the source of public water supply is polluted are two, viz.:

1. Failure to purify.
2. Inefficiency of the purification.

The failure to install a purification plant is usually due to an undue confidence in a water supply which is safe "most of the time." It is difficult for some officials to understand, without a severe lesson, that it is not sufficient to have a water supply that is safe for 360 or 361 days in the year, and to these officials it seems scarcely justifiable to require expensive purification for the sake of the four or five days in the year during which, due to weather conditions, pollution may take place. Such a supply with a favorably placed intake, may escape pollution for more than a year. There was no evidence of serious pollution of the water supply of the city of Erie during the year 1909, yet the appalling disaster of January and February, 1911,‡ showed that pollution could take place under certain weather conditions.

There is also too much confidence placed in

* Whipple, Geo. C.: Typhoid Fever, page 179.

† Cobb, J. O.: Water Contamination Aboard Ship and Its Prevention. *Journal American Medical Assn.*, 1909, vol. liii, page 2057.

‡ Hygienic Laboratory Bulletin 77, page 98.

unfiltered surface supplies from inhabited watersheds. Even where there is alleged control of the watershed and ample storage, pollution may occur. In regard to unfiltered surface supplies, the need of bacteriologic control is very evident. Dangerous pollution may be present only for a few days or for a few hours. The bacterial count per cubic centimeter is valuable, but the quantitative estimation of *B. coli* is of far greater importance. A low count does not necessarily imply a safe water, but a low count, coupled with absence of *B. coli*, may be considered an index of safety.

In Europe surface supplies are almost invariably filtered, and eventually such supplies in America will be treated or filtered.

Poor filter efficiency is often responsible for disaster in the shape of typhoid outbreaks and may be due to several causes. The slow sand type may give poor filter efficiency when sufficient extra units are lacking, necessitating excessive rates and placing of "green" filters in service. Excessive rates, too little coagulant, insufficient sedimentation capacity, and insufficient storage are common operating and structural faults of the mechanical type. Sometimes a properly constructed plant is struggling with a raw water which has a high bacterial content and even with fair filter efficiency yields an unsafe effluent. Probably the greatest single cause of a poor effluent from filter plants is inefficient operation by unskilled men. It is absolutely essential for good results that bacteriologic examination, including *B. coli* estimation, be made at least once daily, and in slow sand plants from each unit separately.

The man in charge must be able to do this. In mechanical filter plants or with hypochlorite plants he must also have the necessary skill to adjust his chemicals with nicety according to the changes in the raw water. With such a man in charge of a properly constructed plant a safe effluent is assured at all times. When struggling with a bad raw water he will use hypochlorite as an adjuvant with good results. He will study the peculiarities and fluctuations of the constituents of the raw water and adjust his treatment accordingly.

The most serious defect in sanitary control of our water supplies is the lack of proper daily bacteriologic examination of the water and quantitative estimation of the *B. coli* content. In some of the lake cities there is proper daily bacteriologic examination of the water supply, but in many of them there is either an imperfect examination or none at all. One city with a slow sand filter plant of three units and a consumption equal to the safe filter capacity of the beds operates these without rest, putting the units in service "green" and with an occasional examination of the water once or twice a month. One of the largest lake cities using an unfiltered supply exposed to sewage pollution makes a bacterial count daily, but restricts its effort to detect

sewage pollution to the antiquated and indefinite test of inoculating a guinea-pig occasionally with a small portion of a broth culture.

The significance of polluted water supplies in large industrial centers from an interstate standpoint is enormous. Trains and steamboats take their water supplies at such points and this polluted water is drunk by the passengers throughout the trip. Common carriers in interstate commerce also contribute to the spread of typhoid in interstate traffic by failure to have their railroad trains and steamboats provided with retention tanks for excreta. Human excreta may in this way be deposited in streams used as water supplies or in lake water in the vicinity of waterworks intakes.

Excessive prevalence of typhoid fever in any city which by reason of its commercial or industrial importance attracts large numbers of visitors has an important bearing upon the spread of typhoid from one state to another. The same is true of other cities which because of great natural advantages, the beauty of their surroundings, or other reasons attract thousands of tourists and visitors from other states. For these reasons the prevalence of typhoid and the character of the water supplies in cities like Pittsburgh and Detroit, Niagara Falls or Mackinac Island become a matter of serious moment from an interstate standpoint. The excessive prevalence of typhoid fever for years in Niagara Falls and Pittsburgh was not only a matter of local or even state concern, but a grave national danger as well.

The drinking water tanks of vessels should have no connection with the sea cocks and piping used to draw water for other purposes. It is feasible to use condensed steam for drinking purposes and if this system is not installed vessels should be required to fill their water tanks from municipal supplies which have been certified as safe.

The sources should be certified to by a federal officer or by a state or municipal officer. If inspection is made by state or municipal officers, they should certify that the source conforms to United States standards.

RECAPITULATION.

To prevent water-borne disease in lake and river traffic it will be necessary to proceed along the following lines:

1. Popular education is necessary to prevent drinking of unpurified surface water.
2. Public water supplies in communities engaged in interstate traffic should conform to United States standards.
3. United States standards should be based upon the bacterial count and the quantitative estimation of *B. coli* and should be the minimum requirements to prevent the spread of disease, such as typhoid fever or Asiatic cholera in interstate traffic, the various states retaining the

right to impose additional requirements, consistent with state laws where such laws exist.

4. United States regulation is necessary, requiring vessels engaged in interstate traffic to fill their water tanks with distilled water or from public water supplies certified as safe and conforming to United States standards.

5. Inspection of vessels by United States officers and by state and municipal officers duly qualified to enforce this regulation.

ARTERIOSCLEROSIS PROBABLY NOT AN IMPORTANT FACTOR IN THE ETIOLOGY AND PROGNOSIS OF INVOLUTION PSYCHOSES.*

BY G. L. WALTON, M.D., BOSTON.

ARTERIOSCLEROSIS without gross lesion of the brain should not be too readily accepted as a cause of symptoms. In a previous communication the writer, in collaboration with Dr. Paul,¹ reported a series of marked arteriosclerotics showing prevalence of vertigo, apoplectiform attacks, and progressive loss of memory, but nothing to suggest that headache, insomnia, irritability or other evidence of psychosis resulted from this condition. This finding was somewhat at variance with the prevailing view, but subsequent observation has revealed nothing to modify our opinion.

The association of cerebral arteriosclerosis with the involution psychoses, and even with manic-depressive insanity irrespective of type, is mentioned by various authors (Albrecht,² Pilez,³ Schreiber,⁴ Neisser,⁵ Stransky⁶), whether with the implication that it is to be regarded a causal factor, or, as Albrecht contends, generally rather a resultant of the emotional disturbance. Again, writers on arteriosclerosis have mentioned the appearance of agitated depression and the like, Alzheimer,⁷ however, with scientific fairness adding that he is uncertain whether the arteriosclerosis should be regarded as a causal factor or as a mere coincidence. It is in the hope of throwing further light on the question that I have studied from the clinical point of view the cases which form the basis of this communication.

That there is no unanimity of opinion on the subject is shown by the fact that DeFursac⁸ mentions lowering of blood pressure and a small compressible pulse among the symptoms of the anxious melancholia of involution, and that Alexander⁹ finds the blood pressure lowered in chronic melancholia, unaltered in simple melancholia, increased in the "acute passive," and less so in the "acute demonstrative," type. Occupying a middle ground, Whitney,¹⁰ in a recent communication, reported ten cases of involution-depression in which peripheral arteriosclerosis was found, but a low blood pressure.

* Read at the meeting of the American Neurological Association, May, 1912.