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Original Communications.

A BIOLOGICAL ANALYSIS OF THE MONTREAL WATER SUPPLY DURING THE PERIOD FROM NOVEMBER, 1890, TO NOVEMBER, 1891.*

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The following account of a biological analysis, made three years ago, has been abridged from my report addressed at the time to Mr. B. D. McConnell, then Superintendent of the Montreal Water Works, who took a deep interest in the investigation. Chemical analyses were made at thesame time by Prof. R. F. Ruttan and Prof. Phister.

PLAN OF INVESTIGATION.

I. Regular monthy examinations of samples of water from the following four localities :

1. The lower reservoir.
2. The settling basin.
3. A point near the intake of the St. Cunegonde Water Supply.
4. A point in the middle of the River St. Lawrence south of Nun's Island.

These examinations were made at the express order of the Water Committee with a view of determining whether the water

* Published by permission of the Water Committee of the Montreal City Council.

obtained from localities 3 and 4 would be preferable to that furnished by the present intake on the north shore of the St. Lawrence, just above the Lachine Rapids.

In addition, I found it necessary to make :

II. Examination of tap water obtained from various points within the city, from the upper reservior, and from the aqueduct,

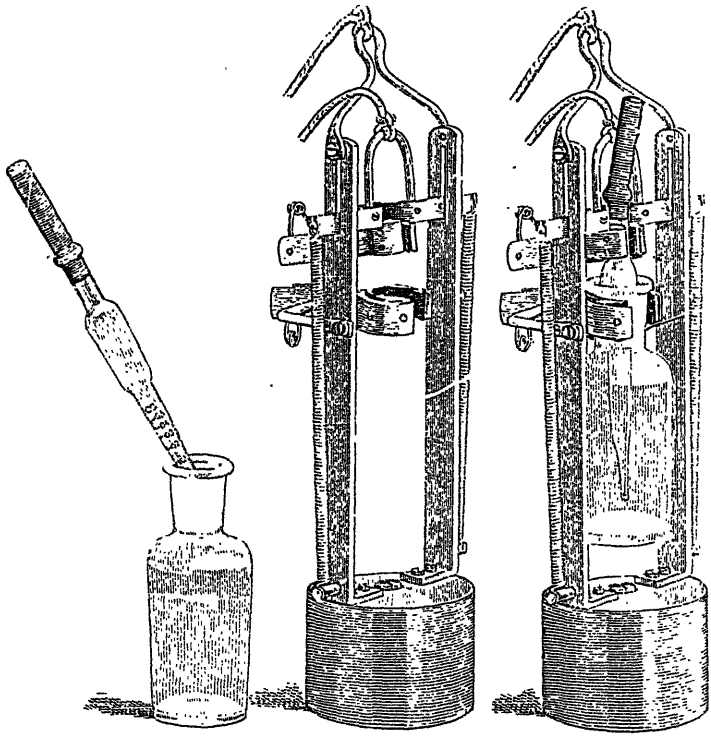

Fig. 1.

to see whether evidences of local contamination existed and to trace the effect of temperature, rainfall and water level.

III. Examination of the water of the St. Lawrence and Ottawa rivers at points above Montreal, to see whether the influence of the sewage from the towns along their banks was perceptible.

IV. Examination of surface waters from other parts of Canada, and especially from uninhabited districts.

METHODS.

A large proportion of the work consisted in the estimation of the number of bacteria present. (Quantative bacterial analysis.) The nature of the bacteria was also studied, as far as the time limits of the analysis permitted. Cultures, for quantitative work, were for the most part made in slightly alkaline, 10 p.c. beef peptone gelatine, made after Loeffler's formula, and grown at 20°C. The samples were taken 10 to 20 feet below the surface, by means of an apparatus which I show in figure 1, and were plated in flat glass vials. The cultures were, as a rule, made within a few minutes of the time of taking the samples, and in a few instances, when about an hour or two intervened, the samples were kept in an ice box.

The sediments were all examined microscopically, and during four months the microscopical organisms present were estimated quantitatively by the Sedgwick-Rafter method.

SOURCE OF SUPPLY.

Before giving the details of the analysis, it might be well, in order to make the report intelligible to those who are not familiar with the local conditions of the Montreal water supply, to briefly mention the character of the water, and the topography of the district from whence it is obtained.

Although taken from the north shore of the St. Lawrence river, the Montreal water supply is derived, during the greater part of the year, from the Ottawa, which enters the St. Lawrence from the north at a point about 20 miles above the intake, and forms a belt of dark water close to the shore, the border between this water and the clear green of the St. Lawrence proper being very distinct, though varying in position with changes in the direction and force of the wind and the relative level of the water in the two rivers. During the winter owing apparently to an ice-jam, the Ottawa passes to the north of the island of Montreal, so that the Montreal supply during the months of January, February and March consists of nearly pure St. Lawrence water.

Ottawa River.

The Ottawa river drains an area of over 60,000 square miles

(rather less than the Danube), most of which is entirely uninhabited. Its discharge has been estimated at 60,000 cubic feet per second. Its average width for the 100 miles above Montreal is somewhat over half a mile. At 25 miles above the city it expands into the lake of Two Mountains, varying from 2 to 4 miles in width, and 4 miles above the intake, into Lake St. Louis, 4 to 7 miles wide. There are rapids and falls 60 and 30 miles above Montreal. At many points between Ottawa and Montreal navigation is impeded by enormous sawdust beds from the Ottawa saw mills.

The population along its course, according to the census of 1891, is about 300,000, or 6 per square mile, of which about 100,000 is comprised in cities or towns of over 1,000 inhabitants, the remainder being rural. The chief centres of population and their distances above the Montreal intake are as follows:

Pembroke	4,401	220 Miles.
Renfrew	2,611	190
Perth	3,136	180
Smith's Falls	3,861	175
Aylmer	1,915	140
Ottawa (and Hull)	55,429	125
Buckingham	2,230	100
Hawkesbury	2,042	60
Lachute	1,751	50
St. Anne	1,500	20
Lachine	3,167	4

The Ottawa water is dark, and contains a large amount of peaty pigment, giving the water, when in a deep column, a tint suggesting that of porter. Apart from this it is stated by Prof. Ruttan to contain almost no organic matter. It is much softer than the St. Lawrence water.

St. Lawrence River.—The St. Lawrence drains an area of 510,000 square miles or about half the Mssissippi. Its discharge, before receiving the Ottawa, has been estimated at 500,000 cubic feet per second. Apart from the cities and towns, situated upon the Great Lakes or on streams draining into them, the total population of the towns and villages of over 1,000, situated upon the river proper, amounts to about 55,000, of which Kingston (20,000) is really in Lake Ontario. The

populations and distances above the intake at Montreal are as follows :

Kingston	20,000	185 Miles.
Gananoque	3,689	150
*Clayton	4,400	430
*Prescott	2,920	120
Ogdensburg	11,062	120
Cornwall	6,085	70
*Valleyfield	3,315	35
*Beauharnois	1,590	20

Towns marked * are on the south side of the river.

The river averages fully one to two miles in breadth during the whole of its course, and expands into Lake St. Louis, 4 to 7 miles wide, just above the intake, and into Lake St. Francis, 8 miles wide, 35 miles above. There are rapids at points 20, 25, 30, 35, and 80 miles above the intake.

The St. Lawrence water is clear and light green in colour, and is fairly hard.*

In both these rivers the temperature falls to the freezing point in winter, even at points near the bed of the stream.

I. Monthly Examination of Water Supply.

Microscopical Analysis.—The method employed was, at first, that of simply allowing the sediment to settle in a conical glass, and by means of a pipette placing a little of it under a microscope. This gives a general idea of the constituents of the sediment, but affords no information as to the quantity in which the different organisms are present. In the Sedgwick-Rafter method (which unfortunately only became known to me after the analysis was completed) a given

* The following table compiled from Dr. Ruttan's analyses shows the average chemical composition of Ottawa and St. Lawrence water (quantities in part per million) :

	Color. Lovibond scale.			Solids.			Nitrogenous Matter.			Oxygen consumed on 80°F.		Hardness (as Calcium Carbonate.)	Chloride (as Chlorine.)
	Red.	Yellow.	Blue.	Total.	Loss on ignition.	Ash.	Free Ammonia.	Albuminoid Ammonia.	Nitrates.	15 min.	4 hrs.		
Ottawa.	1.7	5.4	0 01	52	24	28	0.02	0.12	0.03	3.7	6.1	55	1.5
St. Lawrence.	0.1	1.0	0.47	112	69	74	0 04	0.09	0.09	0 5	1.2	102	3.5

quantity of the water, usually 500 cc., is filtered through sand and the sand with the organisms retained in it shaken up with a definite quantity of distilled water, 1 cc. of this is then placed in a glass cell, leaving a superficial area of 1,000 square millimetres and a depth of 1 millimetre. By examining under a microscope, into the eye piece of which a diaphragm has been fitted covering exactly 1 square mm. with the objective employed, each microscopic field represents a fixed unit of measurement with reference to the original water, and the number of each different organism per cc. can be calculated from the average number present in each field. As a rule the genera only are determined. This method is not applicable for determining the number or character of the bacteria.

During the period from March to November, 1891, the presence of the following organisms was noted. The numbers represent the number of different genera found in one sample and not of individual organisms per c.c. :

Month 1891.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
Sample from :									
Reservoir	*	6	12	16	*	8	8	5	9
Settling Basin.	5	3	15	9	*	10	5	*	8
St. Cunegonde.	4	1	31	18	13	11	5	5	12
St. Lawrence..	*	3	3	12	18	14	5	5	9

* Not estimated.

Of these, the following genera were the most frequent :

DIATOMACEÆ. — *Acnanthes, Amphora, Asterionella, Cyclotella, Diatoma, Encyonema, Epithemia, Fragilaria, Gomphonema, Melosira, Navicula, Nitzschia, Pleurosigma, Stauroneis, Surirella, Stephanodiscus, Synedra, Tabellaria.*

CYANOPHYCEÆ. - *Anabæna, Aphanizomenon, Oscillaria.*

OTHER ALGÆ. - *Chara, Cladophora, Celosphærium, Conferva, Cosmarium, Palmella, Pleurococcus, Pediastrum, Vaucheria, Volvox, Penium, Protococcus, Scenedesmus, Tetraspora, Zygogonium.*

FUNGI. - *Crenothrix.*

RHIZOPODA. - *Actinocyclus, Actinophrys, Amœba, Gromia.*

INFUSORIA. — *Bursaria, Carchesium, Dinobryon, Epistylis, Euglena, Heteronema, Monas, Paramœcium, Trachelocerca, Trachelomonas, Vorticella.*

SPONGIARIA - *Sponge spicules.*

VERMES. - *Anguillula, Monostylus, Rotifer, Stylonychia, Stentor.*

CRUSTACEA. - *Alona, Cyclops, Daphnia.*

As I had not been able to employ the quantitative method during the year of analysis, I give the results obtained, per c.c., from tap water during the period from April 10th to June 4th, 1892, in the following table :

Date of examination.....	April 30.	May 6.	May 15.	May 28.	June 4.
Number of sample.....	62	63	64	65	66
DIATOMACEÆ.	64	84	56	42	322
Acnanthes.....	2	0	0	0	0
Amphora	3	pr	0	0	0
Asterionella	21	36	18	12	20
Cocconeis.....	0	0	0	1	0
Cyclotella.....	pr	pr.	2	0	1
Cymbella	1	pr.	0	0	0
Diatoma	2	0	pr.	0	0
Encyonema.....	0	0	2	0	0
Fragilaria.....	pr	6	pr.	2	0
Gomphonema.....	1	pr.	pr.	0	0
Grammatophora	0	0	0	pr.	0
Melosira	23	24	21	2	5
Navicula	9	9	pr.	1	300
Nitzschia	0	4	11	2	0
Surirella	0	0	1	0	0
Synedra	2	4	0	22	1
Tabellaria	0	3	0	0	0
ALGÆ.					
Chlorococcus.....	0	32	0	0	0
Protococcus	0	2	1	0	0
Zoospores	pr	pr.	pr.	pr.	10
INFUSORIA.					
Monas	0	2	pr.	0	0
MISCELLANEOUS.					
Starch grains.....	3	2.5	2	2	4.5

I have omitted from the table the following genera which, though occasionally seen, were never present in an amount equal to 0.5 per c.c. : *Coscinodiscus, Pleurosigma, Staurocis, Stephanodiscus, Oscillaria, Arthrodesmus, Cladophora, Cœlosphærium, Conferva, Pediastrum, Pleurococcus, Beggiota, Amœba, Cercomonas, Trachelomonas, Spongilla and Cyclops.*

The organisms were more numerous in the warm than in the colder months. The higher animal forms being only met with during the summer.

Pollen grains (most commonly from the pine) and vegetable

fibres were usually present in traces, and were most constant in the samples from the reservoir.

From the above results it will be seen that while the waters contain small amounts of the non-bacterial organisms common to all surface water, these were never found in sufficient quantity to affect the odor, taste, or hygienic quality of the water. Of the organisms, the diatoms Melosira and Asterionella were the only ones occurring constantly in any appreciable quantity.

The green organism (Anabœma or Aphanizomenon) which abounds in the water of Lake Ontario and the Bay of Quinte during the summer, was scarcely detected at Montreal, though owing to the infrequency of the periods of collecting samples it may have been missed. Though present in the reservoir during August and September very little appeared to enter the supply pipes.

The results of examination of sediments, on the whole, were decidedly satisfactory from a hygienic point of view.

Starch Grains.—The only anomalous features presented by the sediments was the constant occurrence of starch grains in the sediment of most of the samples. These I first noticed in the May samples, they being present in the water from the reservoir, settling basin and St. Cunegonde, but not in that from the St. Lawrence.

These grains were usually round or slightly oval, or in some cases presented blunted angles. They measured 12 to 30 microns in diameter, stained blue with iodine solution and polarized with a central cross. Some showed a central fissure in the form of a slit or cross, and often lamination could be distinctly made out.

I was at first disposed to regard them as an accidental contamination, due to the entrance of dust into the samples, but this was shown not to be case by the fact that upon filtering water directly from the tap through glass wool, compressed into a small strainer, the starch was invariably detected, while the materials employed as well as the glass-ware used, showed no signs of it.

Upon consulting the standard works on water analysis, I was unable to find any reference to the presence of starch in water otherwise than as a consequence of contamination by sewage proper, kitchen refuse, or the waste of industrial establishments. On the other hand, all the other results of my analysis were strongly opposed to the theory of contamination of the water.

Being myself unable to identify the grains satisfactorily with any of the known starches, I consulted Prof. D. P. Penhallow, of McGill University, who examined them carefully and called my attention to the fact that they corresponded in size and shape and structure to corn starch grains, and were much larger than any of the starch grains found in aquatic plants.

He stated that, in his opinion, the only starch bearing aquatic plants at all likely to lead to dissemination of starch grains in the water were the yellow and white water lillies (*Nymphæa* and *Nuphar*) the starch grains of which, however, never exceeded 13 microns in diameter, and were readily distinguished, by their form and arrangement, from the granules under consideration.

If the grains were corn starch then they must have come from some starch factory or grist mill.

There were, however, no starch factories or large milling industries along the banks of the Ottawa, and though some starch factories are situated upon the St. Lawrence, none of the grains had been found by me in that water.

Upon estimating the number of starch grains per cc., I obtained the following results, for different seasons of the year, from samples of the water which happened to have been preserved :

Month.	Mar.	Aprl.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
Sample.									
Reservoir.....	*	pr.	*	2	*	*	*	3	2
Settling Basin.	0	*	*	pr.	*	1	*	*	2
St. Cunegonde.	0	*	0.8	4	4	*	*	5	2
St. Lawrence..	*	*	*	0	0	*	*	0	0

* Not examined.

The largest amount of starch ever found in any sample was 7 granules per c.c., in a stagnant rusty sample, obtained from a street hydrant.

The presence of the starch in the Ottawa water and its absence from the St. Lawrence, was a matter which completely puzzled me. Examination of the starch granules of the sweet

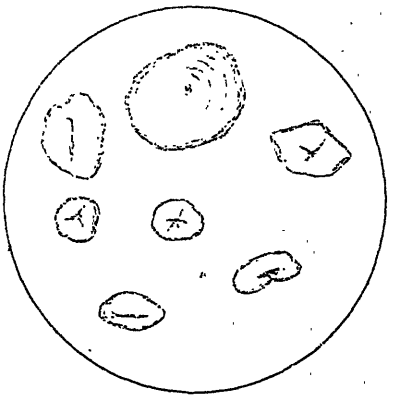

Fig. 2—Starch grains from water.

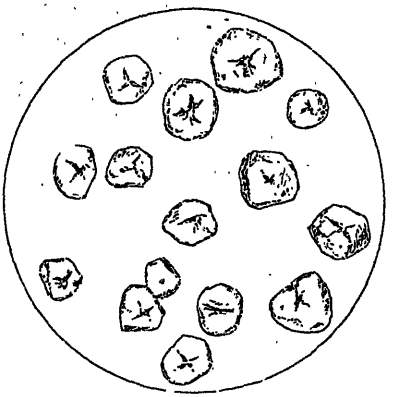

Fig. 3—Starch from white pine bark.

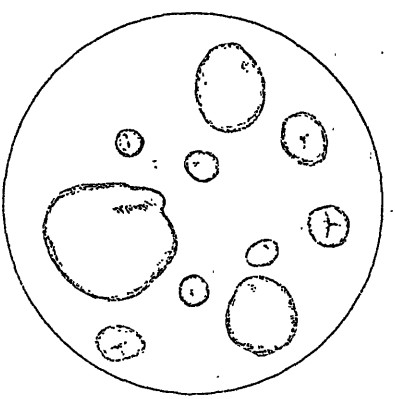

Fig. 4—Starch from white pine bark after soaking in water.

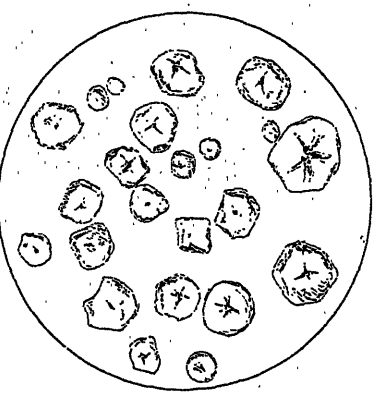

Fig. 5—Corn starch.

flag root and wild rice, showed that these grains were altogether too small to be thought of as a possible source.

At this point, Prof. G. P. Girdwood, of McGill University, suggested to me the possibility that as starch is present in the

bark of some of the coniferous trees, it might be derived from the white pine lumber which, as already stated, is sawn in such large quantities as to block the Ottawa river in places with vast beds of sawdust. Upon my examining white pine bark, I was delighted to find not only that it contained large quantities of starch, but that these, though somewhat more angular, closely corresponded in size, shape and structure with the grains found in the water (and closely resembled corn starch).

Upon soaking pine bark for two months in water, many of the starch grains in it assumed the rounded outline typical of the starch of the water sediments, whereas corn starch grains, after the same period of maceration, became fissured and tended readily to disintegrate upon slight pressure.

The appearance of the various grains may be better understood from the accompanying illustrations, figs. 2, 3, 4 and 5.

Starch grains similar to those of the pine were found, though less plentifully in the bark of the cedar, hemlock and spruce.

The following table gives the diameter in micro-millimeters of the various starches examined :

	Diameter in microns.
Water Sediments	11.4 to 28.0
White Pine Bark	8 to 28.0
Corn	5.8 to 27.0
Sweet Flag	6.0 to 13.0
Wild Rice	5.7 to 13.0
White Water Lily	1.9 to 7.6
Yellow Water Lily	3.8 to 13.3

There is nothing to show that the starch forms a dangerous ingredient of the water. I have also found somewhat similar grains under circumstances which did not show any possibility of sawdust pollution, and unless great care is exercised one is liable to meet with them as a result of contamination of the glass-ware, etc., by dust.

My excuse for giving the above results at such length, is that it does not seem to have been recognized as yet that starch

grains may be observed in water independently of sewage or industrial pollution on the one hand, and of errors in manipulation on the other.

Bacterial Analysis.—The opinion entertained by chemists of the Montreal water supply, at the time when this examination was undertaken, is fairly well expressed in Bulletin No. 15 of the Inland Revenue Department at Ottawa, which in referring to the relatively high proportion of organic matter, speaks of it as " capable of sustaining and nourishing, to a much greater degree than in most water supplies, those minute organisms which, while in most cases harmless, are closely related to others known as disease germs. A water so largely impregnated with organic matter, as that of the Ottawa, would become a very efficient nidus for the propagation of morbific bacteria were such organism to find an entrance to it."*

It may be stated in a general way that a pure water should not habitually contain large numbers of bacteria. Although no hard and fast rule can be set, Miquel's scale fairly expresses our present ideas upon the relation of the number of bacteria to the purity of water :

Exceptionally pure water contains		0 to	10 per c.c.
Very pure	" "	10 to	100
Pure	" "	100 to	1,000
Poor	" "	1,000 to	10,000
Impure	" "	10,000 to	100,000
Very impure	" "	100,000 and over.	

The number of bacteria in filtered water should not, according to Koch, habitually exceed 100 per c.c.

I was agreeably surprised to find that the Montreal water, instead of teeming with bacteria, was conspicuously free from them, as compared with other bodies of running water, so that whatever might be the nature of the organic matter present it did not appear to be specially favourable to bacterial growth.

The following table shows the average number of bacteria found in some well known surface waters, most of which are

* McGill, Bulletin No. 15, Department of Inland Revenue, Ottawa.

used as sources of drinking water. These marked * are filtered before being distributed :

		Locality.	Authority.
Ottawa	220	Montreal	Johnston.
St. Lawrence	360		
Mississippi	800	St. Louis	Currier.
*Danube	2,000	Vienna	Kowalsky.
Seine	33,000	Above Paris	Miquel.
*Thames	19,750	Above London	P. Frankland.
Croton Aqueduct	4,280	New York	Health Report.
Hudson	3,065	Albany	Prudden.
Potomac	3,774	Washington	Thos. Smith.
Neva	5,772	St. Petersburg	Poehl.
Rhone	75	Geneva	Fol.
Rhine	20,300	Mulheim	Moers.
*Main	2,050	Frankfort	Rosenberg.
*Spree	65,000	Above Berlin	Frank.
Elbe	28,700	Hamburg	

Number of Bacteria found each month.—The following table shows the average number of bacteria per c.c. found each month in the reservoir, settling basin, St. Cunegonde and St. Lawrence samples :

Date.	Temperature of water °C.	Level of water at Lachine in feet.	Bacteria per c.c.				
			Reservoir.	Settling Basin.	St. Cunegonde.	St. Lawrence.	Combined Average.
1890							
December 1st...	4°.	11·1	8	313	473	265	284
1891							
January 5th.....	0°.	12·0	31	44	30	61	41
February 2nd...	0°.	10·9	20	89	63	29	50
March 5th	0°.	12·2	185	164	316	577	310
April 13th.....	0°.	13·0	171	347	363	161	260
May 4th.....	10°.9	15·0	79	121	156	324	167
June 2nd.....	13°.0	13·0	42	189	130	210	142
July 2nd.....	18°.3	11·5	30	481	197	81	275
August 3rd	21°.0	11·5	92	119	101	85	99
September 7th..	18°.3	10·1	21	81	53	53	52
October 1st	13°.1	10·1	40	55	29	43	42
November 25th..	4°.	10·5	143	1132	1883	363	930

The following summary shows the maximum, minimum and average number of bacteria per c.c. for each sample throughout the year, together with the dates upon which the maximum and

minimum numbers occurred, and the total number of samples examined from each source :

Number of samples examined.	Source.	Bacteria per c.c.		
		Max.	Min.	Average.
70	Reservoir	286 (Nov.)	9 (Feb.)	78
67	Settling Basin	1900 (Nov.)	32 (Oct.)	278
73	St. Cunegonde.....	2260 (Nov.)	12 (Oct.)	316
71	St. Lawrence	600 (Nov.)	18 (Oct.)	189
281				

The above tables show that during the greater part of the year the number of bacteria per c.c. of the water varies between 100 and 200. During the early part of the summer and in midwinter this number falls considerably below 100, and during the spring and early fall it rises for a short period to between 1,000 and 2,000. These temporary elevations coincide with a period of heavy rainfall which ushers in the winter, and with the melting of the snow in the spring, on both of which occasions the river level rises considerably.

The interval of one month between the taking of samples is so great, that the temporary rise in the number of bacteria might pass unnoticed, if this sample did not happen to be taken exactly at the time when it occurred. Suspecting that this was the case in 1891, I made private examinations of the tap water at intervals of one week, with the result that a rise to 1940 per c.c. (compared with 347 per c.c. in the official sample taken a few days before) was observed, the number falling to 117 by the time the next official collection became due. The number obtained in the official settling basin being 121.

It is evident that the 12 months covered by the analysis comprises the early winter increases in bacteria for both 1890 and 1891, which makes the average number for the year higher than would otherwise be the case.

This spring contamination of the water was also studied in

tap water during April, 1892. The following table shows the variation in the number of bacteria :

Date.	Bacteria per c.c.
April 2	112
9	830
16	2400
26	122
30	46

The two periods characterized by low numbers of bacteria (midwinter and early fall) correspond with seasons when the level is very low.

These relations are shown graphically in Fig. 6.

Although rainfall, when sufficient to produce a marked rise in the water level of the rivers, was found to be associated with an increased number of bacteria, due no doubt to the washings of the soil, no increase was noted corresponding to the ordinary local rainfall.

Comparison of the Four Samples Examined.

Reservoir.—One is struck by the marked superiority of the reservoir water shown by its small number of bacteria, as compared with the other samples. During 9 months of the 12, the number of bacteria was below 100, while the average number was less than one-third of the number found in the settling basin. This, apparently, is due to the beneficial effects of sedimentation, although the reservoir is not well constructed for that process (not having separate inlet and outlet pipes), but chiefly serves to secure a head of water with constant pressure and to form a reserve in case of need. That the reservoir water does not stagnate, and that its quality remains unimpaired in spite of a large accumulation of mud and slime at the bottom, is a matter which can be readily accounted for. We know now that the agencies which produce the series of oxidative and nitrifying changes, leading to the self purification of waters, are a special class of organisms (nitro-bacteria) which are most abundant in that very slime which is generally regarded with so much suspicion by the public. To secure the proper perform-

ance of this beneficial process, by which the albumenoid and ammoniacal bodies, which indicate pollution, are (perhaps after being first decomposed into more readily assimilable forms by the agency of the water bacteria) changed into the more stable forms of nitrates, it is necessary that there shall be a sufficient supply of dissolved oxygen in the water and a sufficient circulation to promote oxidation and check any tendency to anærobic putrefaction. For this reason shallow reservoirs of 15 to 30 feet in depth are better than deeper ones.

Sunlight has been supposed to act beneficially by keeping in check any tendency to bacterial overgrowth, but although I have not yet been able to practically test the matter, it seems probable that the opacity of the Montreal water supply in summer would render the effect of sunlight very slight.

That the improvement which reservoir waters undergo during sedimentation is not merely due to a mechanical sinking of the bacteria, is shown by the fact that the number found in the deeper strata does not show any corresponding increase. This was seen in the following observations:

		Depth.		Bacteria per c.c.		
		From surface.	Above bottom.	Max.	Min.	Average.
Lower Reservoir..	(South Basin)..	10	15	66	43	54.3
No. 564.....	Oct. 2, 1891.	24	1	86	55	67.3
Lower Reservoir..	(North Basin)..	10	15	.....	.....	16.0
No. 561a.....	Oct. 2, 1891...	24	1	20	15	17.5
Lower Reservoir..	(South Basin)..	5	20	236	180	203.0
No. 570.....	Nov. 29, 1891.	10	15	246	214	238.0
		20	5	248	96	172.0
		24	1	182	148	165.0
Lake St. John.....	(Roberval).....	5	40	57	9	24.2
No. 555.....	Oct. 7, 1891...	40	5	27	8	17.6

From what we know of nitrification in waters, the ideal bed for a reservoir should be coarse sand or gravel rather than of bare masonary or cement, though probably the natural sediment from the water would soon furnish a nitrifying medium.

Settling Basin.—This term as applied to the pond at the wheel house is a misnomer, as the current is always so rapid as

to allow of very little settling, and, as a matter of fact, the number of bacteria found there was never noticeably less than that in the aqueduct. From a biological point of view the plan suggested by the Superintendent of having a separate channel for the water used in obtaining power for pumping, and of greatly enlarging the settling basin seems to be an absolute necessity. At present the water is pumped into the mains with very little settling at all, while only a small proportion of it ever passes through the reservoir. I might point out that the question of what should be the proper dimensions of the settling basin, is a biological, as well as an engineering one, and a series of examinations should be made to find out what amount of surface area would be sufficient to secure, by sedimentation the requisite reduction in the number of bacteria*.

St. Cunegonde.—The samples from the St. Cunegonde source in the Nuns Island Channel showed about the same number of bacteria as those from the settling basin, and were decidedly inferior in quality to both the reservoir and St. Lawrence water.

Evidently the theory of the supposed superiority of this water arose through a mistaken interpretation of the chemical analyses by the Inland Revenue Department, and simply consists in a lessened amount of organic matter due to larger dilution by the St. Lawrence water. As the organic matter, characteristic of the Ottawa water, has been shown by Dr. Ruttan to be of the nature of a harmless pigment (crenic and apocrenic acids), the most exact proportion in which it may be present is a matter of indifference from a sanitary point of view.

That the mere passage over the rapids in anyway improves the water by oxidation has never been demonstrated, and as we now know that the oxidation of water is not simply a matter of aceration, but is due to the action of the nitrifying bacteria, there is no longer this theoretical argument in favour of this point of supply.

On the other hand, a special investigation, made jointly by

* The question of the undesirable proximity of the garbage depot to the settling basin had not arisen at the time when this analysis was made, and I have since had no opportunity of investigating the matter.

Dr. Ruttan and myself in July, 1891, brought to light facts which show that the intake of the St. Cunegonde supply is not very favourably situated.

The discharge from the tailrace, which empties into the Nuns Island channel 150 yards above the St. Cunegonde intake, brings with it the contents of the river St. Pierre. This little stream receives the drainage of all the land lying to the north of the canal between Montreal and Lachine, with the result that its water half a mile west of Cote St. Paul was found to contain over 13,000 bacteria per cc. A little further on it receives the washings of the West End Abattoir. This addition gives the water a very offensive character, and I found it to contain 172,000 bacteria per cc. In examining the tailrace water upon several occasions I never failed to detect floating portions of offal and animal debris. After receiving the tailrace water this number was reduced to 92,500 per cc. owing to the dilution.*

As the discharge of a large volume of this filthy water at a point 450 feet above the St. Cunegonde intake which is situated, 900 feet from the shore, was so obvious an objection, I made, jointly with Dr. Ruttan, an examination of samples obtained on July 7th, 1891, at 5 points in the line between the shore and the intake in order to see how far out the zone of pollution extended. The wind was off shore and its velocity 15 miles per hour. The water level was fairly high in the channel. The water close inshore opposite the intake contained 69,000 bacteria per cc.; at 100 feet out it contained 669 per cc.; at 200 feet out it contained 238 per cc.; and at 400 feet 157 per cc. The number obtained from a sample of tap water at the pumping station was 127 per cc. which one would expect in pure water.

The chemical results obtained by Dr. Ruttan showed marked pollution inshore and at 100 feet, with slight pollutions at 200 feet and none at 400 feet, thus corresponding closely with the biological result.

It is evident that on that occasion the zone of pollution

* This contamination of the tailrace has no bearing upon the Montreal supply as the water only becomes polluted after leaving the settling basin.

ceased between 200 and 400 feet from the shore or 500 and 700 feet from the intake, and it is unlikely that under ordinary conditions the contents of the tailrace enter the St. Cunegonde supply. Still, as under altered conditions of the current, water level or bed of the river it is not impossible that this may occasionally happen, especially when the shallow flats lying inshore are packed with ice.

It would seem safer to divert the drainage of the St. Pierre into the city sewers, though I never found any evidence of such pollution in the samples examined.

I was not able to detect any evidence of pollution from the tanneries either in the water or the ice of this locality, but the probability that the Verdun shore may soon become densely populated is a further objection to the site.

An interesting point in the analysis was the increase in bacteria, was almost entirely caused by a species apparently identical with the colon bacillus. Corresponding with this increase there was a falling off in the proportion of the *Bacillus fluorescens liquefaciens*, which formed from 30 to 40 per cent. of all the colonies in the pure water of the river and only 0.5 to 1.0 per cent. of those in the polluted water of the tailrace. At 100 feet out the proportion of *B. fluorescens liq.*, rose to 12 per cent. at 200 feet to 25 per cent. and at 400 feet to 33 per cent. It would seem that any unusual deficiency of the proportion of this organism to the total colonies during summer should be regarded with great suspicion.

St. Lawrence Water.—The results of the examinations show that this water is not better from a sanitary point of view than the present city supply, as far as can be judged from the number of bacteria and the nature of the sediment. Although informed that the line of the pure St. Lawrence water would always be met with at a point 800 feet south of Nun's Island, I have on two occasions seen the Ottawa water extend as far as 1500 feet south of the island. Of the St. Lawrence water it can safely be said that it is a perfectly clean and pure river water. One point in favor of the St. Lawrence is that it is far less

affected than the present city supply by temporary pollution due to heavy rainfall or melting snow.

II.—Examination of Local Conditions Affecting the Montreal Water Supply.

Tap Water.—In order to determine whether the water as supplied by taps was similar in quality to that of the mains, numerous samples were examined during July and August of 1891. The taps were in all cases allowed to run for at least 30 minutes before samples were taken and two or more samples were always examined, in order to make sure that the number obtained was typical for the day. Besides taking samples each day from one special tap which was allowed to run continuously, I made frequent examinations from taps in various parts of the city.

The tap water was found to contain practically the same number of bacteria as the water of the settling basin and, as a rule more than that of the reservoir. The number of bacteria was found as a rule remarkably constant, irrespective of the points from which the samples were obtained. Usually, but not always, the taps on the circuit supplied by the upper reservoir (the water from which is pumped up from the lower reservoir) contained fewer bacteria than those in the lower circuit. I have given the results in the following table.

Comparison of Upper and Lower Circuit

Date.	Number of Bacteria per cc.	
	Lower Circuit.	Upper Circuit.
1891.		
May 1		
" 8	306	117
" 14	210	66
" 22	146	105
June 23	50	48
" 30	30	22

As far as it goes this supports the view that the water is improved by standing in the reservoir.

During July the daily examination showed for the upper cir-

cuit a maximum number of 136 bacteria per cc. and a minimum of 28, the average being 68. During August the maximum was 160 per cc. the minimum 17 and the average 55.

A comparison was made of the water from the lower and upper circuits with the following results.

	Lower Circuit.		Upper Circuit.	
	Reservoir.	Taps.	Reservoir.	Taps.
Sept. 23.....	39	37	41	50
Oct. 2.....	53	49	29	54

Although this shows relatively slightly more bacteria in the upper than the lower circuits, the difference is not large enough to be outside the limits of experimental error.

Aqueduct.—Two examinations of samples taken at 5 points along the aqueduct gave :

	Aug. 7.	Sept. 12.
Maximum.....	173	102
Minimum.....	93	38
Settling Basin.....	224	113
Lachine Intake.....	115	80

The variation is not sufficient to show any material change in the water during its passage from Lachine.

Dead Ends.—In districts where the circulation in the mains is not complete complaints are often made of turbidity of the water. This turbidity appears to be due to rust from the mains, but as the consumers are inclined to consider this condition as unwholesome, I made on Aug. 24th, 1891, an examination of the water from 11 different districts supplied from dead ends. The average number of bacteria found per cc. was 94, and therefore such as to exclude any idea of a polluted or stagnant state of the water. The vital statistics from the streets supplied by dead ends do not show any greater frequency of typhoid than other parts of the city. Iron rust is, as we know used as a means of precipitant for freeing water of organic matter.

III.—Study of the River Water at Points Above Montreal.

Ottawa Water.—In order to study the influence of the towns along the course of the river upon the character of the water, two sets of examinations were made in 1891, one on July 3rd, and the other on Sept. 24th. Samples were collected from the bow of a steamboat by means of a fishing rod and line to which small weighted bottles were attached, and the cultures made immediately. Duplicate samples were taken at 15 points on each trip, and a sample was also obtained from lake Des Chenes, 10 miles above Ottawa. Owing to an accident, several of the cultures made during the first trip could not be made use of. The results obtained are given in the following table together with the distances below Ottawa.

	Distances below Ottawa.	Bacteria per cc.
Above Ottawa (C.P.R. Bridge).....	0 Miles.	170
Gatineau.....	5 "	686
Cumberland.....	30 "	1530
Grenville.....	65 "	48
Carillon.....	80 "	60
*Como.....	90 "	72
*St. Anne.....	100 "	11
Lynch's Id.....	120 "	49

*In lake of Two Mountains.

These are shown graphically in Fig. 6.

This showed a marked increase in the number of bacteria below the city of Ottawa, diminishing to the normal for river water by Grenville and reaching a minimum in the lake of Two Mountains, and increasing slightly in the river channel below St. Anne. None of the smaller towns appeared to have any perceptible pollutory effect on the water.

In the second test on Sept. 24th and 25th, a much more thorough examination was obtained, but the results corresponded to a remarkable extent with those of the former examination. I have given the table in full in order to show the measure in which samples taken from the same points on two succeed-

ing days resembled one another in regard to the number of bacteria:

Locality.	Up Trip.			Down Trip.			Combined Average of both trips.
	Max.	Min.	Aver.	Max.	Min.	Aver.	
Lake Des Chenes.	.....	.....	.....	6	4	5.2	.....
Mil's below Ott'a.							
2	580	378	479	365	250	307	393
5	528	500	500	732	329	532	520
10	460	272	377	.....	.....	.....	.....
15	155	123	140	.....	.....	.....	.....
20 Cumberland.	172	130	147	176	139	152	149
30 Thurso	314	131	257	172	72	122	204
50 Montebello..	47	46	46	45	24	34	40
60 L'Orignal....	40	26	33	45	24	34	33
65 Grenville....	26	19	23	.....	.....	.....	.....
80 Carillon	37	34	36	38.	26	32	34
90 Como .. (Lake of Two M'ts.)	18	10	14	28	16	22	17
92 Oka.... (Lake of Two M'ts.)			17	8	5	6	12
100 St Anne (Lake of Two M'ts.)	10	6	8	16	0	8	8
105 Lynch's Id...	21	15	18	22	14	18	18
120 Lachine	18	8	12	.....	.....	.....	.....

This is shown graphically in Figs. 7 and 8.

A point to which Dr. Ruttan was the first to call attention is that the thickly settled agricultural district composed by the counties of Pembroke and Russell, having a population of about 100,000, drains into the Ottawa. An examination of water of one of the large streams for this district, the South Nation river, was made by us in May 1892, but no evidences of pollution were detected.

From this it is evident that any pollution due to the Ottawa or other sewage is effectually got rid of long before it reaches Montreal. The greatest improvement apparently takes place in the Lake of Two Mountains the bacteria being much fewer at the lower than the upper end. Attention may also be called to the fact that the number of bacteria in the water of the Lake of Two Mountain is lower than that of the present Montreal supply which on Sept. 23rd, gave 30 to 49 per cc.

That St. Anne, and upper Lachine with the intervening population along the banks of the St. Lawrence do not form a

possible source of infection for the Montreal water supply is by no means clear as our water is taken from the portion which flows by the north bank of the St. Lawrence. It seems advisable that a careful sanitary inspection of this district should be made

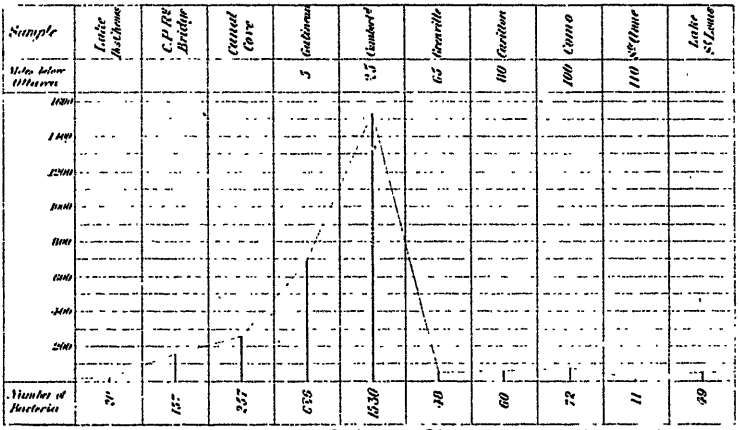

Fig. 7—Diagram showing the condition of Ottawa water above Montreal. (First examination, July 30th, 1891.)

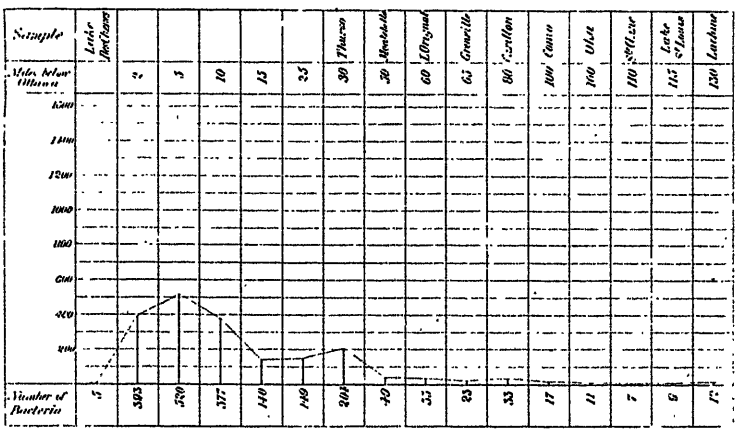

Fig. 8—Diagram showing the condition of Ottawa water above Montreal. (Second examination, Sept. 24th, 1891.)

and a map prepared showing the position of all privies, barns, etc., in order that any possible source of infection should be eliminated. The key to the safety of the Montreal drinking supply may be said to lie between St. Anne and the intake.

The entrance to the intake is confidingly placed so as to catch all washings from the adjacent portions of the lower Lachine road.

Question of typhoid infection.—The following inquiry into the possibility of water-borne typhoid in connection with the Montreal water may be of interest:

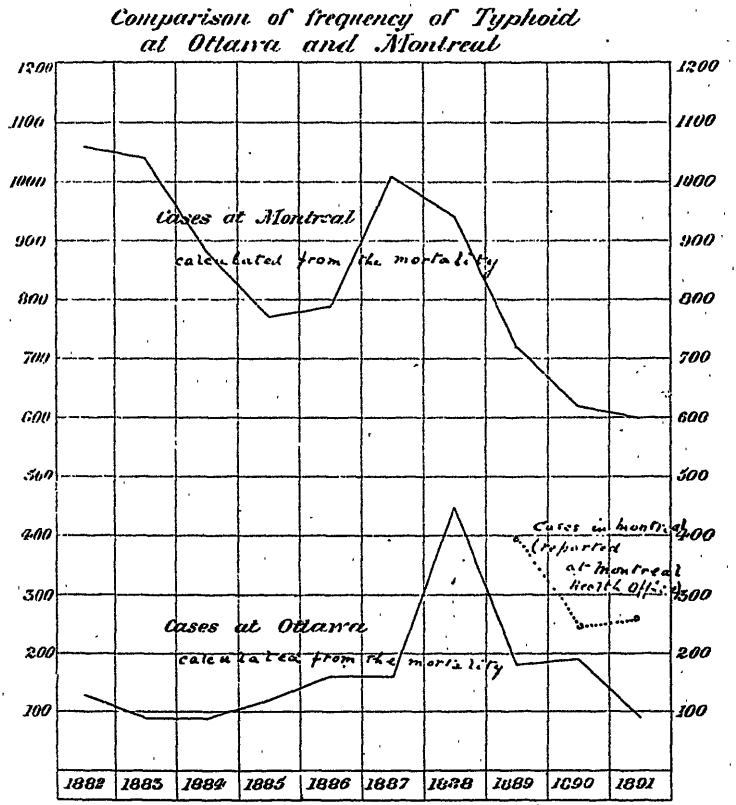

Fig. 9.

The number of cases reported each month at the health office are shown in figure 6. It is evident that if the frequency of typhoid fever depended upon general contamination of the water supply, it would, allowing for the period of incubation, be expected to appear in the month following the greatest contamination of the water. As no increase in typhoid occurred in these

months, that disease being most prevalent when the number of bacteria in the water reached its lowest point, it is evident that the turbidity and increase in bacteria which periodically affects the Montreal supply is not of such a nature as to cause or predispose to typhoid infection. In this connection it was interesting to see if there was any relation between the frequency of typhoid at Ottawa and at Montreal. Unfortunately non-fatal cases of typhoid are not reported to the Ottawa health office, and it is a well-known fact that less than half of the cases are reported at the Montreal office. As the deaths from typhoid are reported however, I have taken these as my basis, calculating the mortality at 10 per cent. As shown by figure 9 there is not only no constant relation between the frequency of typhoid in the two cities, but that even the severe epidemic of typhoid at Ottawa in 1888, was not accompanied by any increase in the number of cases in Montreal.

It appears therefore that general pollution of the Montreal water as may occur is probably of a harmless nature and does not form a source of infection.

St. Lawrence above Montreal.—A double series of observations was made in the same manner as in the case of Ottawa, the samples being taken on July 27th, 1891, between Brockville and Lachine, and on Sept. 30th, 1891, between Kingston and Lachine.

The results with the distances above the Montreal intake at which the samples were taken, are shown in the following table and in figures 10 and 11 :

Sample from	Distance above intake.	Bacteria per cc.					
		July 27th			Sept. 30th		
		Max.	Min.	Average.	Max.	Min.	Average.
Lake Ontario near Kingston	190 miles.	.....	.....	.....	29	16	22
Long Point	180 "	.....	.....	.....	51	48	49
Clayton	175 "	.....	.....	.....	33	25	29
Brockville	125 "	76	14	44	.....	.....	.....
Galop Rapid	98 "	38	31	37	.....	.....	18
Head of Long Sault	75 "	210	70	121	.....	.....	76
Foot of Long Sault	68 "	156	141	151	.....	.....	.....
Cornwall	65 "	155	90	130	72	56	63
Coteau	35 "	77	26	47	15	10	12
Caughnawaga	2 "	74	49	61	33	20	27

This examination showed an interesting increase in the number of bacteria on both occasions in the swift and relatively shallow stretch of river below Prescott, the number falling again in Lake St. Francis and rising somewhat below Lake St. Louis.

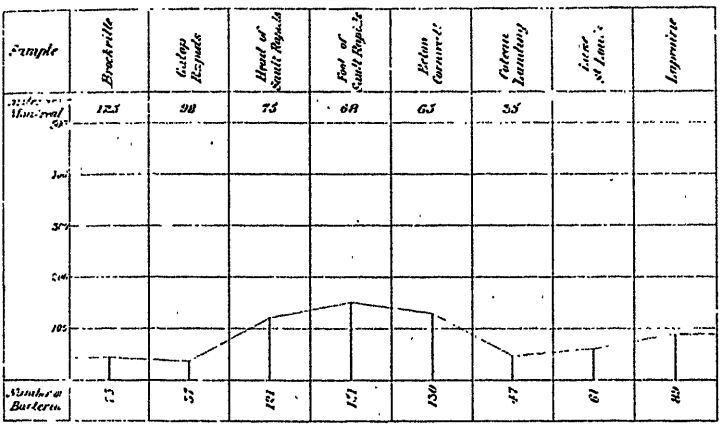

Fig. 10—Diagram showing condition of St. Lawrence water above Montreal. (First examination, July 26th, 1869.

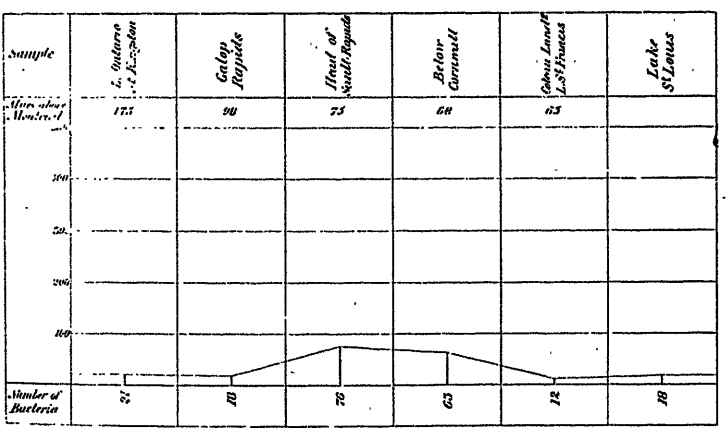

Fig. 11—Diagram showing condition of St. Lawrence water above Montreal. (Second examination, October 1st, 1891.)

It also shows throughout a relatively smaller number of bacteria in the water in September than in July.

IV. Surface Waters in other Parts of Canada.

Water from Uninhabited Districts.—A number of examinations made for the purpose of comparing the Ottawa water with

similar peaty waters for uninhabited districts, may be briefly recorded here by means of the following table, which shows that the water of the large rivers of the far north, coming from a desolate and almost unexplored country, contain as many bacteria as the Montreal water supply. It must be mentioned however that some of the samples were taken during a period of heavy rainfall late in the autumn.

Date.	Sample.	Bacteria per cc.			
		Max.	Min.	Average.	Temperature of water °C.
1891.					
Aug. 30.....	Saguenay above Chicoutimi	70	41	56	18°
Oct. 7.....	Ouiatchouan	134	101	118	12°
"	Ashuap-Mouchuan	700	400	476	10°
"	Mistassini	694	400	474	10°

Other Canadian Water Supplies.—Finally it seems of some interest (in view of the scanty data available on the subject) to mention some analysis of other Canadian water supplies which I made during the summer of 1891, though the fact that these waters were not repeatedly examined makes it impossible to draw any definite conclusion as to their relative sanitary value. In each case several different samples were taken and the cultures were, in every case made upon the spot.

Locality.	Date		Bacteria per cc.		
		Number of samples.	Max.	Min.	Average.
Kingston, Ont.....	Sept. 30th, 1891.	8	99	48	65
Quebec, Q.....	Oct. 7th, " .	5	112	86	90
Sherbrooke, Q.....	July " .	7	263	85	212
Halifax, N.S.....	July 17th, 1892.	7	218	41	99

I mention these results partly in order to emphasize the fact that for a reliable analysis the water must be repeatedly examined and samples obtained at different seasons. In a recently published biological analysis of 21 Canadian water supplies,* made in the spring of 1894 very different results were obtained,

*E. B. Shuttleworth. Toronto Telegram, May 10th. 94.

the number of bacteria found in the Quebec water, for example being stated as 1045 per cc. as compared with 90 on the occasion when I examined it.

Description of Species of Bacteria Found—Qualitative Bacterial Analysis.

From a sanitary point of view the most pressing questions in connection with my analysis of the Montreal water supply were those bearing upon the possibility of pollution. This can be determined as a rule better by quantitative than qualitative work, and I found that the study of the problems of this nature took up so much time that very little was left for the determining of the species of bacteria present.

Although I isolated over fifty different forms from the water, I was not able in all cases to study them thoroughly enough to identify them with existing species described by others. This identification is a matter of extreme difficulty except in the case of well known and easily recognized forms, and the difficulty is increased rather than diminished by the fact that some workers have published as new species forms which were already described, or described them in so vague and unsatisfactory a manner that it is impossible, from the meagre details given, to tell whether they are new or not. Microphotography does not seem to have greatly helped matters, and with the pigment producing (chromogenic) bacteria, it is impossible to tell from the descriptions given what the shade of colour really is and in how much its tint depends upon the medium employed.

For these reasons, although I detected and described several forms which I consider to be new species, I have hesitated to publish them for fear of adding to the existing confusion.

It seems to me that the great tendency which these organisms have to form varieties and races makes it really of less importance except in the case of pathogenic forms to multiply the number of new species by emphasizing minute points of difference than to study their points of resemblance, and so form them into definite groups in which, while the members might differ slightly from one another, their main characteristics

would enable them to be distinguished from the members of other groups. In other words, I would suggest the study of the affinities as well as the differences of the organisms. In that case, even if one might not be quite certain if the organism was a new species, he would know approximately where to place it.

It may, perhaps, not be out of place to quote the following passage from my report made in 1891:

"The result of the large number of disjointed efforts made in the direction of systematic description of the water bacteria makes it clear that the matter can never be settled on paper or by the isolated observations of individuals. What is wanted seems to be more co-operation among those working on the subject. This would lead to a sounder basis of classification of the water flora and seems really to be the only feasible means of attaining that end. If a society or committee of those engaged in water analyses in different localities could be formed, and each member allotted one group to investigate, so that various organisms of the same group obtained from different localities could be compared by parallel cultures, the results when compared and published would soon form a recognized standard of comparison. This would not only help beginners, but would obviate to some extent the causes which tend to confuse the work."

Not feeling myself competent to take the lead in a project of this sort, I refrained from taking any steps in the matter, but it may be mentioned that with the co-operation of Professor Adami, of Montreal, an attempt is now being made to organize somewhat upon the lines just laid down a scheme for the co-operative study of the water bacteria.

Bacteria Found in Montreal Water.—The forms which occurred were almost exclusively bacilli, only two species of micrococci being met with.

During the pollution due to heavy rains and melting snow a considerable number of molds, were present. A new form of *Fusarium* was once detected in tap water.

The relative proportions of the species present often gave valuable indication of slight degrees of pollution when the total

number of colonies was not sufficient to attract attention * and certain species, notably B. mycoides, appeared when the water was exposed to the washings of cultivated land.

As a rule 5 to 7 forms were detected in each sample when the water was pure, while in impure samples from the Montreal harbour, I have isolated as many as 16 species from the sample. On the other hand when a large number of bacteria developed in stored waters which were pure nearly 90 per cent of the colonies would belong to one species, usually *B. Fluorescens liquefaciens*, and if during the summer the proportion of this organism (which was normally from 30 to 40 per cent of the total colonies) fell to below 12 per cent, other proofs of pollution were usually forthcoming.

A singular circumstance was that in winter this ratio fell to 5 or 10 per cent., although the water was pure, the proportion suddenly rising again when the warm weather returned, while *B. Aquatilis* and other members of the yellow pigment-forming group formed the leading flora during winter. This transition is shown in the following table of analyses :

No.	Sample.	Date.	Temp. of water.	Bacteria per c.c.	B. Fluresc. liq. %	B. Aquatilis, %
128	Tap	May 6, 1891.	6°	646	4	30
129	Tap	May 7	6°	860	8	35
146	Tap	May 14	10°	106	15	20
143	Reservoir	May 14	13°	106	15	20
140	Basin	May 13	11°5	146	12	20
138	St. Cunegonde	May 13	10°	189	15	15
131	St. Lawrence	May 13	9°	245	10	25
155	Tap	June 4	11°5	140	40	2
156	St. Lawrence	June 5	14°	123	30	4

The following were among the common forms met with in Montreal water :

B. arborescens, *B. aquatilis*, *B. flourescens*, *B. fluorescens liquefaciens*, *B. janthenus*, *B. glaucus*, *B. megatherium*,

* See page 99.

B. multipediculus, *B. mycoides*, *B. nacreosus*, *B. aurantiacus*, *B. ramosus*, *B. aquatilis sulcatus*, *B. mesentricus vulgatus*, *B. mesentericus fuscus*, *B. proteus*, *B. fulvus*, *B. fuscus*, *B. ochreceus*, *B. plicatus*, *B. implexus*, *B. ruber*.

Among the rare forms may be mentioned B. Berolinensis, of which one single colony was met with.

Spirilla were not detected, but it must be mentioned that the plan of cultivating in weak peptone solutions was not known at the time.

I was able by means of the Parietti and Péré methods to isolate forms apparently belonging to colon group, but never succeeded with Montreal water in finding a perfectly typical distinctive culture of *B. Coli* or *B. Typhi*, whereas I found them abundantly in some spring water at a village where typhoid was epidemic.

I regret that I was unable to test the pathogenic properties of the forms met with.

CONCLUSIONS

From the result of this analysis it appears :

1. That the Montreal water is of good quality, as compared with other surface water, and does not appear to be at present a source of danger to public health, though its future purity is not altogether assured.

2. That from a biological point of view the St. Lawrence water is not superior to that of the Ottawa.

3. That the St. Cunegonde site offers no advantages.

4. That the reservoir water is superior to that of the settling basin, and that the Ottawa water is well adapted for storage in open reservoirs.

5. That better facilities for settling water should be provided, and no water pumped into the mains without previous sedimentation.

6. That inasmuch as the extreme severity of the winter makes the employment of filtration impossible, it is necessary to watch very carefully any minor sources of possible pollution, especially those lying between the settling basin and St. Anne.

7. It would be advisable to make experimental studies upon

the dimensions and capacity of a suitable settling basin, and also to make arrangements by which the water could be examined regularly at weekly or fortnightly intervals in order that any variations from the usual standard of purity established by these analyses may be promptly investigated. It would also be well to see if a better quality of water could not be obtained from the Lake of Two Mountains, and to investigate the amount and quality of water available in the lakes in the Laurentian Mountains, lying to the north, in case of a change of supply becoming necessary in the future.

I have to record my thanks to Mr. A. Davis, Superintendent of the Montreal Water Works, for having obtained permission to publish the foregoing report, and also for kindly loaning the cuts which illustrate it.

ON FIVE CASES OF PYOSALPINGITIS.*

Abstract of Paper by A. LAPTHORN SMITH, B.A., M.D., Montreal.

Case I. was a Mrs. M., 37 years of age, mother of four children, last child thirteen years of age. She had also a miscarriage eleven years ago. She began to menstruate at the age of seventeen and was married soon after. Her periods had always been profuse. It was learned from her family physician that her husband had given her gonorrhœa about the time of her miscarriage, since which she had never been a day well. She presented the dirty, bronzed complexion, characteristic of poisoning either by pus or fæces. It was ascertained that she had always been troubled with constipation, her bowels not being moved more than once in eight days unless she took medicine. She stated that she passed water fifty times a day. Since eleven years she has suffered constantly from pain in the sides and down the thighs, besides having had several attacks of pelvic peritonitis, the last one occurring six months ago, from which she nearly died. On examination she was found to have a lacerated perineum, lacerated cervix, and a pair of large pus tubes adherent to the ovaries and both bound down in Douglas' cul de sac. Three operations at one sitting were strongly urged, but she would only consent to the cervix operation, promising to submit to abdominal section later if she did not improve after the repair of the cervix. Schroeder's operation was accordingly performed, the greatest possible care being taken not to disturb the diseased appendages. All went well until the twelfth day, when she was allowed to get up, but an hour afterwards she was taken with an acute attack of pelvic peritonitis. It was evident that the pus tubes were either leaking or that they had burst, and immediate laparatomy was decided upon, but before the family's consent could be

* Read before the Montreal Medico-Chirurgical Society, May 4th, 1894.

obtained the abdomen had become so distended that it was thought impossible to return the bowels without opening them with the knife, if a section of the abdomen were made. It was, therefore, necessary to wait for three weeks until, with great difficulty, the peritonitis had been somewhat subdued and the vomiting was stopped. Finally a cœliotomy was done and a pair of distended tubes and ovaries were dug out from the many layers of densely organic adhesions. Thick yellow pus poured from the cut ends after they were placed on the tray. The stumps at the uterine cornua were cleansed with a solution of bichloride of mercury, the abdomen was thoroughly flushed with hot water, and a drainage tube was inserted, but was only left in for twenty-four hours, being no longer required. The pain in the pelvis which she had suffered so many years disappeared after the operation, and the woman made such a good recovery that she was up in four weeks, walked down stairs in five weeks, and in six weeks was nursing her daughter, performing with alacrity the work which this entailed.

On examination, the tubes and ovaries of both sides were found to be glued together into one mass the size of a large hen's egg. When placed in water the fringe of torn adhesions was clearly seen. No amount of dissection apparently would have been sufficient to separate the ovary from the tube without tearing the latter. A cross section of the tube near the uterine end showed that while the calibre of the canal was almost obliterated, the walls were very much thickened, the muscular layers being replaced by white fibrous tissue. The glandular and epithelial structures had been destroyed, while the mesosalpinx was very much thickened by the deposit of inflammatory exudation from the tube.

Case II. The next specimens were removed from a Mrs. A., 29 years of age, whose troubles date from a miscarriage which she had nine years ago, never having had any children. She had severe dysmenorrhœa ever since, so severe

that ordinary doses of anodynes had no effect in relieving her. Bimanual examination revealed the uterus in normal position, but Douglas' cul de sac was found to be filled with two round hard masses, very sensitive to the touch, which were thought to be the tubes and ovaries united together. As she was anxious to have children and declined to have the ovaries removed, palliative treatment was tried for several weeks with some benefit, but three months later she was worse than ever, and demanded a radical operation, which was performed on the 19th of April. The distended tubes, which were firmly cemented to the ovaries, were as large as hen's eggs, and required a long and forcible dissection with the fingers before they could be lifted to the surface. The abdomen was flushed and drained, and the woman made an uneventful recovery, getting up on the twenty-first day and going home on the 23rd of May.

She assured the operator, the day after the operation, that the pain she had had for nine years had entirely disappeared.

Case III. Mrs. M., 26 years of age, had been under the reader's care for several years for menorrhagia and dysmenorrhœa. Although married three years she had never been pregnant. She had to have morphine at every period, other anodynes having failed to relieve her. At every second period even large doses of morphine proved ineffectual; she was seen on several occasions when her suffering was certainly agonizing. Rapid dilatation was performed twice at intervals of three months with only temporary relief, but at the end of six months she was as bad as ever, so it was determined to remove the appendages, which was done at her home on the 22nd March, 1894. This case was remarkable for two things; the short convalescence, and the fact that one tube was completely sealed up while the other had a beautiful pavilion. She could not afford to have a nurse, but had her sister to attend to her for a couple of weeks. This sister had very little control over her, so that she insisted upon getting up at the end of a week. The doctor called unexpectedly on

the tenth day and found her rocking herself before the kitchen fire. In spite of being scolded she got up to stay up on the fourteenth day, but fortunately the silk worm-gut stitches remained in for one month. It would appear from the examination of the two tubes that the very severe dysmenorrhœa every second month was due to the absolute closure of the fimbriated extremity of the tube of that side on which the ovum matured, while the somewhat less painful period every other month took place from the ovary, on the side on which the tube was patent.

Case IV.—Mrs. F., an emaciated and sallow looking woman, thirty-five years of age, who had been married eleven years without ever having become pregnant, probably for the reason that two weeks after her marriage she had an attack of pelvic peritonitis, from which she nearly died. She was five weeks in bed with it, and it was three months more before she was able to get about. That was eleven years ago, and since that time she has had slight attacks of pelvic peritonitis about four times a year, which kept her in bed about a week each time, Her bowels have always been confined, generally moving only once in eight days and defecation being very painful, as was also coitus, which generally caused her to faint away. A bimanual examination revealed an irregular shaped and slightly fluctuating mass filling Douglas' cul de sac, the diagnosis of pus tubes and ovaries was made, and their removal strongly advised. Cœliotomy was performed at Dr. Lapthorn Smith's private hospital on the 13th April, the operation requiring nearly an hour of hard work owing to the density of the adhesions. The drainage tube was required for thirty-six hours. No morphine was needed, the patient having stated that the pain which she had had for eleven years had entirely gone since the operation. She was out of bed in two weeks and went home on the twenty-first day.

Case V.—Mrs. R., aged 24, mother of one child, 3 years old, since the birth of which she has never been well. She

had a miscarriage four months ago, and bled steadily for a month afterwards. For this she came under the writer's care. On examination the uterus was found to be large and retroverted, with the tubes large, hard and tender, lying behind it. Lest there might be some retained placenta, the uterus was thoroughly curetted with the sharp curette which, however, only brought away the thickened and spongy endometrium. It was swabbed out with Churchill's iodine and packed with iodoform gauze. She declined at this time to submit to removal of the appendages, although she was informed that she was in constant danger of them rupturing. She was told to send for the doctor immediately if she should be ever taken with sudden pain, as the operation would have to be done at once to save her life. Nothing was heard from her for several months, when one day an urgent message was received to come at once, her husband stating that the abscess must have burst, as she had suddenly complained of a terrible pain in her side, and soon after she had fallen on the floor unconscious. He ordered her to be brought immediately to his private hospital, preparations being made without delay for an abdominal section. When she arrived she was in a condition of profound shock, having no pain, but her pulse being fast and thready. As soon as she could be prepared, the abdomen was opened, and at the first nick in the peritoneum an ounce of thin yellow pus flowed out. The tubes and ovaries were dug out of their bed of adhesions with considerable difficulty, there being a hole in the tube where the pus had escaped. The tubes, an inch from the uterus, were thickened to the size of the thumb, consisting almost entirely of solid fibrous tissue of very brittle consistency. Beyond that point the tubes were thinned out to form an abcess cavity. The peritoneum was cleaned in the usual way and a tube inserted, from which in the course of the first day eight ounces of serum were removed. She also made a good recovery, stating that her pain had disappeared after the operation, and getting up in two weeks and going home in three.

The reader of the paper remarked that these five cases were almost exactly like each other, and differing very slightly from about twenty others on whom he had operated. He stated that he had about forty other similar cases under his care during the last ten years, all of whom he thought would eventually come to an operation, although he had not so far been able to convince them of its necessity. A few of them had remained fairly comfortable for as long as two years at a time without treatment, and then they would have a pretty sharp attack of pelvic peritonitis. Of course the longer they delayed the more adhesions there would be and the more difficult the operation. He had no apology to make for having performed these operations, as all of these women had been almost constant sufferers for from two to eleven years. On the contrary he thought it was his duty, as it was the duty of every practitioner, to diagnose these cases as early as possible, and to urge the removal of the appendages at the earliest possible moment. No one could be more averse than he was to removing an otherwise healthy organ for functional disease, but in the light of his experience with pus tubes and ovaries, he felt that he had in the past rather erred on the side of ultra-conservatism, a fault which he promised he would not be guilty of in the future. The operation in his experience was much less dangerous than would be supposed, it being rare for the convalescence to cause any anxiety. This immunity from peritonitis, even when the tube had burst and inundated the bowels, he attributed to the tolerance which the peritoneum acquires after several inoculations with gonococcic or staphylococcic virus. So that while they were among the most difficult, they appeared to be among the safest of abdominal operations. He had generally found with his fingers in the abdomen that the condition of affairs was much worse than it had appeared to be by bimanual examination. The organs being organically diseased and their function destroyed, and being moreover a constant menace to the patient's life, he felt that we should have no hesitation in removing them.

Reviews and Notices of Books.

Transactions of the Association of American Physicians. Ninth Session. Held at Washington, D.C., May 29th, 30th, 31st and June 1st, 1894. Volume IX. Dr. I. Minis Hays, Recorder, Philadelphia.

This volume contains the following articles:

The Rise and Fall of the Licensed Physician in Massachusetts, 1781-1860. By Reginald H. Fitz, M.D., of Boston.

The Treatment of Certain Symptoms of Croupous Pneumonia, Particularly in Adults. By Beverley Robinson, M.D., of New York.

A Treatment of Typhoid Fever. By Samuel A. Fisk, A.M., M.D., of Denver, Colorado.

Cases of Traumatic Headache. By Charles F. Folsom, M.D., of Boston Mass.

Clinical Report of Two Cases of Raynaud's Disease. By Frederick P. Henry, M.D., of Philadelphia.

Investigations upon Cow-pox. By Stephen C. Martin, M.D. Presented by Harold C. Ernst, M.D., of Jamaica Plain, Mass.

Modification, Temporary and Permanent, of the Physiological Characters of Bacteria in Mixed Cultures. By Theobald Smith, M.D., Chief of the Division of Animal Pathology (Bureau of Animal Industry) of the U.S. Department of Agriculture; Professor of Bacteriology and Hygiene in the Medical Department of the Columbian University, Washington, D.C.

Notes on the Observations of Malarial Organisms in Connection with Enteric Fever. By W. Gilman Thompson, M.D., Professor of Physiology in the Medical Department of the University of the City of New York; Physician to the New York and Presbyterian Hospitals.

Experiments in Artificial Melanosis. By George Dock, M.D., of Ann Arbor, Mich.

On Lead Palsy in Children; with a Report of Three Cases. By Wharton Sinkler, M.D., of Philadelphia.

Apoplexy in its Relation to the Temperature of the Body.

With a consideration of the Question of Heat Centres. By Charles L. Dana, M.D., Professor of Nervous and Mental Diseases in the New York Post-Graduate Medical School; Visiting Physician to Bellevue Hospital.

The Frequency of Renal Albuminuria, as shown by Albumin and Casts, Apart from Bright's Disease, Fever, or Obvious Cause of Renal Irritation. By Frederick C. Shuttuck, M.D., of Boston.

Experimental Phthisis in Rabbits with the Formation of Cavities—A Demonstration. By T. M. Prudden, M.D., of New York.

A report of the Ultimate Results Obtained in Experimental Eye-Tuberculosis by Tuberculin Treatment and Anti-tubercular Inoculation. By E. L. Trudeau, M.D., of Saranac Lake, N.Y.

The Effects of Various Metals on the Growth of Certain Bacteria. By Meade Bolton, M.D., Associate in Bacteriology, Johns Hopkins University.

Some of the Chemical and Bacteriological Characteristics of Milk. By T. M. Botch, M.D., of Boston, Mass.

Osteomalacia, with a New Case. By George Dock, M.D., of Ann Arbor, Mich.

The Mild Character and Diminished Prevalence of Syphilis, and the Infrequency of Visceral Syphilis. By J. H. Musser, M.D., of Philadelphia.

The Compensatory Changes in the Right Ventricle in Mitral Stenosis. A Case with Hypertrophy, but Without Dilatation; Death from Hæmoptysis. By Alexander McPhedran, M.B., Associate Professor of Medicine, University of Toronto; Physician to the Toronto General and St. Michael's Hospitals, and the Victoria Hospital for Sick Children.

Cough Induced by Posture, as a Symptom Nearly Diagnostic of Phthisis. By Norman Bridge, A.M., M.D., Professor of Clinical Medicine, etc., in Rush Medical College, Chicago. (Los Angeles, Cal.)

Gastro-enteric Rheumatism. By Henry M. Lyman, A.M., M.D., of Chicago, Ill.

The Chemical Products of the Anaërobic Putrefaction of Pancreatic and Hepatic Tissues, and their Effects upon the Tests for Morphine. By Victor C. Vaughan, M.D., of Ann Arbor, Mich.

Tetany in America. With a Report of Five Cases. By J. P. Crozer Griffith, M.D., Clinical Professor of the Diseases of Children in the University of Pennsylvania; Professor of Clinical Medicine in the Philadelphia Polyclinic; Physician to the Children's Hospital, etc.

Stomatitis Neurotica Chronica. By A. Jacobi, M.D., of New York.

Diseases of the Skin. An outline of the principles and practice of Dermatology. By MALCOLM MORRIS, Surgeon of the Skin Department, St. Mary's Hospital, London; etc. With 8 chromo-lithographs and 17 wood-cuts, pp. 556, Lea Brothers & Co., Philadelphia, 1894.

Of the many smaller books which have appeared lately on this subject, the present volume is one of the best. It is essentially a practical handbook for clinical work and consequently is not to be compared to the larger works, inasmuch as the theories of causation of disease are largely omitted and the matter is necessarily condensed. The author is already well known, through his contributions to the current literature of the subject, as a skilled worker in the field of Dermatology and the arrangement of his book shows that he understands what is required in a volume of the character of the one he has published.

Regarding classification he says "No formal scheme of classification is propounded, but an attempt is made to group the diseases described in accordance with the tendency of modern pathological research--that is to say, etiologically." This is no doubt the best way to put the matter at present, for so many of the diseases described are as yet so little understood that classification is difficult if not impossible. The chapter on the principles of diagnosis is a special feature of the book and will be found of great use. The descriptions of the various diseases are short and to the point, those which are commonly met with being given more space and attention than the rarer forms. The whole is illustrated by 8 coloured plates giving representations of 19 forms of skin disease, as well as a number of wood cuts.

Teratologia: Quarterly Contribution to Antenatal Pathology. Edited by J. W. Ballantyne. Vol. 1, No. 2. Published by Williams & Nirgate, London.

Those who are interested in this much neglected field of

pathology will owe a debt of gratitude to Dr. Ballantyne for bringing out a new journal devoted to the study of diseases and malformations of the fœtus. One valuable feature of the new journal is the review of current literature, which is very complete and well arranged, and this alone would make it a valuable work of reference. At present any one wanting to look up some point about pathological conditions of the fœtus is obliged to search through an endless series of books, journals and reviews on Obstetrics, Pediatrics, Anatomy, Physiology, Pathology, Histology, Embryology, Heredity, etc., and is in the end uncertain whether the information sought is not concealed after all in some journal on general medicine. The original matter of the number before us is interesting and well illustrated.

Index Catalogue of the Library of the Surgeon General's Office, U.S.A. Authors and subjects Vol. XV. Washington Government Printing Office, 1894.

This most useful work is now approaching completion, the present volume bringing the matter down to the letter V. It contains over six thousand author titles and nearly nine thousand titles of books and pamphlets, as well as a great number of titles of articles in medical journals. This gives some idea of the scope of the work; of the way in which it has been carried on, nothing need be said, beyond saying that the present volume is similar to those previously issued.

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Leprosy. By Isadore Dyer, Ph. B., M.D. Reprinted from the May, 1894, number of the Texas Medical Journal.

Report for the Year 1893-94. Presented by the Board of Managers of the Observatory of Yale University to the President and Fellows.

Teno-Suture and Tendon Elongation and Shortening by Open Incision: Advantages and Disadvantages of the Various Methods. By H. Augustus Wilson, M.D. Reprinted from International Clinics, Vol. 1., Fourth Series.

Report on the Leprosy Question in Louisiana. By Isadore Dyer, Ph.B., M.D. Reprinted from the Proceedings of the Orleans Parish Medical Society, June Meeting.

The Uric Acid Diathesis and Its Treatment. By John F. Barbour, M.A., M.D. Reprint from the American Therapist, June, 1894.

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Canadian Medical Literature.

[The editors will be glad to receive any reprints, monographs, etc., by Canadian writers, on medical or allied subjects (including Canadian work published in other countries) for notice in this department of the JOURNAL.]

PERIODICALS—JULY, 1891.

CANADIAN PRACTITIONER.

(1.) Case of Cholecystotomy for Obstructive Jaundice—R. Whiteman, p. 479.

Some phases in the management of consumption—E. H. Adams, p. 485.

(2.) A Case of lumbar hernia—F. N. G. Starr, p. 491.

(3.) A case of cerebral glioma—J. E. Graham, p. 503.

ONTARIO MEDICAL JOURNAL.

Hip joint disease—W. W. Bremner, p. 443.

Proceedings at the meeting of the Ontario Medical Council—(*Continued*), p. 448.

MARITIME MEDICAL NEWS.

Hysteroraphy, or ventral fixation of the uterus, with four successful cases—E. Farrell, p. 323.

Antipyretics—F. W. Goodwin, p. 326.

The Fullerton inquest, pp. 331 and 338.

DOMINION MEDICAL MONTHLY.

(4.) Uncured Gonorrhœa, its causes and sequences—E. H. King, p. 1.

Case of placenta prævia centralis—J. Campbell, p. 5.

Case of typhoid fever—Wm. Glaister, p. 8.

L'UNION MEDICALE DU CANADA.

De la vaginotomie postérieure—M. T. Brennan, p. 337.

De la vaccination faite antiseptiquement—M. T. Brennan, p. 337.

Entérocèle vaginale—C. A. Daigle, p. 339.

CANADA LANCET.

(6.) Notes on a case of biliary calculi—G. T. Orton, p. 324.

The uses and abuses of the nitrites—Jas. Newell, p. 327.

CANADA MEDICAL RECORD.

Demonstration of intestinal anastomosis with the Murphy button—A. Lapthorn Smith, p. 217.

JOURNAL d'HYGIENE POPULAIRE.

(7.) Un cas de mort après vaccination, p.

BRITISH MEDICAL JOURNAL.

(8.) A note upon chlorosis in the male—C. F. Martin, p. 123.

(1.) Dr. Whiteman reports a case of cholecystotomy in a man aged 54, who had suffered for 4 months from severe

jaundice with some emaciation. The gall bladder, which was greatly enlarged, was first secured to the abdominal wall, and a trocar then inserted. About one and a half pints of dark green tenacious bile ran out. No evidence of gall stone or tumour could be made out. After the operation, the jaundice gradually disappeared, about 20 to 40 oz. of bile escaping daily from the fistula. He became better for a couple of months after the operation, but then began to fail and died 5 weeks later. An autopsy showed a cancerous tumour in the duodenum near the orifice of the common bile duct.

(2.) In Dr. Starr's case the patient was seized with a stitch in the side when lifting a heavy weight and had noticed a lump in the back ever since. The swelling was as large as a duck's egg and situated in the right lumbar region above the crest of the ilium. It was tympanitic and readily reducible on palpation.

The same patient also had a small hernia, the size of a marble below the ensiform cartilage.

(3) Dr. Graham reports the case of a man who presented symptoms of motor aphasia with slight paralysis of the right arm and right side of the face. There was a history of a severe blow on the head four months before; while apparently doing well in hospital he developed fever with delirium and died in a few days. At the autopsy a glioma, the size of a large walnut was found in the region of the right internal capsule surrounded by an area of acute cerebritis.

(4.) Dr. King emphasizes the infectious nature of old-standing cases of gleet and gives instances where upon marriage this has led to severe pyosalpinx and pelvic cellulitis. It may be mentioned that the author considers no cases of gonorrhœa cured after the discharge has ceased, unless the urine remains clear of shreds for at least two weeks after the last injection. He recommends the use of a blunt pointed syringe holding at least half an ounce of fluid which should be injected with sufficient force to distend the whole urethra. The ingredients of the fluid, provided it is not too strong and irritating, are of less importance than the manner of using it.

(5.) Dr. Brennan emphasizes the necessity of observing strict antiseptic precautions in all cases of vaccination.

(6.) Dr. Orton reports a case of biliary calculi where cholecystotomy was performed. Several large calculi were found lodged so firmly in the cystic and common ducts that they could not be dislodged. The patient died on the fourth day after the operation.

(7.) A report is given of the inquest recently held in Montreal which was referred to in our editorial columns last month.

(8) Dr. Martin reports four cases of chlorosis in the male in all of which the number of red corpuscles was normal, while the proportion of hæmoglobin considerably diminished. In the first case, age 27, there were 5,300,000 red corpuscles per cubic milimeter and the hæmoglobin was 68 per cent by Fleschl's apparatus. In the second case, age 27, the red cells were 5,300,000 and the hæmoglobin 72 per cent. The third case, aged 25, gave hæmoglobin 77 per cent and red cells 6,030,000. In the fourth case the hæmoglobin was at 77 per cent and the red corpuscles 4,800,000. In all these cases there were symptoms of dyspepsia and constipation, and all improved upon treatment with arsenic and iron.

Dr. Martin thinks that chlorosis is not, as has hitherto been assumed, a rare disease among males.

Selections.

Indicanuria as a Symptom of Latent Suppuration.—Indican, in small quantities, is a normal constituent of healthy urine, but under certain circumstances the amount is so large as to merit the designation of indicanuria. This condition is usually dependent on decomposition of the intestinal contents consequent on constipation; but it has recently been discovered in the urine in connection with the formation of pus in such quantities as to authorize the belief that its presence may afford an important indication of latent suppuration. The first thing, of course, is to eliminate the intestinal tract as the source of the indicanuria, and this is done by the administration of naphthol, bismuth, or other disinfectant. Should chemical analysis still reveal the persistence of the indicanuria, there is reason to suspect suppuration. In several cases observed by Dr. Keilmann, of Dorpat, the information thus obtained led to a successful search being made for foci of suppuration, the indicanuria subsiding as soon as the pus was evacuated. The analysis is simple enough to admit of its application by every one, which is more than can be affirmed of many of the tests proposed by laboratory physiologists. Equal quantities of urine and strong hydrochloric acid are shaken together in a test tube, and a little chloroform is added. In the presence of indican this becomes blue from the indigo liberated by the decomposition of the indican, and falls to the bottom of the tube. A fair idea can thus be readily obtained of the amount of indican present, but for purposes of diagnosis it is necessary to resort to a quantitative analysis. This does not involve much additional trouble, advantage being taken of the bleaching powers of hypochlorite of calcium, a standardized solution of this salt being dropped into the above mixture until complete decoloration results. Three or four drops of a five per cent. solution may suffice for this purpose, but in some cases as much as fifty, or even eighty, drops may be required.—*Medical Press and Circular.*

A Therapeutic Retroversion.—In the good old days of Edward the Second or Third, John of Gaddesden was court physician. He was the first doctor in England to win this high distinction. The honour was probably not unworthily bestowed, for he was an Oxford man, and doubtless knew what little was known of medicine in his time.

He lived at a time when medicine was a curious mixture of fact, fad, fiction, and folly, when the demon theory of disease was accepted for truth, when the hearts of nightingales were prescribed for loss of memory, when lunatics and epileptics were treated by causing the patients to fast, hear masses, and to wear about their necks appropriate texts of Scripture on certain holy days, and when the therapeutic efficacy of amulets, charms, and prayers was never doubted by the best physician.

This John of Gaddesden wrote a quaint old book, the *Rosa Anglica seu Practica Medicinæ*, wherein the following measure is recommended in the treatment of smallpox: So soon as the eruption has appeared, "Cause the whole body of your patient to be wrapped in scarlet cloth, or in any other red cloth, and command every thing about the bed to be made red. This is an excellent cure." Sir Thomas Watson, commenting upon "the erroneous principle," with results "eminently disastrous," upon which in the olden time the treatment of smallpox was conducted, says:

The eruption they considered to be the natural and only cure; and adopting the vulgar maxim, that "it was better out than in," they did all they could to promote a copious eruption by a hot regimen, by covering the patient with bed-clothes, by keeping the doors and windows jealously closed, and excluding every breath of fresh air, and sometimes by administering wine and cordials. The celebrated John of Gaddesden . . . improved even upon this. He surrounded the half-suffocated patient with red curtains, red walls and red furniture of all kinds; every thing he saw was to be red; for in that colour there was, he pretended, a peculiar virtue. This John of Gaddesden, by the way, was a very sad knave. . . . He had one medicine so good

as to be fit for the rich only; and he recommended a double dose for the wealthy: "*Duplum sit, si pro divite.*"

Sydenham was the first, in this country, to employ the opposite or cool regimen in smallpox; and although his prejudiced contemporaries refused to follow his example and adopt his practice, he confidently predicted its final triumph. "*Obtinebit demum me vitâ functo.*"

In the light of these historical reminiscences the following, which we clip from the New York Medical Record (17th inst.), is most interesting:

"RED LIGHT FOR SMALLPOX.—Finsen (Hosp. Tid., No. 27, 1893), has made some observations on the effects of light on the skin. He referred to the good results obtained by Black and others by the exclusion of daylight in the treatment of smallpox, but argued that, as Widmark has shown that it is the ultra-violet rays which have the strong chemical action, it is not necessary to exclude the daylight, but by using red curtains tightly drawn, or red window panes, the injurious effects of the light can be prevented. The correctness of this hypothesis was proven by Svendsen, of Bergen, who last summer treated four cases of smallpox in unvaccinated patients by covering the windows with thick red woollen curtains. The patients escaped the suppurative stage; there was no rise of temperature, no œdema. The patients passed from the vesicular stage, which was slightly prolonged, into convalescence, and escaped scarring."

In this connection the verse of old John of Gaddesden's contemporary, Chaucer, is apt indeed:

> "For out of the old fieldes, as men saithe,
> Cometh all this new corn from yere to yere;
> And out of old bookes, in good faithe,
> Cometh all this new science that men lere."

The moral of this is, that inasmuch as things are found to be so by experience long before science comes and tells us why they are so, much that seems silly in the practice of olden times may be found by science to have good foundation in fact.

The old masters in music made all their wonderful blendings of melody, harmony, and orchestration long before the physicists knew why they wrote as they did, and while the analogy

is incomplete, we may expect medical science to justify much of the practice of the fathers in medicine.

The solar spectrum tells us why John of Gaddesden made things red around a smallpox patient; bacteriology (asepsis) tells why the traditional midwife burns the hole in the compress that goes over the cord of the new-born infant; the marvelous effects of thyroid gland injected or ingested in myxedema tells us how results may have been obtained through the administration of the viscera or glands of various animals in some affections; while hypnotism, to say nothing of other phases of psychic science, may yet redeem from scorn the superstitious belief of the ancients in stella strokes, demoniacal possession, doubles, ghosts, and witchcraft, and their faith in the therapeutic efficacy of charms, characts, amulets, fasts, sacred verses, and prayers.—*American Practitioner and News, March* 24, 1894.

The Production of Vaccine Virus.—(Report of a committee of the Norfolk District branch of the Massachusetts Medical Society.)—Your committee have visited the two principal depots from which the vaccine stock is supplied to this section, namely, the New England Vaccine Company's operating-rooms in Chelsea, and the operating-rooms of the late Henry A. Martin, M.D. We were welcomed with gentlemanly courtesy and attention at both places, where the processes were freely shown and explained. We have also had freely given from Codman & Shurtleff a description of the process pursued by them at their farm in Stoughton, which we were cordially invited to visit. Also, I will state that, at the meeting of the Norfolk District Society where this report was originally made, Dr. Francis C. Martin made some remarks in regard to the course pursued by him at his establishment.

At Chelsea we found buildings well adapted for the purpose—a stable so built with cemented floors, gutters and walls, that it could be thoroughly flushed; and it had evidently so been, for not a particle of stable *débris* was present. Leading from this

stable, separated by an entry and double-doors, is the operating room proper. This room has a floor of artificial stone, tiled walls, and is heated by steam. It is furnished with sets of stanchions in which to securely and comfortably confine the cattle undergoing the operations, and with a closet of fine-wire gauze, for the drying of the freshly charged points, admitting the air but excluding the coarser particles of dust. This room can also be thoroughly flushed, and it is claimed that it is so treated with antiseptic solutions from time to time. There is an evident intent to preserve the appearance, at least, of asepsis, but one notices a carelessness of the employés in handling the charged points, etc., with hands which are certainly not surgically aseptic. Whether this comes from ignorance of what science has a right to demand in such a process, or whether it is the carelessness which familiarity with routine work almost necessarily begets, I do not know. In regard to the results I will speak later.

The operating-room at the Martin establishment is an ordinary room opening directly from the carriage-house of the stable. This room has wooden floor and walls, and has no conveniences whatever for producing aseptic conditions other than such as accompany ordinary cleanliness. Mr. Reed told us they made no pretensions to do more.

The process of securing the lymph at the two establishments differs in many ways. At the New England, they use mature animals, about four years old. These are vaccinated on the back of the buttock and on one side of the belly, in small patches about three-fourths of an inch square, which do not materially enlarge in development. At the New England establishment the animal while undergoing operation remains standing, confined by a set of stanchions. At the Martin establishment the work is done upon the animal lying on its side, and strapped to a table. At Codman & Shurtleff's, and at Dr. Francis C. Martin's, the age of animals and the process are practically the same as at the Martin stable in Brookline.

At the first glance at the animal vaccinated and ready for use, the sight is repulsive, and the broken-down, suppurating

crust seems a most disagreeable thing to inoculate into the human organism. These crusts and their accompanying *débris*, you are told, are ground up with glycerine and regularly dispensed as vaccine stock in some foreign countries. *Here* the crust and all loose tissue are removed, thus exposing the base of the vesicle. At the New England institute, this, with the surrounding skin, is thoroughly washed with a sponge and clean water, and after a few minutes the serum exudes and, the animal standing in an upright position, trickles down to the lower edge of the patch from which it is taken upon the points. The first flow is a little discolored with blood, and is kept to revaccinate new animals with. After a while the flow of serum is obtained perfectly clear and of a slightly yellowish shade. By this method, at the New England institute, the points are not brought at all in contact with the raw surface but receive the lymph as it trickles down to the second skin. The points are then laid upon a nickel-plated metal tray, channelled and adapted for the purpose. When the tray is filled, it is placed inside the gauze closet to dry.

At the Martin establishment, as I have said, the vesicles are individually smaller, and, after having been freed from the crust, are not washed but are wiped with a towel which seems to have done some service in the same direction before. From these vesicles, there being less tension of the tissues than where the patches are larger, the lymph does not exude itself but is squeezed out by compression of the base with forceps, and the points are charged directly from the denuded surface; therefore all are more or less discolored with blood. At the New England establishment the points having been received from the factory are sterilized before being charged—subjected for an hour to a temperature of 212°. At the other place, as I have said, no attempt at asepsis is made.

At Codman & Shurtleff's establishment the process is similar to that at the Martin, except that, instead of dipping points into the lymph exuding from the raw base of the vesicle, the lymph is collected in little glass cups, and any *débris* present in it is allowed to settle or is skimmed off, after which the points are charged with the clear lymph.

Now, while neither of these processes approach what we know as surgical asepsis, yet the fact remains that we never hear of septic inflammation setting in within a *few hours after vaccination*, which it surely would do if septic matter were directly introduced into the system; so that we must believe that the charged points are not septic even if the process of preparing them is not ideal.

On the other hand, when suppuration does occur, it sets in as a secondary result to the mature vesicle. This it is claimed, and justly it would seem, is due to atmospheric germs having found their way within the ruptured capsule of a broken vesicle. Therefore, when this occures in this secondary manner, it is after the vaccinia has been produced, and it does not, as is sometimes claimed, interfere with the protective power of the vaccination. The resulting sore should therefore be treated antiseptically from that time on, and healed as soon as possible.

Dr. Cutler, at the head of the New England establishment, maintains that a small vesicle should always be obtained, and that, from the commencement, it should be kept as dry as possible, no moist or oily dressing ever being used. A small vesicle produces less inflammation—and so less necrosis of subjacent tissue, less areola, and so less constitutional disturbance. Moreover, it is far less liable to crack and rupture. He claims that the size and accompanying characteristics of the vesicle may be absolutely determined by the size of the original scarification, which had better be a mere puncture, and never should exceed one-sixteenth of an inch in diameter. There should be two or three of these vesicles situated nearly two inches apart, so that they may never become confluent with one another. He exclaimed, "It was a bad day when we were taught to scarify instead of the old-style puncture." His explanation of this and of his theory that a large scarification makes a confluent and highly inflamed vesicle is, that, while it is necessary to spread the inert virus obtained from calves over a large scarification, to get any result—uncertain at best—the lymph obtained from mature animals is richer in germs which become implanted all over the scarification and start numerous colonies, each a

nucleus of vesicles which, as they grow, coalesce until they form the large confluent vesicle.

In conclusion, your committee are inclined to believe, from the limited observation which they have been able to make, that the New England virus is the more active and therefore the more dangerous virus to use; that the Martin virus is not as active and consequently may be the safer for general use. In reference to this the New England people state that the danger of excessive result should not be laid at the door of active virus, which is necessary to fight an epidemic with, but is due to the ignorance of the proper technique of vaccination among some members of the medical profession, and especially among laymen who often do not hesitate to perform the operation. On the other hand, the late Dr. H. A. Martin has maintained that the serum from the large confluent vesicle on the cow, with its higher degree of inflammation, is alone responsible for the greater degree of irritation in the human subject. Your committee believe that these points can only be settled by a more careful attention, on the part of physicians, to the technique of the operation, and an observation of subsequent results.

Further, your committee are led to the positive belief that the whole subject of preparation of vaccine stock should not be left in the hands of rival commercial companies, but should be wholly under the official control of either city or State.—D. D. GILBERT, M.D., *in the Boston Medical and Surgical Journal, 3rd May*, 1894.

Report of the Committee on "Prevention of Blindness through Legislative Enactment."—(Presented at the 128th annual meeting of the Medical Society of the State of New Jersey.)—At the Meeting of the Medical Society of New Jersey, held at Asbury Park, June, 1893, a paper entitled "The Present Status of Legislation for the Prevention of Blindness" was presented, and the following resolutions were unanimously adopted: Resolved, That a committee of three be appointed to consider the question of Legislation for the Prevention of Blindness, to report at the next annual meeting of the society.

Your committee would respectfully report that action favoring such legislation for the prevention of blindness is under way in a large number of States, and that in six States, i. e., New York, Maine, Rhode Island, Minnesota, Ohio and Maryland, laws have already been enacted making it a criminal offense punishable by fine and imprisonment, of any person or persons neglecting to comply with them.

The census returns for 1890 indicate a total of 50,411 hopelessly blind in the United States; of these, 27,983 are males, 22,458 are females; 43,351 are white, 7,060 are colored; 41,265 are natives, 9,146 are foreigners.

It is estimated that nearly twenty per cent. of all blindness occurring in early life is dependent upon ophthalmia neonatorum; it has been shown that the disease may be almost absolutely prevented by prophylactic treatment, and that when ophthalmia neonatorum does occur and the inflammatory processes resulting have involved the cornea, it is a disease which frequently results in complete destruction of the eyes.

When a qualified practitioner of medicine can be placed in charge of a case at the onset of the disease, and an active antiphlogistic and curative treatment at once adopted, the prognosis is favorable to an ultimately satisfactory recovery. Hence the necessity of placing all sufferers from this affection under appropriate and skilful medical treatment by "legislative enactment."

Legislation directed at such cases compels attention; and, requiring immediate report of all midwives, nurses and attendants cannot fail to accomplish much good, as all of the fallacies regarding the etiology of the disease from cold, the treatment by the application of breast milk and the numberless remedies advised by ignorant "knowalls," will be relegated to a well-earned obscurity.

That prophylactic treatment will reduce the percentage of cases of ophthalmia neonatorum occurring to the minimum is acknowledged, and easy of demonstration, by a study of the literature, some authorities claiming that it will only occur in about two-tenths of one per cent. of all deliveries against at least ten per cent. of all cases when no prophylaxis has been adopted.

The method of Crede, is recommended by the committee for use after all deliveries. The treatment is simple and is unattended by any danger. It consists in carefully washing the eyes immediately after delivery with a soft linen cloth dipped in plain tepid water, which has been used for no other purpose, and the instillation of a single drop of a two per cent. solution of argent. nit., which is allowed to fall from a pipette immediately upon the cornea. The lids are then closed.

That in cases of ophthalmia neonatorum once developed, prompt treatment frequently results in preventing corneal infection and subsequent loss of the eyes is undisputed. When a purulent secretion is present the eyes should be cleaned frequently enough to keep them free from pus. The period of time between such cleansing should never at any time of the day or night be longer than one hour, and should, if necessary, to keep the eyes free from pus, be as frequent as every 10 or 15 minutes. The lids should be gently separated by the fingers, care being taken, especially if there is any suspicion of corneal infection, not to make any pressure on the globe. The accumulated pus is to be removed carefully with a pledget of cotton dipped in tepid water, or preferably a tepid solution of hydrargyrum bichloride, one to ten thousand. The inflamed conjunctiva should never be wiped with the cotton, the pus being either removed by flushing the eye with water squeezed from it or by gently patting the everted lid, if necessary. The palpebral conjunctiva should each day receive an application of a solution of argent. nit., varying in strength with the period of and severity of the disease—argent. nit. gr. v. to XL. aqua dest. oz. 1.

In the early stage of the disease, the bathing should be very frequent and the applications thoroughly accomplished in order that corneal infection may be prevented, as the probability of corneal infection is lessened after the acute phases of the disease are controlled. If the inflammation is very acute ice cloths are, if they can be kept in position, of service and very grateful to some patients. If solutions of argent. nit., stronger than gr. x to the ounce are used the lid should be immediately bathed

with a mild saline solution to neutralize the silver and prevent erosion of the cornea.

If the cornea becomes affected sulphate of atropia gr. 1 to the ounce of aqua destil., should be instilled, one drop three or four times a day, or if the corneal ulceration be peripheral, sulphate of eserine gr. ½ to the ounce aqua dest., may be used, one drop three or four times a day.

If the secretions diminish on the third or fourth day of the treatment, renewed vigilance should be recommended on the part of the attendant, in order that a probable relapse may be prevented, from which recovery is often very slow and which is invariably more difficult to control than the primary infection, and quite apt to be followed if it does occur by corneal ulceration.

In every case of purulent eye disease each person who may have occasion to handle the purulent secretion should be especially warned to thoroughly cleanse and disinfect the hands after every contact with the infectious products, and to destroy by burning all cotton or cloths used in bathing the eyes.

A circular letter, directing the attention of the medical profession throughout the United States to the subject of legislation for the prevention of blindness resulting from ophthalmia neonatorum, was issued by the committee appointed by the American Medical Association at the annual meeting in 1893.

The following draft of a bill for the prevention of blindness resulting from ophthalmia neonatorum, which was enclosed with the circular, is recommended by the committee for the approval of the society, and for subsequent adoption by the Senate and General Assembly of our State. "A bill for the prevention of blindness in the State of New Jersey."

The people of the State of New Jersey represented in Senate and Assembly, do enact as follows:

Section 1. Should one or both eyes of an infant become inflamed or swollen, or reddened at any time within two weeks after its birth, it shall be a duty of the attendant midwife, nurse, or attendant having charge of such infant, to report in writing, within six hours, to the health officer or some legally qualified practitioner of the city, town or district in which the parents of the infants reside, the fact that such inflammation or swelling or redness of the eyes exists.

Section II. Any failure to comply with the provisions of this act shall be punished by a fine not to exceed two hundred dollars, or imprisonment not to exceed six months or both.

Section III. This act shall take effect on the —— day of ——, eighteen hundred and ninety——

The committee would recommend a section in addition to the above, compelling the parents or relatives of an infant suffering from a purulent discharge from the eyes to place it immediately in charge of some legally qualified practitioner of medicine, or of the city or district physicians if unable to employ a family physician.

Although the committee have not considered it desirable at this time to incorporate with this present proposed enactment any methods of legislation regarding the prevention of blindness from other sources than ophthalmia neonatorum, they cannot refrain from enumerating some of the other sources of danger which might be possibly considered as susceptible of management by the State and local health boards.

Blindness as a result of trachoma and all blenorrheal communicable eye diseases, conveyed by the carrying of the germs of the disease or by the actual inoculation of the ocular or palpebral conjunctiva with the products of the inflammatory action may certainly be lessened by the adoption of ordinances by health boards and by assistance from the State Board of Medical Examiners.

Ordinances should be enacted prescribing regulations compelling in all public lavatories, whether located in hotels or other places, a strict observance of necessary sanitary precautions, scientific plumbing, especial care regarding the linen, and entirely forbiding the use of that common carrier—the roller towel.

In all schools and reformatories applicants should be examined by a competent medical examiner before admission, and any applicant declined who has any form of communicable eye disease unless especial quarters are provided for the isolation of such cases.

The buildings of all such institutions should be periodically inspected by experts in sanitary science, and a detailed report

made to the State or local health boards setting forth the sanitary conditions of the buildings, closets and lavatories. The capacity of the institution should be regulated by ordinance, fixing the number of persons to be admitted, allowing an ample air space for each person, and providing for the entrance of fresh air and abundant sunlight.

There is no source of danger promoting contagion more surely and rapidly than the massing together of humanity in the vitiated air of closely-packed apartments with insufficient accommodations for proper ablutions, and with subtle poison arising from unsanitary sinks, lavatories and closets. The conditions referred to, by insidiously undermining the constitutions of the inmates, render them not only more susceptible to the contagion of communicable eye diseases, but make them fertile fields for the germination of the bacterial products of any form of contagion.

There should be apartments especially light and airy, set apart for the isolation of any case of communicable eye disease which may originate within buildings, or may, for any reason, be admitted. The patients must be so domiciled that they will not become vehicles of contagion to the remaining occupants of the institution, and constant quarantine maintained until the danger of contagion has passed.

Blindness as a result of accident in factories seems to be on the increase. Greater precautions in guarding dangerous machinery is recommended. The posting of notices in conspicuous places where danger exists should be compelled by ordinance.

In closing your committee would respectfully recommend that steps be taken at the next session of the Senate and Legislature of the State of New Jersey to have a bill for the prevention of blindness introduced as indorsed by and its passage requested for the Medical Society of New Jersey.

Respectfully submitted,

WALTER W. JOHNSON.
PHILANDER A. HARRIS.

The following resolution was unanimously adopted at the

One Hundred and Twenty eighth annual meeting of the Medical Society of New Jersey:

Resolved: That the Committee on Legislation for the "Prevention of Blindness" be continued, and requested to have a bill drawn and introduced at the next session of the Senate and General Assembly of the State of New Jersey, regulating the care of infants suffering from communicable eye disease, and that the bill be introduced as indorsed by and its passage requested for the Medical Society of the State of New Jersey.

The Art of the Surgeon.—The art of the surgeon may for purposes of comparison, be viewed from two aspects. One is allied to the art of workers in wood and iron, and may be called mechanical. The other aspect has little of the mechanical about it, and is closely allied to a fine art. The mechanical side, the art of the application of tools, is an important but comparatively simple one, and need not detain us. Easily learnt as it is, it is still worthy of being taught. It is not, perhaps, a good thing that a surgeon should for the first time handle a saw or chisel, or a drill, or a trephine on a living human bone: and it would be well if we, who have much to do with apparatus, knew the qualities of the metals and other materials we employ, and the ways of jointing, and welding, and moulding them to meet the ends we desire. It would, in fact, be good for most surgeons to spend a month or two in a mechanic's shop under the severe discipline of a skilled British workman. With most of us it certainly would not be labour wasted. But I would not make tuition in the joiner's art compulsory because we use joiner's tools. In respect of mechanical skill in their handling, I would place the surgeon's tools on the level of the sculptor's spatula or chisel, or only a little higher. The chisel of the sculptor and the knife of the surgeon are mere accessories in the work to be compassed by the brain-compelled hands. Still, as accessories they have their importance: we ought to be familiar with our tools. But the surgeon, I repeat, is more than a mechanic; he has work to do which brings him to the level of the true artist.

The other side of our craft I would venture to compare with that which produces what are known as works of art ; and this side is by far the more important. Here the work of the fingers is of small moment as compared with the work of the brain. The brain is supreme, and yet in delicacy, deftness, and general preciseness of obedience to the brain's behests, the fingers and hands have great calls made on them. In painting, sculpture, or music, mere manual dexterity rarely is deficient to him who has the artistic soul ; or, if there is deficiency, practice and education will do much to remove it. So in surgery the hands rarely fail to rise to the demand the brain makes upon them if they are trained. Let us look a little more closely into the surgical fine art, for it is nothing less than a fine art.

The highest part of the surgical art is more than handicraft ; it is braincraft uttered through the fingers. It is not mere manual dexterity or cunning. In fact, mere manual cunning, being a result of routine practice which begets reflex movements, is detrimental to surgical art, which demands the widest possible scope and variety of action. I should not quote the marvellous manual dexterity of the button-maker as the highest education of the hand, any more than I should quote the clever work of the oak-grainer as the highest art in painting. The surgeon's art demands breadth and variety in manual training ; the hands must have all-round capacity. The finger surgeon begins at the wrong end ; he ought to have been a button-maker. No training, however, comes amiss to the surgeon's fingers. By many devices and practisings he may and ought to improve their capacity ; but their final and most perfect training is in the actual work.

The skill of the hand depends greatly on the sense of touch and on what has been called the muscular sense. We are endowed with a sense of touch more delicate, perhaps, than is found in any other animal—the only sense in which we excel. The highest cultivation of the sense is essential to the surgeon.

Now the sense of touch is trained through the intellect as much as through the fingers ; it is helped by comparative appeals to the other senses, and especially to sight. The blind have been found to have no special excellence in actual sense of touch : they excel in the intellectual interpretation of the sense impressions. We who can bring the sense of sight to help out the impressions of touch ought to surpass the blind in tactile power. Put it in this way. A blind man could scarcely map out in his trouser's pocket the figure of Britannia on the back of a penny. But, after seeing the figure, the possessor of a trained finger will recognize by touch many of the details such as the shield and the trident and the limbs : and so he will identify the whole picture. The blind man cannot correct and verify his groping sense of touch by sight ; the seeing man can. So I say that a man who can see might, if he were determined, and were loyal to the sense he seeks to train, cultivate his sense of touch to a higher pitch of delicacy than the blind man.

Now there are no limits to the demands made on the surgeon's tactile powers. Touch is to the surgeon what hearing is to the physician in diagnosis, and more in treatment. The exquisite delicacy of differentiation possessed by the ear of the physician we desire to have for the finger pulps of the surgeon. In diagnosis touch tells us what sight cannot ; in operating in the dark depths of the body it goes where sight cannot, and sometimes it guides more truly than sight could. But always it is the intellect that interprets. It is as true to-day as it was twenty centuries ago that " 'Tis mind that sees and mind that hears ; all other things are deaf and blind."

Amongst the plastic arts sculpture perhaps gives us most points for comparison with the surgical. Each deals with the human body. The sculptor has to know the body externally in architecture, in bulk, and in outline ; the surgeon has to know it in the same ways, internally as well as externally, and in sections vertical, transverse and oblique as well. Each art demands from its votaries abso-

lute fidelty to form ; the ignorance that misplaces a tendon in a statue will lead to grief on an artery in an operation. There are similarities in their ways of working too. The inferior sculptor, by adding here and subtracting there, by measuring and squeezing and scraping, may, after long working, make a tolerable likeness, but never a work of the highest art. The true artist goes straight to the stopping point and then stops. What this stopping point shall be we cannot define, but it gives us that sense of true balance between detail and mass which signifies artistic proportion. So in surgery ; the surgeon-artist forms a clear conception of the work he has to do and makes straight for the ending of it. Between details and bulk he determinedly keeps a true artistic proportion. His time is limited, and into this time he must put his best work. He wastes no time over trifles ; he is very deliberate over difficulties. The most elaborate finish in both arts is visible where the technical difficulties are greatest. The clean straight strokes of a true artist are visible equally in the work of the surgeon and the sculptor.

The surgeon who is not an artist is devoid of a sense of true proportion. Where one bold cut is wanted, he will make a dainty nibbling dissection. He verifies his anatomy on the way to his work by the help of the director. He goes a little in this direction and retraces his steps ; then a little in that direction and returns. He has hobbies, and he rides one or two well. One man turns the peritoneum in, the other turns it out, a third is careful to ignore it. Perhaps he gives one suture to peritoneum, one to muscle, one to fascia, and one to skin, and each suture is perhaps of a different colour or a different material, so that nature may have no chance of making a mistake. His work is not towards one finished work of art, but to the making of half a dozen clever separate studies. Like the sculptor who is good at hair, and works out every one, or the painter who is good at eyes and puts in the dots in the iris, each sacrificing the whole to the part, our inartistic surgeon lingers over his fancies, and so fails to produce finished and

harmonious work. His details are not all equally balanced some are exquisite, some are mediocre, others are bad. The whole work, the whole operation, will not be the best possible for the saving of life; it is not all round a finished work of art. Therefore it is to be condemned.

The surgeon's art has in it not only the elements of boldness, honesty, and simplicity pertaining to the sculptor's art; it leads him in some of its departments into methods of working which may fairly compare with the most delicate amongst artistic pursuits. The finest work of the surgeon makes demands on the delicacy of the fingers little, if anything, less exacting than the demands made on the fingers of the etcher or the line engraver. The surgeon, as a painter, has to make pictures not only in life size, but in miniature; as a sculptor he has to do not only the full figure and the medalion; his work may also be compared to that of the graver of gems.

The operative art of surgery is truly a high art; the demands it makes on the hand, the eye, and the brain of the artist are the same for surgery and the fine arts. Surgery and fine art may indeed well be practised by the same man. We see it in our own time. The art in etching of Sir Seymour Hayden, and the art in surgery of Sir Henry Thompson, each supreme in its way, have two sides only on the surface; they are identical at bottom. And we have seen this in past times, sometimes to the loss of surgery, sometimes to its gain. The world lost a great surgeon in Leonardo da Vinci and gained a great painter: it lost a great artist in Sir Charles Bell and gained a great surgeon.

Now of this art of surgery, where and what is the teaching? Where and who are the masters who guide and correct the young artists in their work? It may be said at once, of masters there are plenty, but they do not teach. There is no real teaching of the art of surgery in our country. Here and there a favoured few, house-surgeons and assistants, are permitted to pick up what knowledge they

can by looking on and by helping; but of personal guidance in the actual work on the living subject analogous to the guidance given in other arts, we in ours know nothing. We have to teach ourselves by experience alone. Think what this would mean in art training. It would mean that to paint a thousand portraits is the only way to become a first-rate portrait painter; to model a thousand figures is to become a perfect sculptor. It means in medicine that the midwife of 5,000 experiences is more to be trusted than the obstetric gold medalist of London University, who can boast of only 50. And note this further. The young sculptor may with impunity make and break figures to his heart's content; the young surgeon, in learning his art, is not supposed to damage or destroy human beings.

Artists, mechanics, craftsmen of all sorts learn their work in the workshops or studios with a master to correct their faults and guide their efforts. Surgeons alone have, unassisted, to grope their way to excellence in their art. In his science the student has guidance enough in all conscience, and in his note taking and his dressing he is sharply looked after. But he is severely left to his own devices to pick up the technics of his craft.

Is this right? That the art of surgery is teachable there can be no dispute, that it is worth teaching is still less disputable. Why, then, is it not taught?

The art can be taught in only one way, the way of teaching of the plastic arts. The young artist must, while beginning the practice of his art, have a master at his elbow, a master who will criticise his methods and correct them, who will guide him in the use of his hand, his eyes, and his instruments; who will in the fullest sense make him his pupil and personally lead him on, step by step, towards such excellence in the art as he himself has acquired.

In no way do I seek to detract from the value of such knowledge as is got in the class of operative surgery, so-called, or on the benches of the operating theatre. As a step between anatomy and surgery, the performance of operations on the dead body is of supreme value; it is indeed

indispensable. It is the first step towards operative surgery, but it is not operating. For instruction in the living art of surgery, attendance in the operating theatre is of little value. The student sees little, and that little with uninstructed eyes. The student of surgery is just as likely to learn his art simply by attendance in the operating theatre as is the student of the violin to become a true artist simply by going to concerts. In both cases to learn the art the student must work at it; to attain to the highest degree of excellence he must work under a master.

If then the art of surgery is to be perfectly taught, it must be taught to the young surgeon actually operating. And here is our first difficulty. We cannot teach the art to unqualified men; students are not permitted to operate. We must begin our teaching after the student is qualified. As things are at present this is not easy. Our pupil of yesterday is our colleague of to-day; when qualified he is supposed to be our equal and therefore above our criticism. It is difficult to imagine a skilled senior in the operating theatre calling attention to the faulty methods of his young colleagues: it is impossible to conceive him pushing him aside and showing him how to do it. And yet, if the living art is to be taught at all, this personal way is the only way. Why should the young surgeon more than any other young artist fear tuition in the operating theatre? Possibly the presence of young students, of whom he is probably a teacher, would be a chief objection. Then, if the humility of him who truly seeks after knowledge is not forthcoming, must the young students be excluded from operations at which open instruction is given to young surgeons. And it resolves itself into this, that the master has a few qualified pupils, and is present at the operations of these few. He guides them in their work: he points out faulty methods; he advises and, perhaps, assists; and this he does in the presence of all his pupils.

As a matter of fact I doubt if the young surgeon would fear tuition in public, if such tuition were given honestly and courteously by a man whom he could look up to as a

master. There is no method of education in handiwork that can surpass fair criticism of the work before compeers. The mere pointing out of faults calls attention to details which the average onlooker would fail to see. But criticism is not all fault-finding: it calls attention to excellence as well as defects. The pointing out and correcting of faults, and the praising and holding up for imitation of any special excellence in operating might well, to the advantage of all and the discomfort of a very few, form part of the routine education of the hospital operating theatre.

What would you or I or any surgeon amongst us not give to have a Liston or a Syme at our elbows to teach us? Who that really has his soul in his art could fail to welcome an opportunity for such tuition? And why should we not have it? There is no lack of capable teachers, and surely they could easily be induced to teach. I can conceive no finer ending to a great surgeon's career than to devote it to the education in his art of the men who are to succeed him. He has handed over his legacy of science to all mankind; he has laid aside his own knife, but his art will survive him, for, in the band of pupils whom he has trained in their work, his legacy of art will be as enduring as his legacy of science.

Am I suggesting a return to something like the old apprenticeship? Well, what then? The art of surgery is no new thing. Probably as an art, pure and simple, it was more perfect in the apprenticeship days of fifty years ago than it is to-day. For then, before the days of anæsthesia, the highest art was not only a saving of life, but a merciful saving of suffering. If we have lost this stimulus to perfecting ourselves in the art that pain to the patient gives, we have still the saving of life to urge us on, and that is an even greater stimulus. How a surgical artist like Robert Liston, the greatest probably the world has ever seen, trained as he was in the cruel and exacting school of pre-anæsthetic days, would have revelled in all our "otomies," "ectomies," and "ostomies" of to-day! To imagine Liston, trained in practice as he was, living

amongst us now, and having before him the science we possess, is to realize my ideal of the surgeon-artist.

If we did have the old apprenticeship back amongst us it would be for surgery a something. It would be at least better than the nothing we have now. But I am not asking for the old apprenticeship; I am pleading for something higher. We speak of apprenticeship rather as to a trade; I am pleading for pupilage as if to a fine art. I am simply asking for the surgical high art what is freely and abundantly given to all other parts; personal teaching in actual work by competent masters.

I make no complaints, and I offer no accusations. British surgery needs no apology. I simply seek to give it one more push upwards. We have reached a high degree of excellence, but we may reach a higher, and one way to this is through personal tuition in the art. We start as physicians; we are educated in the technical arts of the physician at the bedside and under masters. We are likewise obstetricians; here, also, we have personal instruction in the actual doing of our work. But in surgery, nowadays, and in operative surgery alone amongst all arts and crafts, we have no genuine personal instruction. If, on this foundation, British surgery has reached the height it has, to what eminence might it not rise if we were careful that every young surgeon were trained in the highly technical and highly important practical art of operative surgery?

Detailed suggestions as to how this training might be carried out would be out of place on an occasion such as the present. This matters little; for, if you think as I do, the result will surely follow. But we must fight for our own right hands. We must expect no help from the State. The State, like Providence, helps those that help themselves. When we have shown that we need practical teaching in our art; when we have proved that we can provide it; when in fulfilment of those powers with which we have been legally endowed we have created in our teaching centres some working process of practical instruction, then

we might ask for more. We might ask to be put on the level of the fine arts and seek for a Royal Academy of Surgery, as we have royal academies of painting, sculpture and music. To such an academy a school with teachers would be attached. The school would be a surgical hospital endowed with every known excellence of hygiene, and nursing and appliance; the teachers would be those who are supreme in art; the pupils men already qualified who seek for practice in the higher walks of surgery. Do you believe me that this would be good for surgery? Then let us work for it.

And now I have finished. I have spoken of our art solely from the practical point of view, as to how it may be improved in *technique;* that is, as to how it may confer most benefits to others. I have not referred to any ennobling of ourselves. Indeed, I have little belief in it. All arts tend to elevate; this, the ultimate criterion of true art everywhere, has no more truth for the surgical than of the painter's or any other art. In the highest flights of the imaginative faculties, the faculties that make poets and inventors and musicians, we do not stand very high. Yet a previous generation can point to a surgeon who practically founded a new science; this generation can point to a surgeon whose purely surgical discoveries have created new laws for the preservation of health and the cure of disease. These are high aims, but they are not the highest. Our dealing is with the body; the painter, the poet, and the sculpture deal with the soul; their goal is higher than ours.

It has its punishments, too, for surgery is a terrible taskmaster. The punishment is not a mere heart-burning over the rejection of a picture by an academy; it is a heart breaking over the losing of a life by our own work. Our worst punishments are self-inflicted; for every failure, even if incurred in the leading of a forlorn hope, means a personal criticism of a cruelty and thoroughness which no outer criticism can match: a criticism that condemns without chance of condonement, for our own conscience is

judge. These things I hint at, but do not dwell upon. They are there, however, and their presence makes us better surgeons, and I trust better men.

More than 500 years ago Guy de Chauliac, the greatest of the surgeons of the Arabic period, wrote these words: "Knowledge is created by additions; the same man cannot lay the foundation and perfect the superstructure. We are as children carried on the neck of a giant: aided by the labors of our predecessors we see all that they have seen and something beyond." These words might have been my text. The burden of my theme has been to hold fast and care well for the old truths: in our love for the new science not to forget the old art. For in autumn the leaves fade and fall first from the youngest branches: they linger longest green on the old wood. Let us graft our new truths on the old stock; so will they live longest and flourish most.—*J. Greig Smith, M. D., in British Medical Journal, August 4, 1894.*

THE

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THE PREVENTION OF BLINDNESS.

In another part of this JOURNAL we print the "Report of the Committee on Prevention of blindness through Legislative enactment." This subject has been exciting a good deal of attention among medical men, and in several of the States laws have been enacted for the protection of infants against the ignorance and folly of midwives and parents. When it is known that the terrible disease, ophthalmia neonatorum, is a preventable one, and even when it is contracted is, in the majority of cases, curable, it is apparent to all that neglect of treatment is most culpable and should be made a criminal offence and punished as such. The report states that fully twenty per cent. of all blindness in early life is caused by this disease, and as it occurs principally among the poor, it adds greatly to the misery and hopelessness of their condition as they have little or no chance of any teaching, and their only way of making a living is by begging or more questionable methods.

It is a serious economic question, as well as a medical one, and should not be longer neglected. While our Boards of Health are doing such good work all along the line of contagious and preventable diseases, let them add this to their list and *insist* on notification of all cases so that they can be investigated and adequately treated. At the same time steps should be taken for the diffusion of knowledge

among midwives and nurses regarding this disease, and the necessity of immediate treatment.

This subject is not new, but it is one which is continually thrust upon our notice and, in spite of all that has been said and written about it, a good deal of ignorance still prevails.

THE PROVINCIAL BOARD OF HEALTH.

In the current number we publish some of the statistics regarding death rates, &c., in this Province. They are collected by the Provincial Board of Health from over eight hundred different municipalities. This will give an idea of their work in this direction

The death rate for twelve months, deduced from statistics collected for only half that time, is probably a little too high, especially for the cities, because in that time the hot summer months are included, when the mortality is particularly high. This is the first period for which statistics have been collected, the law having only come into effect on July 1st, 1893, and in future the year will run from January 1st to December 31st.

The Board is at present constituted of the following members :

E. Persillier Lachapelle, M.D., President, Montreal.
Henry R. Gray, Esq., Montreal.
Robert Craik, M.D., Montreal.
Alphonse Methot, M.D., Three Rivers.
J. I. Desroches, M.D., Montreal.
Laurent Catellier, M.D., Quebec.
Elzear Pelletier, M.D., Secretary.
J. A. Beaudry, M.D., Inspector, Montreal.
Wyatt Johnston, M.D., Bacteriologist, Montreal.
R. F. Ruttan, M.D., Chemist, Montreal.
L. J. H. Roy, M.D., Statistician, Montreal.

The head office, with the laboratories, is at 76 St. Gabriel street, in the old Government building, formerly occupied by the Geological Survey.

We propose to publish these and other statistics and reports from time to time, and we trust that they will prove of interest as showing the state of the health of the province, the relative healthfulness of various localities, and the measures taken to promote and guard the health of the population.

The Board of Health for the Province of Quebec have, during the past month, established a Bacteriological Laboratory in connection with their office, at 76 St. Gabriel street. This laboratory, which is in charge of Dr. Wyatt Johnston, is well equipped with the best modern apparatus for sanitary investigations. A Chemical Laboratory for the sanitary analyses of water and food supplies, drugs, etc, is also being fitted out, and will be in charge of Prof. R. F. Ruttan, who, in the meantime, is carrying on the work in his laboratory at McGill College. Besides making such analyses and researches as may be required by the Provincial Board, it is proposed to make arrangements by which local health boards and municipalities can have analyses made at a very moderate cost. We congratulate the Board upon providing what has long been a great want in connection with public medicine in the province.

Dr. J. E. Laberge has been appointed City Bacteriologist in connection with the Montreal Health office. Dr. Laberge has received his training in the Pasteur Institute of Paris, and his appointment is considered an excellent one in every way. There is a great opportunity for making a record in connection with civic health matters which has long needed the attentions of a bacteriologist.

Distribution by Counties of some of the causes of death. An abstract from the statistics for the last six months of the year 1893.

Name of Counties.	Tuberculosis.	Diphtheria	Scarlatina.	Typhoid.	Measles.	Whooping Cough.	Grippe.	Diarrhœa.	Cancer.	Still Born.	Premature Birth.	Accident.	Old Age.	Cause not given.	Other Diseases.	Total deaths.
Argenteuil	6	2	1			1	3	9	4	1		2	3	3	21	59
Arthabaska	14	10	7	1	16		10	50	2	5	7	2	7	13	87	231
Bagot	16	5	1	3	1	2	1	54	1	6	2	3		5	79	182
Beauce	28	78	2	11	2	2	16	87	3	20	2	5	3	10	145	423
Beauharnois	8	1		3				46	3	7		3	4	4	63	142
Bellechasse	6	10	5	2	1		8	46		13		1	3	1	73	172
Berthier	15	14		1	5	10	2	68	3	6	1	1	4	2	90	225
Bonaventure	8	3				20	4	25	3	4	1	3	2	14	37	124
Brome	11	2	1	5		1	1	12	2	2		3	3	1	40	84
Chambly	4	6	3	2	1		2	32	1	2	2	2	1	4	48	110
Champlain	13	2	6	7	3	2	2	66	4	10		3	8	11	120	257
Charlevoix	11	5		1			7	15	2	6		2	1	20	53	123
Chateauguay	4	3		2		1	3	18	3	4	2	3	4	1	35	80
Chicoutimi and Lake St. John	16	46		4		1	6	42	2	11		5	5	9	60	207
Compton	13	3	1	3			2	15		6	1	5	2	10	46	107
Two Mountains	10	6	24	5		2		25		5	1	1	1	10	45	135
Dorchester	12	50	1	5	1	1	7	21	1	11	1		5	13	57	186
Drummond	23	2	2	1	2	4	1	29		6	1	2	5	9	19	136
Gaspé	13	7			1	34	1	5	2	8	3	1	5	19	42	141
Hochelaga	73	30	31	17	12		11	217	11	32	21	8		11	390	873
Huntingdon	17	1.	5	1			1	8	2	4	2	3	1	7	35	87

Distribution by Counties of some of the causes of death. An abstract from the statistics for the last six months of the year 1893.

Name of County.	Tuberculosis.	Diphtheria.	Scarlatina.	Typhoid.	Measles.	Whooping Cough.	Grippe.	Diarrhœa.	Cancer.	Still Born.	Premature Birth.	Accident.	Old Age.	Cause not given.	Other Diseases.	Total Deaths.
Iberville	8	.....	1	2	.....	1	2	16	1	5	.....	.....	1	3	42	82
Jacques-Cartier	19	7	3	3	.....	.....	1	40	0	8	.....	8	.....	.....	91	185
Joliette	23	3	2	5	16	5	1	62	6	19	.....	5	12	10	102	271
Kamouraska	12	19	3	3	1	21	3	52	3	11	.....	3	10	16	66	220
Laprairie	7	3	.....	2	5	.....	.....	21	3	6	.....	2	2	3	58	113
L'Assomption	9	8	9	1	.....	1	.....	28	4	14	.....	.....	5	10	76	165
Laval	8	5	.....	2	1	.....	.....	25	1	4	.....	12	3	3	48	163
Levis	26	30	4	3	7	1	3	82	5	16	.....	7	3	2	106	295
L'Islet	7	.....	.....	2	.....	1	.....	35	5	12	.....	1	3	3	58	127
Lotbinière	11	3	.....	2	.....	.....	.....	34	4	6	.....	6	7	8	88	169
Maskinongé	15	5	.....	3	4	4	1	55	3	6	.....	3	.....	3	56	158
Megantic	11	18	3	2	5	10	1	53	4	8	.....	2	8	18	52	195
Missisquoi	13	6	.....	4	.....	3	2	14	1	3	1	1	5	7	50	110
Montcalm	8	4	2	1	3	1	2	20	.....	11	3	1	3	4	59	122
Montmagny	11	.....	2	3	.....	.....	4	47	1	12	.....	4	12	20	80	197
Montmorency	17	.....	.....	3	.....	2	5	24	2	4	.....	3	7	36	60	163
Napierville	7	4	3	1	2	.....	6	18	3	1	.....	.....	3	2	33	83
Nicolet	35	18	3	7	7	18	16	54	5	18	.....	3	11	47	98	340
Ottawa	24	17	23	2	2	3	3	57	4	18	2	12	7	55	162	391
Pontiac	13	1	2	5	.....	2	.....	9	3	3	.....	3	5	3	22	71
Portneuf	28	6	.....	3	.....	1	6	51	3	12	.....	3	9	14	148	284
Quebec (County)	25	1	.....	7	.....	1	2	68	5	9	.....	3	8	26	138	291

Richelieu	10	8	1	4	2	15	3	53	1	8		3	5	5	92	215
Richmond	11	4	2		1	1	3	17	3	5		1	2	6	38	94
Rimouski	21	27		2		1	13	53	2	16	3	4	6	32	86	266
Rouville	3	1	3	2			1	39	2	8		1	8	3	56	127
Saguenay	8	1					1	4	1			2		5	14	36
Shefford	12	2	3			4	2	32	2	7		1	15	33	55	168
Sherbrooke	8	5	5	5		1		29	4	4			1	3	71	136
Soulanges	6			1		1		25	2	4		3	2	2	50	96
Stanstead	13	3	3	1	1	4		17	9	2		4	4	3	51	115
St. Hyacinthe	27	3	1	7	6	3	1	51	2	12		5	10	6	118	252
St. John	10	1	1	1		1	2	23	2	3		1	3	4	41	93
St. Maurice	11	1	1	3	1		8	25	2	5		2	3	10	43	115
Temiscouata	15	26		4		1	7	54	3	10		5	6	30	88	249
Terrebonne	10	11	2	8		1	1	53	4	25		3	9	30	101	258
Vaudreuil	14	5		2	1		2	19	2	4		2	3	3	42	99
Vercheres	5	3		4	4		2	38	2	4	1		7	1	56	127
Wolfe	3	4		2	3	2	4	16		14		1	2	8	39	98
Yamaska	25	12		10	1	25	6	60	1	11	2	8	10	8	67	246
Three Rivers	17			1			1	35	5	9		2	3	1	41	115
Quebec City	67	18	1	16	2		6	234	16	27	32	6	25	5	412	867
Montreal	343	71	140	24	7	6	25	838	71	53	213	51	75	163	1773	3853
Total	1297	960	316	237	125	222	234	3471	257	606	301	240	395	846	6642	15852

Death rate for each Province for the last six months of the year 1893 :

Counties.	Number of Deaths.	Population.	Death rate per 1,000 for 6 months.	Death rate per 1,000 for 12 months.
Argenteuil	59	15,210	3.87	7.71
Arthabaska	See Drummond and Arthabaska.			
Bagot	182	21,820	8.34	16.68
Beauce	123	39,450	10.72	21.44
Beauharnois	142	16,830	8.43	16.86
Bellechasse	172	18,740	9.17	18.34
Berthier	225	19,350	11.62	23.24
Bonaventure	124	21,320	5.81	11.62
Brome	84	14,410	5.11	10.22
Chambly	110	11,910	9.23	18.46
Champlain	257	27,280	9.42	18.84
Charlevoix	123	16,700	7.36	14.72
Chateauguay	86	13,735	6.26	12.52
Chicoutimi, Lake St. John	207	30,100	6.87	13.74
Compton	107	23,600	4.53	9.06
Dorchester	186	18,278	10.17	20.34
Drummond and Arthabaska	367	45,650	8.01	16.08
Gaspé	141	27,350	5.11	10.22
Hochelaga	873	96,000	9.09	18.18
Huntingdon	87	14,120	6.16	1t.32
Iberville	82	11,325	7.24	14.48
Jacques Cartier	185	14,220	13.00	26.00
Jolliette	271	23,160	11.70	23.40
Kamouraska	223	20,080	11.10	22.20
Laprairie	110	10,769	10.21	20.42
L'Assomption	165	73,300	12.40	24.80
Laval	103	9,430	10.92	21.84
Levis	295	25,529	11.12	22.24
L'Islet	127	13,560	9.36	18.72
Lotbiniere	169	20,645	8.18	16.36
Maskinonge	158	17,914	8.82	17.64
Megantic	195	23,100	8.44	16.88
Missisquoi	110	18,740	5.87	11.74
Montcalm	122	11,930	10.22	20.44
Montmagny	196	14,330	13.67	27.34
Montmorency	163	12,306	13.24	26.48
Napierville	83	10,000	8.30	16.60
Nicolet	340	29,275	11.61	23.22
Ottawa	391	66,800	5.85	11.70
Pontiac	71	22,650	3.14	6.26
Portneuf	284	25,017	11.35	22.70
Quebec County	294	19,310	15.22	30.44
Richelieu	215	21,560	9.97	19.94
Richmond and Wolfe	192	32,650	5.88	11.76
Rimouski and Matane	266	33,340	7.97	15.94
Rouville	127	15,400	8.24	16.48
Saguenay	30	9,730	3.69	7.38
Shefford	168	23,270	7.21	14.42
Sherbrooke	136	17,150	7.92	12.84
Soulanges	96	9,460	10.14	20.28
Stanstead	115	18,725	6.14	12.28
St. Hyacinthe	252	21,635	11.64	23.28
St. John	93	12,286	7.56	15.12

Death rate for each Province during the last six months of the year 1893.—*Continued.*

Counties.	Number of Deaths.	Population.	Death rate per 1,000 for 6 months.	Death rate per 1,000 for 12 months.
St. Maurice	115	12,090	9.51	19.02
Two Mountains	135	14,815	9.11	18.22
Temiscouata	249	25,750	9.67	19.34
Terrebonne	258	23,170	11.13	22.26
Vaudreuil	99	10,620	9.32	18.64
Vercheres	127	12,209	10.40	20.80
Wolfe	See Richmond and Wolfe.			
Yamaska	246	15,800	15.56	31.12
Three Rivers City	115	8,720	13.18	26.36
Quebec City	867	63,259	13.70	27.40
Montreal City	3,853	235,475	16.36	32.72
Total	15,852	1,562,180	10.14	28.28

Death rate of cities of over 5,000 inhabitants during the last six months of the year 1893 :

Cities.	Number of Deaths.	Population.	Death rate per 1,000 for 6 months.	Death rate per 1,000 for 12 months.
Montreal	3,853	235,475	16.36	32.72
Quebec	867	63,250	13.70	27.40
St. Henri of Montreal	265	16,000	16.56	33.12
Hull	149	12,700	11.73	23.46
Sherbrooke	105	10,900	9.63	19.16
Ste. Cunegonde	146	10,900	13.39	26.78
Three Rivers	115	8,720	13.18	36.36
St. Hyacinthe	116	7,500	15.46	30.92
Levis	74	7,228	10.23	20.46
Sorel	87	6,900	12.60	25.20
Valleyfield	67	6,000	11.16	22.32
Total	5,844	385,573	15.15	30.30

Medical Items.

—The mother-in-law of the Mikado of Japan was recently ill. She had 423 physicians in attendance, and yet she recovered. A Buddhist priest located the cause of her illness in the introduction of railways.

THE CHEMISTRY OF ETHICS.—The leading authorities upon the subject of criminal anthropology appear to be convinced that the ultimate causes of the criminal diathesis are abnormal chemical substances found in the system. We might suggest that these substances, if they exist, should be classified as *tocsins* of the soul.

—M. Delisle, librarian to the National Library of Paris, says that the paper upon which most modern books are printed will soon begin to decay. Books printed upon paper made from wood pulp are especially liable to rot early. Even many so-called hand made papers are not more durable, as they are so treated with chemicals as to easily decay. Old fashioned paper made with rags has stood the test of hundreds of years.