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PROCEEDINGS

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ERRATA.

Page 5, line 18, for "Macaites," read "Macaizes."

Page 6, line 36, for "Antoeus," read "Antæus."

Page 6, line 37, for "capturing," read "attacking."

Same line, for "who became the willing slave of their Queen," read "that willing slave of Queen Omphale."

Page 6, line 40, for "Cassiopea," read "Cassiopeia."

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PROCEEDINGS

OF

THE CANADIAN INSTITUTE.

EXTRACT FROM THE ANNUAL ADDRESS OF THE PRESIDENT, A. B. MACALLUM,
M.B., PH.D.

(Delivered November 7th, 1896.)

The success which the Council has achieved during the past session in the management of the Canadian Institute has enabled the Editing Committee to formulate an improved method of publication, a method which is more in accord with the present requirements of Science. In the past our volumes of "Transactions" appeared at irregular intervals, and in some cases very long after the papers published in them had been read before the Institute. Speedy publication for scientific papers of value is a great desideratum. No investigator relishes the prospect of having his results held over for an inconveniently long time, with the chance that when they are published they may be out of touch with the literature of the subject appearing between the date of presentation and that of publication. In this case, also, he must face the risk of his results being anticipated by another worker in the same field. He, therefore, looks for speedy publication of his papers, immediately they are completed, and those means are sought which offer this advantage.

In consequence of these considerations, and desiring to attract scientific papers of merit to the Institute, the Editing Committee has decided to change the present mode of publication. It will not affect the "Transactions," which will be published as heretofore, but at the end of the Session, and containing only carefully selected papers worthy of publication in extenso. The point of departure is in the institution of "Proceedings," one number of which is to appear every two months during the session, and each will contain the short papers, and the abstracts of others read before the Institute in the preceding interval. This will ensure speedy publication, and at the same time put a premium upon brevity, while it will enable the Editing Committee to exercise greater freedom in the choice of papers for the volume of the "Transactions." If the Institute is to maintain its large list of Exchanges, it must strive for a high standard in the papers which it publishes. Having had in the past but one mode of publication, it was natural that the Editing Committee should have difficulties to contend with. Papers which contained matter of interest, from a scientific, historical, or other point of view, but were of inordinate length, were frequently offered for publication. These had to be accepted outright or rejected summarily. There was no middle course. With the plan now adopted, the Editing Committee can offer, for very short papers of value, such an opportunity for speedy publication as will considerably offset the sacrifices made for brevity. I trust that the men of science in the Dominion will avail themselves of the advantages now offered, and that the new venture will be a success.

RARE BIRDS TAKEN AT TORONTO. BY JOHN MAUGHAN, JR., ESQ.

(Read April 13, 1895).

Great Black-Backed Gull (*Larus Marinus*). Locality, 8 miles out from Toronto, Island in Lake Ontario. Date, 8th February, 1894. Measurements: spread 5 ft. 9½ ins., wing 2 ft. 7 ins., length 2 ft. 6 ins., leg 11 ins., tarsus 3¼ ins., tail 8½ ins., bill 2½ ins., bill, from gape, 4¼ ins., middle toe 3¼ ins. Sex ♂.

Peregrine Falcon or Duck Hawk (*Falco Peregrinus Anatum*). Locality, Toronto Marsh, Ashbridge's Bay. Date, 25th June, 1894. Measurements: length 19½ ins., tail 7½ ins., wing 19½ ins., spread 44¾ ins., tarsus 2 ins., middle toe 2¾ ins., bill 1 in., gape 1½ ins. Sex ♂.

Remarks.—Plumage very light ashy, feathers very much battered and bare.

Marsh Hawk (*Circus Hudsonicus*). Locality, Toronto Marsh, Ashbridge's Bay. Date, 20th May, 1894, and 2nd April, 1895. Measurements: length 18½ ins., wing 20 ins., spread 3 ft. 6 ins., bill 1 in., gape 1¼ ins., leg 10½ ins., tarsus 2¾ ins., middle toe 1⅝ ins., tail 8½ ins. Sex ♂ and ♂.

Remarks.—Both these hawks are noted for their being old males in the "Blue Plumage." Colour: very light bluish ash, with pure white under wings and upper and under tail coverts. Measurements are practically identical.

Razor-Billed Auk (*Alca Torda*). Locality, Hamilton Bay, Ont. Date, 9th December, 1893. Measurements: spread 27⅜ ins., tail 3½ ins., wing 12 ins. Sex ♂.

Remarks.—This species is undoubtedly very rare here, as records of only two have been noted before this one. No doubt it came along with the Guillemots that were taken in such numbers at different points during the winters of 1893, 1894 and 1895.

Red Phalanpe (*Crymophilus Fulicarius*). Locality, Toronto Island (east end). Date, 6th October, 1894. Measurements: bill 1 in., spread 15 ins., wing 6½ ins., tail 2 ins., leg 3 ins., tarsus 15-16 in., middle toe 15-16 in. Sex ♂.

Leash or Yellow Rail (*Porzana Noveboracensis*). Locality, Centre Island, Toronto. Date, 6th October, 1894. Measurements: length 6½ ins., spread 10¾ ins., wing 4⅞ ins., leg 3⅞ ins., tarsus ⅞ in., tail 7-16 in. Sex ♂.

Purple Sandpiper (*Tringa Maritima*). Locality, Toronto Island (east end). Date, 27th October, 1894. Measurements: length 9 ins., tail 2 ins., wing 7⅞ ins., spread 15¾ ins., bill 1¼ ins., leg 3½ ins., tarsus ⅞ in., middle toe 1 in. Sex ♂.

THE DWARF DOMESTIC ANIMALS OF PYGMIES. BY R. G. HALIBURTON,
Q.C., F.R.G.S.

(Read November 14, 1896.)

For years I have enjoyed the honour of being a corresponding member of the Institute, but up to the present I have contributed nothing to its Transactions. If I have not shared the fate of the proverbial "unproductive fig tree," it is due to the forbearance of the Institute, and their charitable hope that, if spared by them, I might do better in future.

It is, therefore, with great pleasure that I offer my first instalment, a paper of interest, not on account of the way it is dealt with, but because it opens up for the first time an untrodden field of science that is likely, in proper hands, to yield important results. Whatever will hereafter account for the diminutive size of the domestic animals of pygmies will also explain the origin of the dwarf races of men; and, possibly, this may be true vice versa.

Before dealing with these little animals I must explain that, when my paper on "Dwarfs and Dwarf Worship" was read at the Congress of Orientalists at London, 1891, the subject of pygmy races was considered to belong rather to myths and marvels than to science. A quarter of a century ago Schweinfurth revealed the then incredible fact of the existence of little tribes of hunters and warriors, not much exceeding four feet high, and dwelling near the great lakes of equatorial Africa. At first he was discredited and ridiculed; but Stanley and others have since that more than confirmed his statements. But to reluctantly admit that this was the case in that remote region was the limit of endurance of incredulous scientists. When, therefore, I openly claimed that the very same race of dwarfs were to be found in the Great and the Saharan Atlas, some of them only a few hundred miles from the Mediterranean, there was a howl of indignant incredulity. My paper, which created an unexpected amount of public interest in London, and was reported in full in *The Times*, was denounced by it, *The Standard* and other papers in abusive and personal editorial critiques rarely seen in the press. I was called a Munchausen, and an inventor of Gulliver narratives; my Moorish servant and I must have been in league with the sixty or seventy natives who had testified to impose pygmies on the simplicity of the scientific world.

As the Congress had awarded a medal to me, I withdrew a reply which I had sent to *The Times*, and made up my mind that to republish these articles in four or five years' time, by the light of the discoveries that would be made, would be the most bitter reply that could be devised.

In my paper it was suggested that in early ages these Atlas dwarfs must have found their way to Europe, and that they still survive there in popular tradition as fairies and dwarf smiths with magic powers; and that dwarf tribes were also the subject of very similar traditions in the West Indies and America.

After that it was discovered and shown by me that there are dwarf survivals in the Pyrenees, and also in America.

One of my most persistent critics was among my friends, called "fascinating subject," as this was a pet term of his. Judge my dismay in June last, on reading in an article on "Pygmy Races," the following ominous sentence, with which it begins. "Professor Starr's article on 'Pygmy Races of Men' in *The North American Review* contains much interesting information regarding a curious and fascinating subject." To my relief I found that he admitted most fully all my contentions. The existence of dwarf tribes in the Atlas, similar to the Akkas of

Equatorial Africa, "had been demonstrated"; that there are diminutive Nanos in the Pyrenees was also admitted; and also that strong evidence had been adduced as to the existence of dwarf survivals in America. I could hardly believe that the writer was my old friend but for a significant omission. He fully accepted my discoveries, but forgot to mention my name in connection with them. Still, to have converted him to that extent was eminently satisfactory.

He concludes with some very sensible remarks, which are especially interesting in connection with an even still more fascinating subject, "The Dwarf Domestic Animals of Pygmies." "It is evident that the existence of pygmy races has passed out of the region of myth and fable into that of history and science. Our information regarding these strange races is still incomplete and inexact, but it is being steadily augmented and brought in line with accepted results in biology and anthropology. The facts already adduced suggest many interesting reflections, but perhaps raise more problems than they solve. It seems clearly impossible (?) to regard the pygmy races as owning a common origin, although their tendency to conform to a single fairly well-defined type is very curious.

"Is their case one of degeneration, owing to some special circumstances of climate and environment, or do they represent a remnant still remaining in a stage of development long since left behind by the rest of the human species? We cannot say with certainty, but such questions may yet become capable of solution, when our information on the subject has become more extensive and exact."

In 1890, when I visited Morocco to look into the subject of racial dwarfs there, one of my first informants as to their small animals was a halfbreed dwarf at Tangier, about four feet high, who is to be seen in the Soko, or market place there. In my "Dwarfs of Mount Atlas" (p. 25), we find him say, "the dwarfs are very brave, and great hunters of ostriches, having small, swift horses, that are called by a name, meaning 'those that drink the wind,' and that are fed on dates and camels' milk, and are very lean, and, judged by their looks, would be set down as worthless. This description of these ostrich hunters agreed with that given me by my Berber servant in 1888." A Rabbi from Ternata, on the Dra, also said (see p. 29), "There are many of them (the dwarfs) near the Soudan. The Arabs fear them, and pay to be allowed to pass through their country. Their horses can do without water for four days, and are called dwiminagh ('they that drink the wind')."

There is a place called Adwarfi, two or three days to the south-east of Tafilet, which is a great resort of the dwarfs, and a part of the Saharan Atlas, in that region (I assume), is called the Black Mountains, where is the River Dora, and where there are many caves, in which the dwarfs live with their cattle. They have an Arabic name, meaning "the people that own cattle." A little Ait Atta from near Adwarfi, and also afterwards a Jew from that region, described the dwarfs there as living in hillocks, in which there are very small entrances, leading to a central chamber, into which, at night, they drive their cattle, which are very small. Mr. MacRitchie, in his "Testimony of Tradition," speaks of the "weems" of Scotland, which are precisely similar structures to the hillocks of the Sahara; and in one of them, he says, in its central chamber, were found the bones of a small ox.

In 1893 Mr. Carlo Bruzeau, of the Villa de France Hotel at Tangier, told me that twenty years ago, during a time of famine, he "saw a man bringing into Mogador for sale, a string of shaggy ponies. When asked whence they came, the Moor replied, 'from the mountains (the Saharan Atlas); there, horses, sheep, goats, cows, men, all are very small.'"

In the same year the dwarf tribe that inhabits the Great Atlas, not much more than a day's journey from the city of Morocco, were described to me as owning little sheep, donkeys, goats, and cows; and a Moor offered to bring some to Mogador, should I wish to buy some of them.

The Barbary donkey is well known, a pretty tiny specimen of the breed, generally black, and very active and strong for its size.

Nearly always, wherever pygmy tribes exist, or must have once existed, we find very small domestic animals. Bent, in his "Mashonaland," says that they are very diminutive throughout South Africa. This even extends to the poultry. A hen's egg there is hardly larger than a pigeon's egg.

This is also the case in Europe. Wherever there are survivals or very distinct traditions of early dwarf races, there we invariably find small breeds of domestic animals. In Brittany we not only have occasional survivals of very small people, but also very diminutive cows and ponies. In Shetland and the Hebrides we have very conclusive traditions as to dwarfs, and there, too, we find little Shetland ponies, small, "black-faced sheep," etc. In Wales, too, with its undersized, dark-complexioned people, we meet with little Welsh sheep and cows. In the same way in Kerry, where the tales of the Skillimilinks, and "the little red-headed blacks" are to be met with, there we have the same types of animals. The little Kerry cows are famed for their good qualities. In Galloway, too, in Southwestern Scotland, where history tells us of the warlike, small-sized Pechts, who claimed the right to lead the van in armies, we find the well-known ponies called "Galloways," as well as small cows.

The popular belief of the herdsmen and cheesemakers (Macaites) of the Vosges Mountains, not only that there are pygmy herdsmen there, who dwell in caves in the precipitous cliffs of that region, but also that these dwarfs have dwarf cattle, is most interesting. On this point I may quote the following passages from my paper on "Dwarf Survivals and Traditions as to Pygmy Races" (see Proceedings of the American Association for the Advancement of Science, Vol. XLIV., 1895) :

"Thirteen years ago my attention was attracted by the name of some cliff dwellers in Abyssinia, which Jean Temporal, in his translation of an early Portuguese book on that country, calls 'Vosges.' As I had, in 1863, suggested (see Haliburton, *New Materials for the History of Man* (1863), pp. 14, 23, and note, 41, 74) that there must have been a migration from Africa to Europe in early ages, I made a note of these facts, intending some day to inquire whether there are not traces of cliff dwellings, or cliff dwellers, in the mountainous country of Alsace, 'the Vosges.' In 1892, as Admiral Blomfield Pasha, of Alexandria, and Mrs. Blomfield, were about to spend six weeks in the Vosges, I asked them to look into the question. In a few weeks I received a local guide-book, which more than bore out my anticipations. In the *Guide Joanne, Geradmer* (Paris, Libr. Hachette & Cie, p. 26), we are told that La Schaume, of Nisheim, which surrounds Wurtzelstein, it is believed, is inhabited by a kindly-disposed race of dwarfs, who, when the herdsmen descend to the lower valleys with their herds in the autumn, pasture their cattle, which are of very small size, in the upper pastures, and make cheese till the spring. Among different authorities cited is *The Foyer Alsacien*, by Chas. Grad." "In 1893 (i. e., after I had heard from Blomfield Pasha), I learned in Morocco that, two days south of the Great Atlas, there is a high mountain called Voshe, the inhabitants of which are dwarf cave-dwellers, who are called Ait Voshe (the Voshe Tribe). Professor Schlichter says that the Akka dwarfs of Equatorial Africa are known to their neighbors as Voshu, and also Tiki-Tiki, names connected with the Akka dwarfs of Southern Morocco, who are also called Jed-ibwa ('the Fathers of our Fathers')."

The range of the name for dwarfs, Tiki, or Tiki-Tiki, is almost world-wide. Of the 49 primordial dwarfs, whose creation preceded that of the human race, according to Voluspa of the Icelanders, one was called Nain, and another Theckr. In Germany we meet with the name Tuecke-Kobbold, and in Polynesia with Tiki-Tiki, the name of the dwarf Creator, and in Peru the Creator was called Ticci Ccapac.

When the Akka, or Tiki-Tiki of Equatorial Africa wandered north to Europe, they must have brought their diminutive cattle with them, for in Baker's "Albert

Nyanza" (1866, p. 91), a region where the widespread Akka, or Voshu, are to be found, we are told that "the cattle there are very small. The goats and sheep are quite Lilliputian."

In Ceylon, the original inhabitants of which are the diminutive Veddahs (called often "Devil-dancers"), there is a very diminutive breed of sacred oxen, for their small size is put down to some wonderful myth about Buddha. These oxen are very nimble-footed, and are used in carriages by the natives, as they can easily travel eight miles an hour.

A friend of mine told me recently that in a part of Bengal where he lives, there is a very diminutive breed of oxen, which are very swift; and it is considered by the rich Hindoos the correct thing to have a carriage drawn by six or eight of them.

But all this was known to the ancients over 2,000 years ago. Ctesias, a physician of Artaxerxes, who travelled in Asia, and described the pygmy race that he there saw, says that they owned diminutive flocks, sheep the size of a lamb, small donkeys and oxen, and horses and mules not larger than a ram is in Greece. (See Ctesias fragmenta, No. 57, 11, Didot).

Aristotle states that the pygmies live near the lakes from which the Nile flows, "and this is no fable, for there is really, it is said, a race of dwarfs, both men and horses, which lead the life of Troglodytes." (See Hist. Animal, VIII. 2).

Strabo, who was a sceptic as to the pygmies, though he described small races of men, says of the Western Ethiopians (evidently the dwarfs of the Dra and the Northern Sahara, whom I have alluded to), "their mode of life is wretched. They are, for the most part, naked, and wander from place to place with their flocks. Their flocks and herds are small in size, whether sheep, goats or oxen; the dogs also, though fierce and quarrelsome, are small" (See Bohn's Classical Library, Vol. III., p. 270, 1857).

It was pointed out in 1891, in my "Dwarfs of Mount Atlas," that pygmies are supposed in Northern Morocco and in Nubia to be Cyclops, and that, as the dwarfs of the Atlas, like other natives of Southern Morocco, wear a singular bournous, on the back of which is worked an immense eye, a yard in length, "the people with the eye" must in time have become "the people with only one eye." This view, as well as my contention that the dwarfs of the Atlas have little domestic animals, are confirmed by Robert Brown, Jr., who, in his "Neptune," says that the Cyclops of the Odyssey were an agricultural people of North Africa, who had diminutive cattle, the milk of which yielded very rich cream.

The dwarfs of the Atlas revenged the death of their giant brother, Antoeus, by capturing Hercules, who became the willing slave of their Queen. Under many different names, this great African Queen frequently appears in early Greek mythology. Dating back to an era before the dawn of astronomy, she and her daughter, as Cassiopea and Andromeda, were, with Hercules, placed in the heavens as northern constellations by that father of astronomy, Atlas, who, according to Homer, "knew all the stars, and the remotest parts of the ocean," and who taught Hercules astronomy. "The fat Queen of Pount" still survives on the monuments of Egypt, which, according to Mariette Bey, represent her as a pygmy, and in popular traditions as to the ruins of Poun or Pount, at the head of the Dra Valley, in Southern Morocco, where, in time of drought, Queen Mena is still invoked. Her mantle, no doubt, was believed to have descended on that brave Jewess, called by the Arabs, Queen Kahina ("the sorceress"), under whom the Berbers for a time rolled back the tide of Moslem invasion. A vague idea has for years existed south of the Atlas that Queen Victoria is destined to rule over that country!

I have omitted to refer to two curious points: that there are, in several isolated and inaccessible localities in the Southern States, little communities, composed of survivals of those pygmy tribes that have disappeared from the west coast of Africa; and also that there are on the Atlantic seaboard little ponies, the descendants,

probably, of a small breed that belonged to these dwarfs, and that were shipped with them to America. Strange to say, their name is "Teki horses."

Dr. Weir's interesting article in the *Popular Science Monthly* for June, 1896, on "The Pygmy in the United States" (which, however, does not refer to these small horses), will well repay a perusal.

I invite the attention, not only of anthropologists, but also of zoologists, to this subject: Are these little breeds the original stock and have domestic animals gradually become larger and stronger, just as cultivated plants have; or have scores of thousands of years of privation dwarfed them and their pygmy owners?

It is very desirable that zoologists should carefully study and apply the investigations of Yale naturalists and palaeontologists as to the origin of the horse in America, which would seem to indicate that the ordinary horse had an even smaller prototype than the little "drinkers of the wind" of the Sahara, in a fox-like animal with five toes, developing in later ages into a larger, horse-like animal with a cloven foot. "After that the deluge"—some catastrophe that put a final stop to horse-raising in America in primordial times.

I also suggest a point which zoologists may follow up with good results.

Mr. Cunninghame Graham, three or four years ago, in an article on Argentina, says that the horse of the Pampas differs from the ordinary horse, the lumbar vertebrae of which are one more in number than those of the Pampas horses. This, he says, also applies to Barbs, and he thinks that the Spaniards must have brought out Moorish horses with them to Argentina. I tried, when last in Morocco, to get a skeleton of a Barbary horse examined by a veterinary surgeon, but did not succeed.

If the Barb differs also from ordinary horses, it probably got its peculiarity from the little breed of ponies in the Sahara.

It is also very important to ascertain whether the latest type of fossil horses in America resembled the Barbs or the common horse in this respect.

Henceforth we have immensely improved chances of solving the problems of the origins of small breeds of domestic animals, and of pygmy races of men—for what will explain the one, will also settle the other.

As respects the latter, the tendency of scientific thought is to regard dwarf races of men as having been the original and earliest specimens of humanity on the earth, and to yield to them the place so long occupied by a supposed "missing link." The latest traveller in Africa, Professor Donaldson Smith, writing last summer to *The World* an account of Abyssinian dwarfs discovered by him, says: "Although they live among other native tribes, they differ totally from them as respects their principal ethnological features. This fact strengthens the theory that the African pygmies are not degenerate specimens of the tribes among whom they live, but are the remnants of the first and original population of the Dark Continent."

Mgr. Leroy, Papal Nuncio to East Africa, says the same thing, and asserts that the dwarfs think so, too, and despise all the larger races as parvenus. They claim to be the first, and oldest, and noblest inhabitants of Africa.

* (Note)—After this paper was written it was found that the fossil horse resembled the Barb in this respect. It may be worthy of mention, that a review of the latest book on Anthropology, Hutchinson's "Prehistoric Man and Beast" (Appletons, N.Y.), says: "Certain analogies lend weight to the idea that possibly Stonehenge was erected by the dwarfs or fairies, who, in a previous chapter, are shown to have been a real people. Various writers have come to the conclusion that a dwarf population akin to the Lapps were the actual inhabitants of the "fairy knowes," or underground megalithic structures, and became in time the elves and fairies of folk lore."

THE GAMETOPHYTE OF *BOTRYCHIUM VIRGINIANUM*. BY EDWARD C. JEFFREY,
B.A., LECTURER IN BIOLOGY UNIVERSITY OF TORONTO.

(Read November 21, 1896.)

A complete description of the gametophyte of the Ophioglossaceae has long been a desideratum.

Since the discovery by Mettenius, in 1856, of the subterranean prothallium of *Ophioglossum pedunculatum*, and by Hofmeister, in 1857, of that of *Botrychium lunaria*, nothing has been added till recently to their necessarily incomplete accounts of the gametophyte in these species. Our latest knowledge on this subject is derived from a brief description of incomplete material of the prothallium of *Botrychium virginianum* found in 1893 at Grosse Isle, Michigan, by Professor Douglas Campbell, which was published in the proceedings of the Oxford meeting of the British Association in 1894.

During the summer of 1895 the writer secured a large number of prothallia of the same species at Little Metis in the Province of Quebec. On examination it was found that the material thus obtained afforded a complete elucidation of the development and structure of the antheridia and archegonia, and a less satisfactory series of stages in the segmentation of the embryo. Last summer the remaining prothallia were removed to the number of about six hundred, and, although they have only been partially studied yet, owing to technical difficulties in embedding them, those examined have supplied all the lacking stages of the development of the young sporophyte.

It is proposed at the present time to furnish a brief account of the features of interest—a fuller description will shortly appear in the Transactions of the Canadian Institute.

All the younger prothallia were found in a single circular depression of sphagnum moss about ten feet in diameter, near a corduroy road, running through the wooded margin of a peat and huckleberry swamp at Little Metis, P.Q. Older prothallia were abundant with those bearing fertilized and unfertilized archegonia and younger embryos.

I have also found young sporophytes of several years' growth in the woods on the heights back of Metis; in the "Flats" below the "Whirlpool" on the Niagara river, and also in rich woods along the valley of the Don, near Toronto. In all the examples last referred to the young spore plant was still attached to the gametophyte. It seems probable that the prothallia of our common Canadian species of *Botrychium* are much commoner than has been hitherto supposed. It is necessary to add, however, that although my attention has been directed to the subject for some three years past, I have not yet succeeded in finding the younger stages of the prothallia in any other spot than the sphagnum basin in the swamp at Little Metis.

The gametophyte of *Botrychium virginianum* is of flattened oval shape, the narrower end of the prothallium being terminated by the growing point. My examples are from two to eighteen millimetres in length, by one and a-half to eight millimetres in breadth. Their thickness increases from the growing end backwards. The sides and lower surface of the prothallium are covered in younger specimens with multicellular hairs. In older plants these tend to disappear. The middle of the upper surface is occupied by a well-defined ridge, upon which the antheridia

are situated. The archegonia are found on the declivities which slope away from the antheridial ridge.

As might be expected, the younger sexual organs are found nearer the growing point than those of greater age.

A cross section of the prothallium reveals to the naked eye the fact that the lower part of the gametophyte is composed of tissue which is yellowish in colour, and from which a thick oil exudes, even when the plant has been lying in ninety per cent. alcohol for months. The upper portion of the prothallium tissue, upon which the generative organs are situated, is white in colour and free from oil. A long section of the prothallium shows the same distribution of yellow oil-bearing and white oil free tissue as the cross section, but demonstrates that the oil-bearing stratum is both absolutely and relatively much thicker in the older parts of the plant.

Microscopic examination shows that the oleiferous tissue has its cells occupied by an endophytic fungus and a very abundant protoplasm.

The fungus, so far as it has yet been studied, seems to be a sterile *Pythium*, possibly the same as that found by Treub, Goebel and others in the prothallium of species of *Lycopodium*. The writer hopes to study the fungus more closely in a living condition during the next period of vegetation. The fungus filaments can be seen passing from the prothallium to the outside medium by way of the root hairs.

The antheridia, as has been already stated, occur in numbers on a ridge running lengthwise on the upper surface of the prothallium. The young antheridia originate behind the growing point from a single superficial cell. This divides transversely the outer half, giving rise to the outer antheridial wall and the inner half by repeated simultaneous divisions to a large number of spermatocytes. The fully-developed antheridium is largely embedded in the antheridial ridge, and projects only slightly above its surface. The formation of the spermatozooids has not yet been carefully studied, but seems to resemble closely that described in the *Marattiaceae* and *Equisetaceae*.

The spermatozooids are unusually large in size, but otherwise resemble the ordinary fern type, and consequently differ from the biciliate, moss-like spermatozooids of the *Lycopodiales*.

The archegonia are confined to the sloping sides of the upper surface of the prothallium. Unlike the antheridia, young archegonia, although most abundant near the growing point, may be formed on almost any part of the archegonia-bearing surface. The archegonium mother cell is superficial, and is distinguished from its neighbours by a larger nucleus and a more abundant protoplasm. It first divides transversely into a shallow outer cell and a deeper inner cell. The inner-cell divides again, and as a result the young archegonium consists of three cells. The most external of these, by subsequent divisions, gives rise to the neck of the archegonium. The internal cell is the basal cell. It also divides into a plate of cells sometimes composed of two layers and distinguished by their richly protoplasmic contents. The middle cell of the young archegonium series gives rise by division to the neck canal cell and the ventral cell. The former becomes binucleate, but never divides into two cells. The latter, just before the maturation of the archegonium, divides into the egg-cell and the ventral canal cell. The ventral canal cell is broad, like that of the *Marattiaceae*.

In the ripe archegonium the nuclei of the cells of the upper stories of the archegonium neck become chromatolysed. I do not know yet whether this feature is peculiar to *Botrychium*.

The fully-developed archegonium is sunk into the prothallium, and only the neck projects above its surface. The cervical cells are in four rows as in the other *Pteridophyta*, and the terminal ones spring apart when the egg is ripe.

Spermatozooids are frequently found in contact with the egg. After fertilization the egg grows to many times its original size, and the reduced protoplasm contains a large hydroplastid.

The first division of the o-spore is across the long axis of the archegonium. The next division is parallel with the long axis of the prothallium, and at right angles to the first. The third cross wall is in the transverse direction of the prothallium, and at right angles to the other two. I have been unable to follow satisfactorily the subsequent divisions.

The organs appear very late, and only after the embryo has attained a large size. The root is the first of them to emerge, and the proliferation of cells, indicating its place of origin, is long unmarked by the presence of an apical cell. The cotyledon, stem apex, and foot appear nearly simultaneously.

The root and cotyledon originate from the upper part of the embryonic mass; the foot and stem apex from its lower cells.

The apex of the root in many cases is in the same straight line with the canal of the archegonium neck.

It seems hardly possible to derive the organs from definite octants of the embryo.

The growth of the root ruptures the calyptra, and its exit is followed somewhat later by that of the cotyledon. The latter is not a bi-laterally symmetrical structure, as in most ferns, but is of the same palmate type as is found in the Osmundaceae. The cotyledon begins to assimilate as soon as it reaches the surface of the ground, and thus resembles that of *Ophioglossum pedunculatum*.

There seems to be no evidence to indicate that more than the cotyledon appears above ground in the first season of the young plant's growth. In following summers apparently only a single leaf is produced, as is the case with the older plant. I have found young sporophytes, bearing their sixth leaf, still attached to the mother prothallium; and, as I have never found more than one leaf on the spore plants at once, and as the leaves, like other organs of this species of *Botrychium*, are extremely resistant to decay, I am reasonably certain that such examples were in the sixth year of their existence. This longevity of the gametophyte is of some interest.

One frequently finds two sporophytes on a single prothallium, and in many of these cases the apex of the prothallium is bifurcated. In one case I found two spore plants which had arisen from a single embryo. In another case I discovered two tracheids in a prothallium in the vicinity of a decayed young spore plant. The latter may have been of apogamous origin, as a similar phenomenon generally accompanies apogamy. I have not yet studied thoroughly the growing region of the prothallium, as it is best examined in longitudinal sections of the gametophyte. So far as I have investigated the matter, there seems to be evidence of the existence of an apical cell.

THE HISTOLOGY AND PHYSIOLOGY OF THE GASTRIC GLANDS. BY R. R. BENSLEY, B.A., M.B., ASSISTANT DEMONSTRATOR OF BIOLOGY, UNIVERSITY OF TORONTO.

(Read November 28, 1896.)

PRELIMINARY NOTICE.

In nearly all vertebrates, in which the histology of the stomach has been investigated, the mucous membrane of that portion immediately preceding the pyloric orifice has been found to contain glands differing in certain characters from the glands of the rest of the stomach, and known technically as the pyloric glands. The morphological relation of these glands to the other gastric glands in the lower vertebrates has excited little interest, but in the mammalia, in which the subject assumes great physiological importance, this relation has been the subject of numerous researches, and has been examined from widely different points of view. Heidenhain¹ and Ebstein² compared the cells of these glands with the chief cells of the fundus glands in respect to the action on them of dilute acids and alkalies, and to the appearances presented in different phases of secretory activity, and came to the conclusion that the two kinds of cells were of similar nature. Further force was imparted to this conclusion by the discovery that the pyloric mucous membrane contained a ferment capable of digesting fibrin in the presence of dilute hydrochloric acid, and by the experiment of Heidenhain,³ who established a pyloric sac entirely separate from the fundus mucosa, which, even after five months yielded a secretion rich in pepsin.

The method adopted by Heidenhain and Ebstein in investigating the physiological and morphological value of the pyloric glands was to a certain extent the correct one, and the reason that it did not lead, in their hands, to a more convincing result was that they examined cells in which only a portion of the elements of the living cells was preserved. The researches of Langley,⁴ alone, and in conjunction with Sewall, have taught us that the secretion of pepsin is intimately connected with the formation and disappearance of coarse granules in the chief cells, and he has offered us the most convincing proof that these granules are the zymogen of Heidenhain,⁵ Ebstein, and Grutzner,⁶ and comparable to the granules observed in the pancreas and salivary glands. Any cytological research which does not take into consideration these zymogen granules cannot fail to lead to erroneous results. Unfortunately, it has been found difficult to preserve these granules, and in his first observations on the mammalian glands, Langley depended largely on fresh, or living material. Subsequently he found that in some animals the granules could be fixed, and the part taken by them in secretion investigated by the use of solutions of osmic acid.

Langley and Sewall observed that the coarse granules discovered by them in the fundus glands were not to be found in the pyloric glands, and concluded that the appearance of granules in the cells was not a necessary feature of zymogenesis.

(1) Arch. fur Mik. Anat. Bd. VI., p. 368.

(2) Arch. fur Mik. Anat. Bd. VI., p. 515.

(3) Pflueger's Archiv. Vol. XVIII.

(4) Journal of Physiology. Vols. II., III., and others.

(5) Pflueger's Archiv. Vol. X., and Hermann's Handbuch, Vol. V.

(6) Pflueger's Archiv. Vol. VIII.

Relying on their observation that in the rabbit there is a gradual diminution in the number of granules in the chief cells, from the fundus along the greater curvature, and on the undoubted fact that the pyloric secretion contains a proteolytic ferment, these observers concluded "that the pyloric gland cells and the chief cells of the fundus are fundamentally the same," and that "the chief cells of the fundus" are "a highly differentiated form of the pyloric gland cells." Stohr⁷ in 1882 arrived at a similar conclusion, as a result of his researches on the stomach of man, the cat, dog, and badger.

Many investigators, however, as a result of physiological experiment and observation, have come to the conclusion that the pyloric gland cells are something quite different from the chief cells of the fundus gland. Among these may be mentioned Nussbaum,⁸ Sappey,⁹ Bonnet,⁹ and Bikfalve, who regard the pyloric glands as mucous glands. The most recent contribution to this subject is that contained in the *Lehrbuch der Vergleichenden Mikroskopischen Anatomie*, published this year by Oppel, of Freiburg. From an exhaustive examination of the literature of this branch of research, and from personal observation, this author concludes that "Die Pylorusdrüsenzellen sind Zellen sui generis welche sich sowohl vom Oberflächenepithel wie von den Hauptzellen unterscheiden. Sie sezernieren pepsinhaltigen Magensaft."

One has only to consider the conflicting nature of the results achieved, or to observe the various ways in which similar observations have been interpreted, to convince oneself that the solution of the problem of the morphology and physiology of the mammalian pyloric gland is not to be attained by the ordinary methods of physiological research.

It appeared to me that some information might be afforded by a careful study of the structure of the cells of the various gastric glands, at different periods of digestion, together with a comparison of the structure of the cells in the various vertebrate classes. In order that this investigation might not be open to the objection I have urged in reference to the work of Heidenhain and Ebstein, it was necessary to find some agent that would fix equally well the form and contents of the cell. To the difficulty of accomplishing this, I have already alluded, in speaking of the work of Langley, who found that by the use of osmic acid he could preserve the granules in the chief cells of a few mammals only. It has since been found that mercuric chloride, in saturated aqueous solution, would fix perfectly the zymogen granules of many glands. This reagent, as well as the various osmic acid mixtures, were tried and found to possess certain disadvantages. Whilst they fixed perfectly and satisfactorily the cells of the surface, and of the deepest portions of pieces of mucous membrane immersed in them, the zymogen granules had quite disappeared from the middle regions of the glands. Alcoholic solutions of mercuric chloride were then tried, with the result that whilst the zymogen granules of the whole gland were well preserved, the cells themselves had undergone considerable change of form. It was subsequently found that the addition of an equal volume of two per cent. aqueous solution of potassium bichromate to the alcoholic solution of mercuric chloride, would prevent the shrinkage of the cells, and at the same time effect a satisfactory fixation of the zymogen granules in all parts of the glands containing them.

With the help of this reagent I have investigated the stomachs of several mammals, and of members of the lower vertebrate classes, and have been led to conclude, that the relationship of the pyloric glands to the glands of the fundus region is, within certain limits, a constant one, and that the pyloric glands are to be regarded as feebly differentiated structures, corresponding in the nature of their cells to the upper portions of the fundus glands.

(7) *Archiv f. Mik. Anat.* Bd. XX.

(8) *Archiv f. Mik. Anat.* Bd. XXI.

(9) See Oppel. *Lehrbuch der Vergleichenden Mikroskopischen Anatomie*, p. 269.

Among mammals, I have found the cat most suited to experimental research, on account of the large size of the zymogen granules, and in this preliminary paper I will confine myself to an account of the results attained by observation of the gastric glands of this animal in various stages of secretion, and reserve for the full paper, to be published shortly, the confirmatory facts elicited from an examination of the stomachs of other mammals, fishes, amphibia, and reptilia.

The chief cells of the fundus glands may be divided into two groups, those of the body and those of the neck of the gland. The differences between these two kinds of cells will be minutely described.

If the fundus glands of an animal that has fasted for twenty-four hours be hardened in the alcoholic sublimate bichromate mixture, the chief cells present the following characters:—They are cubical or pyramidal in shape, the base of the pyramid being usually directed towards the lumen of the gland. In preparations stained in haemalum and eosin, the body of the cell is found to contain a network of large polygonal meshes of equal size, and pervading the whole cell. In secretions stained in saffranin, or gentian violet, or the iron alum haematoxylin of Heidenhain, the cell is filled with granules of large size, the zymogen granules. In the Ehrlich-Biondi mixture the network stains red, and it is then seen that each mesh of network corresponds to a zymogen granule. The apparent network is really the optical section of the partitions between the spaces in which the zymogen granules lie. The nuclei are round or oval, occasionally slightly irregular, and placed near the base of the cell. They possess a well-defined chromatin network, and one or two large eosinophilous nucleoli. I have directed considerable attention to the structure of the nuclei in the different phases of secretion, with a view of determining if changes similar to those described by Platner, Ogata, and others in the nuclei of the pancreatic cells are to be observed in the gastric chief cells. So far, however, I have been unable to demonstrate any changes, with the exception of the slight irregularity of outline sometimes seen in the resting cell. This, I feel inclined to attribute, rather to compression by the secreted products, than to spontaneous change of form.

In an animal that has been continuously digesting for a period of six hours the chief cell is distinctly marked off into two zones. The inner zone is still filled with large granules, between which may be seen in Ehrlich-Biondi stained sections, the red stained meshwork of hyaline protoplasm. The outer portion of the cell contains no granules, but is occupied largely by a substance which has a peculiar affinity for nuclear dyes, such as haematoxylin. This substance possesses an obscurely fibrillated structure, the fibrillae being placed side by side in the base of the cell, so that one is at first reminded of the appearance of the striated epithelium of the intralobular ducts of the salivary glands. On closer examination it may be seen that the fibrillation in the outer portion of the chief cell is not so regular, nor are the fibrillae as distinct from one another as in the salivary ducts. The fibrillae are also of larger size, and irregularly swollen at intervals so as frequently to mask the fibrillated structure. The form taken by this substance in the base of the cell, particularly when it is present in small amount, frequently reminds one strongly of the figures published by Macallum,¹⁰ Eberth, and Mueller,¹¹ and others, of the nebenkerne in the pancreatic cells of the amphibia, and one is led to inquire if these structures are not of similar nature. The amount of this fibrillated substance in the cell, under normal conditions, varies inversely with the number of zymogen granules, and one can only conclude that the chromophile substance in the base of the cells breaks down during rest, and thus takes part in the formation of zymogen granules, which is then actively progressing. Mouret¹² takes a similar view of the nature of the chromophile fibrillated substance in the outer portion of the

(10) Transactions of the Canadian Institute. Vol. I. 1890.

(11) Zeitschrift f. Wissenschaft. Zool. Bd. 53. Supplement.

(12) Journal de l' Anatomie. 1895.

pancreatic cells of the dog, and he suggests the name of "pre-zymogen" for the substance. Some information as to the nature of this substance is afforded by the researches of Dr. Macallum, who describes¹³ the differences in staining exhibited by the nucleus and plasma of the exhausted and resting pancreatic cell, and explains this difference as follows:—"The chromatin of the nucleus of the pancreatic cell gives rise to a substance which we may call "prozymogen," sometimes dissolved in the nuclear substance, sometimes collected in masses (plasmosomata), and finally diffused into the cell protoplasm, uniting with a constituent of the latter as zymogen." In a subsequent investigation¹⁴ into the distribution of assimilated iron compounds in animals and vegetable cells, Dr. Macallum found diffused in the cytoplasm of the outer zone of the chief cells, and, with two exceptions, in the cytoplasm of all other glands examined by him, a firm compound of iron, and his observations led him to conclude that this iron compound was the prozymogen of his earlier researches. It seemed probable that the fibrillar chromophilous element observed by me in the outer zone of the chief cell was the prozymogen of Dr. Macallum's investigation; and this proved to be the case. A convenient means of proving this was afforded by the fact that the chief cells of the greater curvature of the rabbit's stomach contain at all periods of digestion a very large amount of the chromophile substance, which in the exhausted phase almost fills the entire cell, the zymogen granules being then confined to a narrow band next to the lumen. Sections of this mucous membrane give no immediate reaction for iron with ammonium sulphide, but after three hours' treatment with a three per cent. solution of sulphuric acid in alcohol, at a temperature of 40 degrees C., those portions of the chief cells containing the chromophile substance take, with acid ferrocyanide solution, a deep Prussian blue color, which is so intense as almost to mask the nucleus of the cell. The Prussian blue reaction also shows the same fibrillar structure as is observed in sections stained in haematoxylin. We may, therefore, use the term "prozymogen" for this substance wherever it occurs.

It is not in the chief cells of the stomach and in the pancreatic cells alone that the prozymogen assumes the fibrillar form. I have observed similar structures in the serous glands of the gustatory area of the rabbit and dog, and it is possible that the rod-like structures described by Solger¹⁵ in the basal portion of the cells of the human submaxillary gland, and by Erik Mueller¹⁶ in the cells of the submaxillary of the guinea pig, may belong to the same category. The fibrillation in the prozymogen of the gastric gland cells may be observed in the fresh cell, examined in aqueous humour, and is, therefore, not the product of the action of reagents. It may be also seen in sections fixed in Hermann's or Vom Rath's osmic acid mixtures, and in aqueous sublimate.

The cells of the neck of the gland are quite different in appearance from those of the body. At no period of digestion do they contain either prozymogen or granules of zymogen. The same remark is applicable to the chief cells of the short collecting duct (sammelgang of Bizzozero), and to the cells of the lower portion of the mouth of the gland. The cells of these three regions have many features in common, and will be described together. As a starting point, I will describe the cells of the upper portion of the neck of the gland.

These cells are usually conical or pyramidal in shape, wedged in between the larger oval border cells of this region of the gland in such a way that the broad base of the cell is directed towards the lumen. In vertical sections of the mucous membrane, from one to four of these cells may usually be observed between each pair of the border cells. Two zones may be distinguished in the cells, an outer protoplasmic zone of fine reticular structure, staining readily with eosin, and an

(13) Op. Cit.

(14) Quarterly Journal Microscopical Science. Vol. XXXVIII., Part II. New Ser.

(15) Anatomischer Anzeiger. Bd. IX.

(16) Archiv f. Mik. Anat. Bd. XLV.

inner zone presenting an irregular network of much larger meshes, and containing a secreted substance, which behaves in a peculiar way to staining agents. By the ordinary stains this portion of the cell appears clear and transparent. The substance contained in the inner zone of the cell appears to be in some respects similar to mucin. It gives a faint metachromatic red stain with thionin, and stains intensely with Bordeaux R. and Indulin. The latter dye has rendered me considerable service in determining the distribution of this kind of secretion in the stomach. I have found the most satisfactory method of applying this stain to be in the form of Huber's blood fluid, consisting of two grammes each of indulin, eosin, and aurantia, dissolved in thirty grammes of pure glycerine, and diluted with four hundred times its volume of distilled water before use. Sections of the fundus mucous membrane immersed in this fluid for one-half hour or longer, show all parts stained red, with the exception of the blood corpuscles, which are yellow, the nuclei of the cells and the mucigenous borders of the surface cylindrical cells, which take a faint haematoxylin tint, and the secretion in the cells of the upper portions of the glands, which takes an intense dark blue color. Stained secretion may also be observed in the lumen of the gland. In sections stained thus the appearance of the inner zone of the cell is different from that above described. It is now found to be pervaded by a close-meshed network of coarse fibres, both the network and the substance enclosed in its meshes being indulinophilous, and often presenting a vacuolated appearance. This appearance seems to me to be due to the formation of a secondary reticulum by precipitation in this form of the solids of the secretion. At the junction of the two zones of the cell the reticulum of the outer zone is much finer in texture and is chromophilous, so that in sections stained in haematoxylin alone, the cell appears to be subdivided by a blue stained band into the two zones. In sections stained in the indulin mixture it is frequently seen that a small quantity of indulinophilous material is diffused through that portion of the outer zone of the cell, between the chromophilous band above referred to and the nucleus. The size of the indulinophilous zone varies with the position of the cell. In the upper part of the neck of the gland it involves only a small portion of the cell, but on passing down the gland, increases gradually in width, until at the lowest portion of the neck of the gland it fills nearly the whole cell. The nuclei of these cells are placed near the base, and vary in shape with the amount of secretion present; in those cells, which possess a large protoplasmic zone, the nuclei are oval or round; in the cell filled with secretion they are irregular and flattened. It is only in cells, however, in which the indulinophilous zone extends to the nucleus that any irregularity of shape is to be observed. Mitoses may frequently be observed in those cells, even when filled with secretion. Among the indulinophilous cells of the lower portion of the neck may be observed a few zymogenic cells. An occasional indulinophilous cell may also be observed among the chief cells of the body of the gland, and these are probably the cells observed by Pilliet,¹⁷ Trinkler,¹⁸ and others, and regarded as stages in the transformation of border into chief cells, or vice versa.

The cells of the collecting duct, and the lower cells of the mouth of the gland, also contain indulinophilous secretion, in the shape of a rounded clump in the midst of the protoplasm of the cell, near the nucleus, possessing the same structure and staining properties as the inner zone of the cells of the gland neck. Passing up the mouth of the gland, this clump gradually approaches the free surface, and loses its indulinophilous character, finally fading into the mucigenous border of the surface epithelium. In these cells, as Bizzozero¹⁹ observed, the mitoses are more frequent than in the neck cells.

There is some evidence that the indulinophilous cells of the neck of the gland

(17) *Journal de l' Anatomie*, etc. No. 5. 1887.

(18) *Archiv f. Mik. Anat.* Bd. XXIV.

(19) *Archiv f. Mik. Anat.* Bd. XLII.

are young cells, which will ultimately grow down into the body of the gland, and take on the function of zymogenesis. This evidence will be offered in a later paper, in which also the regeneration of the surface epithelium will be discussed.

The discovery of the different nature of the cells in the neck of the gland affords a cytological basis for the division of the gland into two regions, called respectively, the neck and the body of the gland.

The length of the neck of the gland varies in the different portions of the stomachs of different mammals. I have not been able to demonstrate any change in the appearance of these cells in the different periods of digestion. In sections fixed in alcohol sublimate bichromate solution the branches of the lumen leading out to the border cells, as well as the fine intracellular secretion capillaries of the latter, may be perfectly seen.

The pyloric gland cells contain at no period of digestion either zymogen granules or prozymogen. They resemble closely in internal structure the cells of the middle portion of the neck of the fundus glands, and contain a similar secretion. As in the fundus glands, this stains intensely with indulin and Bordeaux R., and gives a faint metachromatic red stain with thionin. The reticulum observable in the indulinophilous portion of the cells is, as a rule, finer than in the neck cells of the fundus glands. Here, also, it may be observed that the indulinophilous cells pass, by gradual transition, into the mucous cells of the surface, and it is in the transitional portion of the gland that mitoses are most abundant, although they may be frequently seen even in the deepest portions of the glands.

The identity of the cells of the neck of the fundus gland with the pyloric gland cells in the cat may be demonstrated by a study of the so-called intermediary zone. Here I have found, not the mixed fundus and pyloric glands of other observers, but a gradual transition, brought about by the lengthening of the neck region of the gland, and the gradual disappearance, first, of the zymogenic cells, and finally, of the border cells, as the pylorus is approached.

CONCLUSIONS.

1. During digestion a substance similar in chemical properties to the chromatin of the nucleus makes its appearance in the outer clear zone of the chief cells of the fundus glands. This substance, which may be called prozymogen, stains deeply and readily in haematoxylin, and presents a characteristic fibrillated appearance. During rest this prozymogen is used up in some way, giving rise to zymogen granules.

2. The chief cells of the neck of the gland do not contain at any period of digestion, either zymogen or prozymogen, but are engaged in the formation of a mucinoid secretion, which has a powerful elective affinity for indulin and Bordeaux R., and stains metachromatically in thionin.

3. The pyloric gland cells, likewise, form neither zymogen nor prozymogen, and are similar in structure, in staining properties, and in the nature of their secretion to the cells of the neck of the fundus gland.

4. The cells, both of the pyloric glands and of the neck of the fundus gland, pass, by gradual transition, into the mucous cells of the surface, to which they are obviously closely allied.

THE NATURAL RESOURCES OF THE COUNTRY BETWEEN WINNIPEG AND HUDSON'S BAY: OUR NORTHERN OUTLET. BY LIEUT.-COL. T. C. SCOBLE.

(Read December 5, 1896.)

The area draining into Lake Winnipeg embraces 432,000 square miles, and includes the valleys of the Red, Winnipeg and Nelson Rivers, the overflows of Lakes Dauphin, Manitoba and Winnipegosis, and nineteen tributary rivers. The area of the Red River Valley alone is nearly 42,000 square miles, of which 7,000 square miles are within the Province of Manitoba, and constitute the home of the famous wheat known to commerce as "No. 1 Manitoba hard." The only impediment to navigation on the lower Red River is at St. Andrew's Rapids, where there is a fall of about fifteen feet, distributed over ten miles of the river, and this could be easily overcome by dredging. North-western Ontario, being the height of land, drains through the Winnipeg River into the lake at its south-eastern extremity, and the Great Saskatchewan, with its 1,513 miles of navigable channels, enters at the north-western extremity. Lake Winnipeg is 270 miles in length and 72 miles in breadth, from east to west, at the mouth of the Great Saskatchewan, its area being 9,400 square miles, or 2,070 miles larger than Lake Ontario. The precise elevation above sea level, Col. Scoble considers not yet determined, as authorities disagree. The average depth is from 42 to 90 feet, and there are few obstructions to navigation.

So far only two industries have been developed, those of lumbering and fishing. The spruce lumber cut annually in the Lake Winnipeg district amounts to about ten millions of feet, board measure; value, \$170,000. The fisheries in 1894 yielded 5,443,780 pounds, valued at \$188,014. The Inspector of Fisheries was quoted with regard to the inexhaustible supply of whitefish and sturgeon in these waters.

The geological formation is Laurentian on the east side and Devonian on the west side of the lake, showing that the dividing line between the two systems is covered by its waters. In some of the islands the two systems are in juxtaposition. On Black Island there is a most valuable deposit of soft brown hematite iron ore, yielding from 44 to 62 per cent. of metallic iron to the ton. Gold and silver are also found on the same island, with several other minerals of economic value. At Berens River and other points red hematite iron ore exists in vast quantities, and gold had been discovered on Bad Throat River and at Pipestone Lake on the Upper Nelson River. Beyond Lake Winnipeg north and eastward the whole country is intersected by lakes and waterways existing in the depressions in the Laurentian formation. The falls and rapids of the Nelson River were described in detail.

The boat route over which the Hudson Bay Company carried its traffic for over a century was next described, and the curious phenomenon of two rivers, one flowing east and the other flowing west from a narrow height of land only twenty-nine yards in width, was commented upon. Then the lecturer pointed out that the difficulties to be encountered in improving either of the two routes before described might be overcome by crossing the height of land to Molson's Lake. By this route out of a distance of 68 1-2 miles from Winnipeg to Hudson Bay, only fifty-seven miles would need any improvement to secure continuous seven-foot navigation, and of this distance only ten and a half miles would require canalling. Eight dams and thirty-four locks were all he estimated as being necessary in order to overcome the descent. No "locking up" would be required to get over the height of land, and the whole drainage area of the Winnipeg basin could be employed if necessary to develop the system. A mineral belt, similar to that of the upper Lake Superior system, crosses the country, and promises well to explorers.

The varied resources of Hudson Bay were described, and the question was asked, "Why should not these resources be exploited for the benefit of Canada?" American whalers had taken out millions of dollars' worth of oil and bone, and would continue to do so until Canadian rights were asserted. It was necessary in the interests of Canada as a whole, as well as for the North-West, that a new outlet to the ocean should be opened via Hudson Bay:

THE PANIS—AN HISTORICAL OUTLINE OF CANADIAN INDIAN SLAVERY IN THE EIGHTEENTH CENTURY. BY JAMES CLELAND HAMILTON, M.A., LL.B.

(Read December 12, 1896.)

- I. Examples of early American slavery among the Portuguese, Spaniards, and New Englanders. Story of Inkle and Yarico. Reference to panis in writings of Hennepin, Charlevoix, Colonel Landmann, and Captain Knox. Dr. D. G. Brinton, J. G. Shea, and Horatio Hale as to the Pawnees and Pani stock and their habitat. The New York and other early Colonial documents referred to.
- II. The Lower Canada records as to panis in cities of Quebec, Three Rivers, Montreal, and elsewhere. The punishment of slaves, the pillory, carcan and the rack. Panis in Montreal Hospital, in the seigniories.
- III. Legal position of Canadian slaves: The statutes, ordinances, and edicts as to them.
- IV. Panis in Upper Canada, at Niagara and Amherstberg. The Huron Treaty of 1764. The last pani.

I. The Portuguese in 1500 sent out an expedition to North America under Gaspar Cortereal, which entered Hudson's Straits. They brought away fifty-seven natives, to be sold as slaves and used as laborers.

The supposed excellent quality of these kidnapped natives, and the large supply which the country was likely to furnish, caused it, as our author alleges, to be called Terra Laborador, or the land of laborers, whence its present name (1). This seems to have been the beginning of the subjugation of aborigines on the North American Continent to slavery by Europeans and their descendants.

Before this the Spaniards had been active in Hayti and Jamaica in reducing the natives there to servitude, working them in the mines, and exporting many to the home slave market. In 1498 Christopher Columbus sent 600 of the natives to Spain and wrote as to them in impious blasphemy: "In the name of the Holy Trinity there can be sent as many slaves as sale can be found for in Spain, and they tell me 4,000 can be sold." He is said to have repented of his cruelty after being in turn sent to Spain in chains by Bovadilla. Tennyson makes him thus bemoan his fate, and theirs:—

" Ah God, the harmless people whom we found
In Hispaniola's island paradise—
Who took us for the very gods from heaven,
And we have sent them very fiends from hell.
And I, myself, myself not blameless, I
Could sometimes wish I had never led the way."

The Spaniards' cruelty in the Antilles was only paralleled by their conduct toward the natives of Mexico. The enslavement of red, as well as of black men,

(1) History of Nova Scotia and other British Provinces, by James S. Buckingham, p. 168. Other derivations have been given, but the above seems appropriate and well founded.

was not unfamiliar to even the Puritan Colonists. In 1675 many towns, villages, and farmsteads in Massachusetts and Rhode Island were destroyed by the Wampanoags, under the famous King Philip.

There were few families in the region attacked who did not mourn some of their members. When Philip had fallen, his chiefs, sachems and bravest men were put to death; the remainder were sold as slaves.

The son of Philip, whose only crime was his relationship to this great chief, was among the prisoners, and was sent as a slave to Bermuda, whence he never returned. An attempt to supply such labor for the New England home market led to speedy repentance.

A New Hampshire Provincial Law of 1714 recited that notorious crimes and enormities had of late been committed by Indians and other slaves within Her Majesty's plantations, and forbade the importation of any Indians to be used as slaves.

Washington Irving was among the first who criticized the stern and cruel features of the Puritans. They, he cried, trained the Indians for Heaven and then sent them there (2).

The story of Inkle and Yarico, as told by Steele, and familiar to all readers of *The Spectator*, illustrates the cruel practice of Europeans of the seventeenth century in treating all persons of darker complexions than themselves as proper subjects for barter.

Young Inkle, an English merchant adventurer, wanders from his ship on the American main, is found and saved by Yarico, an Indian girl, with whom he lived in tender correspondence for some months, when both escaped on a passing ship bound for Barbados. Here, as each vessel arrived, there was an immediate market of the Indian and other slaves, as with us of horses and oxen. The prudent and frugal young Englishman sold his companion to a Barbadian merchant. Had Yarico been carried to the old Province of Quebec she would have been called a *pani* (3).

From these instances of native American slavery beyond our immediate borders, we pass to consider how far such a system obtained in Canada.

Canadian negro slavery has been before described, (4) and reference is now made to the enforced servitude of red men in the French Province of Quebec, and the later Provinces of Lower and Upper Canada.

The Recollet Father, Louis Hennepin, was with LaSalle in 1679, and, writing at Niagara, says: "The Iroquois made excursions beyond Virginia and New Sweden * * * from whence they brought a great many slaves." (5)

A vessel, called "the Griffin," was built on Lake Erie, and in this these early adventurers crossed through that lake, the River St. Clair, and Lake Huron to Mackinac, where LaSalle parted from Hennepin, the vessel having been, meantime, lost in Lake Huron. Hennepin professes to have gone down the Mississippi, and to have been the hero of many wonderful adventures. This part of the story is questioned by Mr. Shea and others, but such details as Hennepin did not personally witness are, no doubt, taken from LaSalle's Journal, and are substantially correct.

As the Pawnee nation had its habitat on, and west of, the Missouri, we do not find them or their relations, the Caddoes, Wichitas and Huecos, mentioned in this interesting volume. It is stated that the Illinois Indians were accustomed to make

(2) As to Indian Slavery in the United States see Kent's Commentaries, part vi., lec. 61. and the authorities there cited. Winthrop's History of New England, vol. 1, pp. 192 to 237. In Carolina hostilities were fomented among the tribes in order to purchase or kidnap captives and sell them as slaves to the West Indies. The sale and slavery of Indians was deemed lawful and the exile and bondage of captives in war, of all conditions, was sanctioned by the sternest Puritans. Bancroft's History, 1, pp. 41-182. The war with the Pequots in 1637, and the confederacy of Indian nations in 1675 by Metacom, Sachem of the Wampanoags, commonly called King Philip, would seem to have been formed for protection and through patriotic views. Chalmers' Political Annals, p. 291. Indian Slavery ceased in Virginia only in 1705. Magazine of American History, vol. 21, p. 62.

(3) *The Spectator*, No. 11, March 13, 1710.

(4) *Transactions of Canadian Institute*, 1890, vol. 1, p. 102.

(5) Louis Hennepin's "Discovery of America," cap. 18, pp. 19-37.

excursions far to the westward, and bring slaves from thence, which they bartered with other nations.

The southwestern Indians raided by the Illinoisans may be inferred to have been Pawnees. From their captors they passed to the white settlers in French Louisiana and Quebec.

Forty years after La Salle's time, intercourse between Louisiana and Quebec became comparatively common, and families coming up by the Mississippi, brought their negro and pani slaves with them.

Charlevoix, who visited Canada in 1721, refers to a nation settled on the banks of the Missouri, from whom persons taken captive were made slaves. He remarks: "The Arkansas River comes, it is said, from the country of certain Indians, who are called Panis Noirs—I have a slave of this nation with me (6)."

Next in date, refer to the story of the adventures of Alexander Henry, the fur trader at Michilimacinae in 1763, when that outpost of Canada was taken and the garrison massacred by the Chippewas and Sacs, he was led to a hiding-place by a faithful pani slave woman, and ultimately escaped. Her owner was Charles Langlade, a French halfbreed merchant and interpreter, and afterwards one of the early settlers in Wisconsin, but her name is not given. The Sacs and Chippewas were then at enmity with the Pawnee nation, and made slaves of such of them as they captured (7).

Colonel Landmann relates that, in 1800, when journeying from Amherstburg to St. Joseph's Island, he found a large Indian camp in busy preparation for the burning of a female prisoner, with a child at her breast. The usual horrors of torture had begun, and death was threatened, but the woman, in stoicism only expected from the other sex, was apparently indifferent to all. The Colonel negotiated for the purchase of both mother and child, and secured them in consideration of six bottles of rum, "that is," writes the careful chronicler "two of rum, mixed with four of water." The woman showed no apparent feeling, nor did she express thanks for her delivery from a terrible fate. This was but a part of the stoic manner of her race. She told all to her people, and before the young officer left St. Joseph's Island, a number of the woman's relations came and, to show their gratitude, made a considerable present of the finest skins they had been able at the instant to collect. The woman and child so saved were Pawnee captives (8). The Capitulation at Montreal had taken place on the 8th of September, 1760, and we find the word pani used in its 47th section, which provides that the negroes and panis of both sexes should remain in their condition of slavery, and belong to their French and Canadian masters, under British rule, as they had been before under the French regime, and that the masters were to be at liberty to retain them or to sell them, and to train them in the Catholic religion, except those who had been made prisoners of war.

Captain Knox visited Canada soon after this, and, commenting loosely on this section of the treaty, states his belief that panis imply convicts condemned to slavery (9). He gives no authority, and is entirely mistaken. This is the more to be regretted as others, assuming to write Canadian history, have copied his remark, traducing the character of the humble, early servant of the old Canadian homesteads. It is also remarkable that the part occupied by them in the social fabric has not been introduced into books of fiction and other writings descriptive of the seigniorial times.

May we not have a gentle Yarico, taking the place of Briseis or Helen, in an epic of the old regime; or even the story of a devoted Friday?

The stately mansion of Belmont, overlooking the St. Charles, home of the

(6) Charlevoix's Journal, vol. 3, pp. 212 and 410.

(7) Henry's Travels, part 1, cap. 10. Parkman's Conspiracy of Pontiac, vol. 1, cap. 18.

(8) Adventures and Recollections of Col. Landmann, vol. 2, cap. 6.

(9) Historical Journal, vol. 2, p. 42^c.

brave bourgeois, Philibert; the manor house of Tilly on the shores of the St. Lawrence; the Chateau of Beaumanoir, famous for the bacchanalian revels of the intendant Bigot; the castle of St. Louis, and other "Seats of the Mighty" in New France, have often been described, but who has pictured the little huts in their courtyards, of the negro and pani?

Dr. Daniel G. Brinton says that the Pani stock was scattered irregularly from the Middle Missouri River to the Gulf of Mexico. The Pawnees proper occupied the territory from the Niobrara River south to the Arkansas. The Niobrara River courses in an easterly direction through the northerly part of the State of Nebraska, and falls into the Missouri. The territory indicated embraces now the States of Nebraska and Kansas, and parts of Iowa and Missouri. It includes many cities and towns, among them being Des Moines, St. Louis, Topeka, and Omaha. The Arikari and Skidi branches of the nation separated at an early date and went north, while the Wichitas, Caddoes, and Huecos roamed over Eastern Louisiana and Western Texas.

The Pani stock, as a rule, had an excellent physique, being tall and robust, with well-proportioned features, the lips and eyes small. Their marriage customs were lax; agriculture was more in favor with them than generally on the plains. Their religion somewhat resembled that of the Mexicans, and indicates a southern origin. One of their divinities was Opirikut, who represented the deity of fertility and agriculture. At the time of corn planting, a young girl, usually a captive, was sacrificed to this divinity. The victim was bound to a stake and partly burned, her breast was cut open, her heart was torn out, and flung into the flames. Her flesh was then divided into small pieces and buried in the corn field, to secure an abundant crop. In Mr. Grinnell's book this divinity appears under the name of Ti-ra-wa, and this sacrifice seems to have been most used by that portion of the nation known as the Skidi, whose home was on the Platte and Loup Rivers in Nebraska.

In 1806 the Pawnee tribe had a population of 6,223, with nearly 2,000 warriors. The Caddoes were of the same stock, and were also numerous on the western plains. "Since the removal of these people to reserves, mostly in the Indian Territory, the evidences of their progress towards civilization are cheering; but their character has changed. In the old barbaric days they were light-hearted, merry, makers of jokes, keenly alive to the humorous side of life. Now they are serious, grave, little disposed to laugh. Then they were like children, without a care. Now they are like men, on whom the anxieties of life weigh heavily. Civilization, bringing with it some measure of material prosperity, has also brought care, responsibility, repression. No doubt it is best, and it is inevitable, but it is sad, too." Recent information as to the remnant of this nation is given by Mr. Geo. B. Grinnell, from whom we have just quoted. Many of the young men were embodied into companies of armed scouts, under Major North and other officers, during the construction of the Union Pacific Railway in 1863, to guard against the depredations of the Sioux and Arapahoes. They were brave and reliable soldiers, and it is to be regretted that the tribe of Pawnees proper is reduced to a few hundred souls, while the whole Caddoan or Pani stock does not probably exceed in number two thousand. (10)

The American Cyclopaedia, article Pawnee, describes the tribe as warlike, long resident in Nebraska on the Platte River and its tributaries. The name Pawnee or Pani is from the Illinois language, and is said to be from Pariki, meaning a horn, referring to the peculiar scalp lock, dressed to stand erect and curve slightly back like a horn; the rest of the hair was shaven off. They were constantly at war with the Sioux and other nations, and, being considered irreclaimable savages, were permitted to be held as slaves in Canada, when bought from other tribes; wherefore,

(10) U.S. Bureau of Ethnology, Vol. 7, pp. 61, 62 and 113, date 1885-6. "The present number of the Caddoan stock is 2,259, settled in Fort Berthold Reservation, N. Dakota, and some on the Indian Territory, some on the Ponca, Pawnee, and Otate Reservations, and others on the Kiowa, Comanche and Wichita Reservations." They are now self-supporting.

any Indian held in bondage was called a panis. As to this our worthy and renowned Canadian ethnologist, Mr. Horatio Hale, writes me: "Panis and Pawnee are undoubtedly the same word, in different orthographies." He states that the article last quoted is from the pen of J. G. Shea, the distinguished ethnologist, and editor of *Charlevoix*: "All that he wrote on Indian matters is of the highest authority—what Mr. Brinton writes is also entirely trustworthy." "The Pawnees were true Ishmaelites. They had no friends upon the prairies, save those they had conquered and held by fear (11)." In addition to the Pawnees, there was certainly another tribe which contributed slaves to Canada (12). In 1712 the Renards, or Foxes, endeavored to capture and destroy Fort Detroit, but were defeated and compelled to surrender at discretion. Those found in arms were massacred, the rest were distributed as slaves among the victors.

There are a few references in the New York Colonial Documents to panis, or to Indians enslaved by whites. A narrative, presented to the Mayor's Court of New York City, 24th January, 1689, complaining of the violent acts of the Lieutenant-Governor, Jacob Leysler, states that an Indian slave of Philip French was, by him, dragged to Fort William on the 23rd of the previous December, and there imprisoned, but French was himself arrested by order of this bold Governor, and spent his Christmas in durance, for various matters of alleged contempt to His Honor. (Vol. 3, 676.)

Colonel Heathcote reports to Lord Townsend, British Colonial Secretary, July 16th, 1715, that the Indians complain that their children, who had been bound out for a limited time to be taught and instructed by the Christians, were transferred to other plantations and sold for slaves. He adds, "And I don't know but that there may be some truth in what they allege." (Vol. 5, 433.) M. La Galissoniere's *Journal of events in Canada*, under date Nov. 11, 1747, says: "The four negroes and a panis, who were captured by the English, would be put on board a small vessel bound for Martinico, to be there sold for the benefit of the proprietors." (Vol. 10, 138.) Colonel William Johnson writes to Governor Clinton, of New York, 22nd January, 1750: "I am very glad your Excellency has given orders to have the Indian children returned, who are kept by the traders as pawns or pledges, as they call it, but rather stolen from them, as the parents came at the appointed time to redeem them, but they sent them away before hand, and as they were children of our friends and allies, and if they are not returned next spring it will confirm what the French told the Six Nations, viz.: that they are looked upon as our slaves, or negroes, which affair gave me a great deal of trouble at that time to reconcile. I cannot find that Mr. Abeil, who has a Seneca child, or Vandrieson, who has got a Missisagey, are to deliver theirs, which I am apprehensive, will cause a great disturbance." (Vol. 6, 546.)

We find references of a similar character in the diary of David Zeisberger, the good Moravian missionary (13). He was loath to believe that such cruelty was practised, and ascribed the stories he heard to "lying rumours." Yet it is clear that these were well founded. Writing in 1795 at Fairfield-on-the-Thames, now known as Moraviantown, Ont., he says: "We had many lying rumours which the Indians hatch out, that the Indians here are entrapped by the white people, and will not be let go until they have all been sold as slaves. . . . The Chippewas have war with the North-western Indians. They have brought into Macinaw one hundred prisoners, a part of whom they sold to the whites. This is a nation with which they have waged war for many years." (14)

II. Next refer to the records in the old Province of Quebec relating to Panis. For these we are mainly indebted to the Abbe Tanguay's researches, made and

(11) "Pawnee Hero Stories and Folk Tales," by Geo. B. Grinnell, 1889, p. 307.

(12) McMillen's *History of Canada*, p. 91.

(13) *Diary of David Zeisberger*, by Eugene F. Bliss, published by the Historical and Philosophical Society of Ohio, 1885, Vol. II., pp. 411 and 491.

(14) A Travers les Registres, Montreal, 1886.

published in 1886 under the Quebec Government. In the church registers at the City of Quebec, under date 1718, it appears that "in the course of that year several Panis, being introduced from Louisiana, being slaves of Quebec families, were baptized."

In 1730 and following years the Church registers of Three Rivers contain records of baptisms and burials of several such slaves belonging to the principal families of the town.

November 4, 1756.—"Marie Judith, agè de trieze ans, a ete baptisee," appears on the register of the parish church at Longue Pointe.

January 22, 1757.—A record shows that a panis slave called Constant, belonging to Madame de Saint Blain, was condemned to the punishment du carcan, and to be perpetually banished from Montreal. The mischievous character of this red woman was fully equalled by a negro slave of Madame de Francheville, who, in 1734, caused a great conflagration which destroyed part of Montreal. This negress was born in Portugal, and purchased by her mistress in New England. She was subjected to severe examination ("a la question ordinaire et extraordinaire"), when, it is stated, she confessed her guilt. (15) These cases are mentioned together, as they seem to be the only instances on the published records of such slaves being punished through the courts of Quebec; nor do panis appear on the Civil Court records, though their darker companions' names are often to be found there.

The carcan was an iron collar, placed around the neck, and connected by a chain to a post or to a wall, so compelling the prisoner to stand for a stated time, often for long, weary hours, in a strained position, and subject to ridicule. It was similar to the English stocks.

"La question extraordinaire" was the French name for the rack. These modes of punishment were not abolished in France until 1832.

We will now look at the records of the Montreal General Hospital, and we find, in a table prepared by the Abbe Tanguay, of families possessing slaves of the nation of the Panis that seventy-nine such slaves died in that hospital between 1754 and 1799. The birth, age and time of death of each are here given, and we have a record full of interesting facts and suggestions. Each poor slave has his or her Christian name, and the names were evidently given when the rite of baptism was performed. Mons. De la Verandrie had two, Joseph and Marie. Saint Luc la Corne had his Panis, Marie Joseph, who died in 1799, aged 100 years.

Among the masters were some gentlemen of aboriginal stock, or connected with Indian missions: M. Perthuis, interpreter of the Iroquois; De Quiensek, chief, and De la Garde, missionary to the Algonquins. (16)

Seigniorial, or well-known, families are represented in the masters, Deschambault, De Bleury, Chevalier de la Corne, De Veaudreuil, Benoît, Desriviers, Perigny, Reame, Decharme, Dames Deslignery and Monier, Messrs. De la Ronde, Delisle, De Longueil, La Coste, Leschelle, Senneville, De Barne and Clignanceur.

There is nothing in the record relating to the origin of these Panis except in regard to the last two, when we find that M. Gamelin had Jacque Cesar and M. Longueil had Marie both put down as Panis noirs, or black Indians of the plains, who were of darker hue than those in wooded lands. This being a distinctive term, places them as derived from the Pawnee nation proper, as designated by Charlevoix.

The Montreal newspapers of 100 years ago had occasional advertisements as to runaway slaves, and these were adorned with wood cuts representing the lost chattel. When a negro was wanted, he was shown running with naked body, save a cloth around the waist. The Panis was represented standing erect, with a feather head-

(15) Abbe Ferland's History of Canada, Cap. 29.

(16) Holding captives as slaves was, as is well known, common with the Indians. The Cherokees and Choctaws also had many negroes in bondage. There are some instances in Canada of red men holding blacks. The most notable of these was Colonel Brant Thayendinagea, who had several, among them being his body-servants, Paton and Ganseville, referred to in the writings of travellers such as Colonel Landmann and the Duke de Liancourt.

dress standing upright and a feather waist-covering, the body tattoo-marked. This comical figure, whether by accident or design, coincides with Mr. Grinnell's description of Pawnee Picts, or tattooed Pawnees. Rollin Michael Barrin, Count de la Gallissoniere, above mentioned, was Governor of New France, and a gentleman of scholarly taste and refinement. He is one of the leading characters in Mr. Kirby's excellent story, "The Golden Dog," the opening scene being laid in Quebec in 1748. Among the masters of Panis is the name of De Veaudreuil, who succeeded as Governor, and of the Chevalier la Corne St. Luc, a gallant soldier, who remained after the capitulation, and became a loyal defender of British rule. Other names, such as Benoit De Longueil and La Coste, are familiar to all readers of Canadian history.

Some months ago a worthy member of the Canadian Institute, with a handful of ashes from an ancient kitchen-midden, by means of a microscope brought up the Huron inhabitants and their surroundings as they were when Champlain unfolded the fleur-de-lis on the Georgian Bay. Our attempt is now, with these disjointed historic fragments from the ashes of the dome, to produce for development some features of these humble persons, the domestic slaves, and of their surroundings in those grand old times, when slavery was a thing of course and the seigniorial tenure most flourished in the old regime. The Pani no doubt spoke in a patois of French and Illinoisian. His dress was a rude commingling of the styles of Quebec and the wild South. He had no taste for work at the tail of the plough, but supplied venison and fish, made bows and lacrosse sticks for the boys, and joined them in games and hunting. The squaws waited on table, were the ladies' maids, the children's ayahs, and fashioned moose-skin moccasins, adorned with bright-tinted quills of the bristling porcupine. Removed from his native wilds, the Pani doubtless followed, to some extent, the religion of his masters, with its rites and ceremonies. But when he gazed on the rising sun, away from the presence of the Black-robe, we may imagine him imploring the protection of the dread Opirikut, god of his fathers; and when, in the winter evenings, the aurora flashed across the vault above, he saw the spirits of his friends in flight from the far south land, and then his heart filled with longings for the banks of the Niobrara, where the ancestral tents were set and the buffalo shook the plains.

With such suggestions, names and facts as have been placed before us, it only needs the wand of imagination to raise the curtain of six-score years and show the home of the seigneur among his habitant friends and neighbours beside the St. Lawrence, the St. Francis or the Chaudiere. And when there comes that happiest hour of the day, when the work is done and the night as yet is young, they gather into the great room, beech logs blaze and cast their light on bronzed features as they enter, capotes are thrown back, waist-sashes loosened, and the snow is shaken from homespun coats and deerskin leggings. Pleasant greetings and kind enquiries pass around, and the news of the day is exchanged. The cure, the seigneur and the notary sit where all can see and hear. In and out flits on moccasined feet a dusky figure almost unnoticed, yet not unwelcome. He quiets barking dogs, brings a coal to light a pipe, or stirs the logs to a fresh blaze. He is the Indian slave, the pani.

III. The edict of Louis XIV. in 1688, authorizing the importation of slaves from Africa, referred only to negroes.

Some doubt seems to have existed as to the legal status of panis, and, to remove these, Jacques Raudot, Ninth Intendant, issued an ordinance at Quebec on April 13th, 1709, referring to negroes and the Indian people called Panis, and declaring, "We, therefore, under the good pleasure of His Majesty, order that all the panis and negroes who have been bought, and who shall be purchased hereafter, shall belong in full proprietorship to those who have purchased them as their slaves." Then followed an injunction, prohibiting the slaves from running away, and provisions for imposing on those who aided them in so doing a fine of 50 livres

Hocquart, Intendant under the Marquis de Beauharnois, Governor-General,

in 1756 issued an ordinance, declaring null all enfranchisements not made in compliance with certain regulations, and registered.

A declaration of the Paris Royal Council of 23rd July, 1745, declared that slaves who follow the enemy to the colonies of France, and their effects, should belong to His Most Christian Majesty.

This was a precedent of General Butler's famous order, made more than a century later, confiscating slaves coming into the Union ranks as "contrabands."

The Parliament of Great Britain was, when Canada was secured to the Empire, very favourable to the importation of slaves into the plantations, and had passed many Acts to aid that object.

Proceedings in the Montreal courts towards the end of last century tended to weaken the master's claims, and ultimately entirely broke them, with more regard to the rising public sentiment in England and France against slavery than to the actual state of the law, as has been shown in our previous paper. (17)

A census taken in 1784 states the number of slaves in Lower Canada at 304, of whom 212 were in the District of Montreal, 88 in that of Quebec, and 4 in Three Rivers. No distinction is there made between negroes and panis. An attempt was made in the first Parliament of Lower Canada, in 1793, to obtain an Act similar to that passed in the Upper Canada House at Niagara, which would have declared all slaves then held, to be in bondage for life, and only given freedom gradually to their offspring; but this proposal, though warmly debated, was not successful. In 1799, and again in 1800, Mr. Papineau presented petitions from many inhabitants of Montreal referring to the ordinances of Intendants Raudot and Hocquart, also to the Quebec Act, maintaining the former laws and usages to the people of Canada, and also to an Act of George III., under cover of which the petitioners allege a number of slaves, panis and negroes, were imported (18). Bills brought in on these petitions were much discussed, but sentiment was against their object; the declaration of the rights of slave-holders, and they failed to pass into law—thus slavery disappeared from Lower Canada. (19) It practically ceased at this time in Nova Scotia also and New Brunswick. The Upper Province had no such judicial and legislative experience as Lower Canada in regard to domestic slavery. When separated from the Mother Province in 1791, civil rights, including the law and customs as to slaves, still held in force. The Upper Canada Act of 1793 passed without difficulty, and there was no enactment here between that and the Imperial Act, which freed the few remaining slaves in 1834. While slavery existed, its character was modified, and personal cruelty guarded against by the code noir and provincial ordinances. As for the Indian slaves, there was also sympathy through the fact that not a few of the inhabitants were connected with the tribes by marriage. Mr. Parkman says with much truth: "Spanish civilization crushed the Indian, English civilization neglected him, French civilization embraced and cherished him. (20)

IV. There are few instances of panis in Western Canada. That of Mr. Langlade, who saved the life of Henry, the trader, at Mackinac, has been referred to. By the second article of a treaty of peace and amity, made by Sir W. Johnson with the Hurons 18th July, 1764 (21), it is provided that "any English who may be prisoners or deserters, any negroes, panis, or other slaves amongst the Hurons, who are British property, shall be delivered up within one month to the commandment of the Detroit." It may be concluded that there were a considerable number of panis in this western region then.

(17) "De Lesclavage in Canada," by Sir L. H. Lafontaine, Proceedings of Societe Historique de Montreal, 1858, and "Slavery in Canada," by J. C. Hamilton. Transactions of Canadian Institute, 1890. Vol. I., p. 102.

(18) 14 Geo. III., cap. 83; 30 Geo. III., cap. 27.

(19) Journal of 1799, p. 123, and of 1800, p. 51.

(20) "The Jesuits in North America," p. 44.

(21) Mr. S. White has the original treaty, but for copy see N.Y. Colonial Documents Vol. VII., p. 650.

In The Niagara Herald of 25th August, 1802, Charles Field forbids all persons harbouring his Indian slave, "Sall." Old residents of Essex County remember a pani who lived at Amherstburg fifty years ago.

Mr. Solomon White, lately member of the Legislative Assembly for Essex, is one of those who speak of him. When a child Mr. White saw "a little yellow man" at church, and he asked his mother who he was. "That is Mr. Caldwell's pani, Alexander," she answered. Though set free in 1834, he continued generally to reside at the old homestead, near the banks of the beautiful Detroit river. Here he was content to stay, passing an humble, happy existence.

There were many coloured people formerly slaves in the neighbourhood, and not far away was a settlement of the Hurons, but he preferred to look on the face and follow the footsteps of his old master, the late Mr. John Caldwell, enjoying the same civilization and religion. He died when on a visit to Detroit. His faith was that of his white protector, and his hope was, not to go to any happy hunting ground of his savage ancestors, but to participate in the white man's future. With him passed from Canada the last of the panis.

(22) As to Indian slavery in the south-west, see Mr. Lucien Carr's "Mounds of the Mississippi Valley," Smithsonian Report, 1891, p. 532, quoting "Narrative of Father Marquette," p. 32, and "Memoir of the Sieur de Tonti," pp. 56-71. "The Saukie warriors generally employ every summer in making excursions into the territories of the Illinois and Pawnees, from whence they return with a great number of slaves." As to sun-worship among these Indians, Mr. Carr states, p. 519, "According to Charlevoix the Indians claimed to have received the calumet from the Panis, to whom it had been given by the sun. . . . In trade, when an exchange has been agreed on, a calumet is smoked in order to bind the bargain, and this makes it in some manner sacred. . . . The Indians, in making those smoke the calumet with whom they wish to trade or treat, intend to call upon the sun as a witness, and in some fashion as a guarantee of their treaties, for they never fail to blow the smoke towards that star." The Sieur de Tonti describes temples dedicated to sun-worship, met in the course of his trip with La Salle down the Mississippi, A.D. 1682, one such temple was like the cabin of the chief, except that on top of it there were the figures of three eagles which looked toward the rising sun. It was forty feet square, and the walls ten feet high and one foot thick, were made of earth and straw mixed. The roof was dome-shaped, about fifteen feet high. Around this temple were strong mud walls, in which were fixed spikes, and on these were placed the heads of their enemies whom they sacrificed to the sun. These temples were found from Arkansas to the southern extremity of Florida, and in point of time they cover the 180 years between the expedition of De Soto and the visit of Charlevoix in A.D. 1721. When the Illinois came to meet Marquette on his voyage, the first ever made by a white man on the Lower Mississippi, they marched slowly, lifting their pipes to the sun, as if offering them to him to smoke.

(23) In P. Campbell's "Travels in North America in Years 1791-92," at p. 236, an account is given of adventures among the Ottawas. Campbell killed two Indians who had attacked him in his tent at night. He was soon after this made a prisoner, and said to his captors that he supposed they would avenge on him the death of the two Indians. He was answered that they cared little for what he had done, "that the men killed were not Ibawas but Pannees (sic), i. e., prisoner-slaves taken from other nations."

A PROBABLE SOLUTION OF THE SECONDARY UNDULATIONS FOUND UPON
 SELF-RECORDING TIDE GAUGES. BY NAPIER DENISON, ESQ., TORONTO
 OBSERVATORY.

(Read January 16, 1897.)

As this is the year set apart throughout the scientific world for special cloud observation and the study of the upper atmosphere as a means of improving the present methods of weather forecasting, and being one of those engaged upon this work for Canada, it seems an opportune time to bring the following investigations before the public :

In June last the writer's attention was first drawn to small, rapid changes of water level on Lake Huron, at the mouth of the river at Kincardine, where a rise and fall appearing to be regular, a set of observations with a temporary float were taken, and a uniform rise and fall of about three inches was found to occur, averaging nine minutes, that is about eighteen minutes for each undulation, the float moved up stream at the rate of a mile and one-half an hour. Upon returning to Toronto in July, by permission from Mr. Stupart, Director of the Meteorological Service, a simple instrument was devised to automatically record such oscillations, and set up at the mouth of the Humber River, where, ever since, most interesting results have been obtained. (1) By comparing these with the sensitive photographic barograph traces of the Observatory, it was found when a rise and fall of about four inches in water level occurred a corresponding, but slight change, in atmospheric pressure is noticeable; also a marked twenty-minute interval between these waves. To fully investigate this phenomenon another instrument, similar to that at the Humber, was placed at the Burlington Canal, and records from both instruments plotted, in conjunction with the barograph traces and different types of weather, as taken from the bi-daily weather charts.

It has been found, ever since the introduction of self-recording tide gauges throughout the world, peculiar oscillations within the normal tidal curves have been noted and commented upon, but to my knowledge, the cause not fully accounted for. These oscillations are most marked at tidal stations situated near the ends of bays, owing to the favourable configuration of the shore, and the shallowness of the water. They are not, however, of constant occurrence, but vary in intensity upon different days. Some months ago my attention was drawn to this peculiar phenomenon by a paper read before the Royal Society of Canada in May, 1895, by W. Bell Dawson, Ma.E., C.E., in charge Canadian Tidal Service, (2) who graphically demonstrated the existence of these secondary undulations, but left their cause unexplained. Thinking the above lake researches might help to solve the cause of these secondary tidal curves, through the kindness of Mr. Dawson, copies of the tidal records for Halifax, N.S., and St. John, N.B., were obtained for a number of days, including different types of weather. To fully investigate all the phenonema pertaining to these curves, days in succession were taken, chiefly those preceding and during stormy weather, for instance, the 5th, 6th, and 7th of February, 1896. These curves were plotted upon one-tenth inch squared paper, allowing one inch to the foot for Halifax, which has a range of about six feet, and one inch to five feet for St. John, which has a range of about twenty-eight feet, (3) and allowing one-tenth for every five minutes, being careful to minutely measure the extent and duration of every oscillation; above this was plotted the readings of the Halifax barometer, taken every three hours, also the hourly direction and velocity of the wind.

(1) A full account of these lake researches to be published shortly.

(2) Note on secondary undulations recorded by self-registering tide gauges. Vol. I., Sec. III.

(3) The St. John tidal curve is not included in above table, as only the most pronounced undulations are noticeable due to the reduced scale necessary where such high tides occur.

The following table gives a brief summary of results:—

Date.	Time.	HALIFAX, N.S.						Location of Storm Centre with Barometer Reading	Distance of Storm Centre from Halifax in miles.	Distance travelled during last 12 hours in miles.	REMARKS.
		Condition of Tidal Curve.	Atmospheric Pressure—Inches.	Weather	Wind		Precipitation.				
					Vel.	Dir.					
1896. Feb'y 5th.	8 a.m.	Unbroken.	30.12	Cloudy	3	E.	0	over New Orleans (29.46)	1750	—	
" "	8 p.m.	Decidedly undulatory.	30.18	Cloudy	3	S.	0	over Montgomery, Ala. (29.30)	1475	275	From noon to 11 p.m. decided undulations throughout, but not exceeding .2'
" 6th.	8 a.m.	Most pronounced oscillations, often exceeding .4'.	30.23	Fair	0	0	0	over Lynchburg, Va. (29.00)	1000	475	Barometer rising until 6 a.m. 6th, wind calm from 1 to 6 a.m., gradient for easterly gale extending to Boston.
" "	8 p.m.	Ditto.	29.90	Lt. Rain	26	S.	R.	over New York City (28.70)	580	420	Barometer falling rapidly, gale extending to Halifax. Grand Manan, in the Bay of Fundy, reports 60 miles per hour.
" 7th.	8 a.m.	Amplitude of oscillations about .6'	29.08	Foggy	10	SW.	1.22	North of Portland, Me. (28.90)	300	280	Maximum oscillations from 1 to 6 a.m., ranging from .8' to 1' with an average interval of 20 minutes; also time of max. vel., 41 miles from S. and S.E.
" "	8 p.m.	Oscillations diminishing.	29.02	Cloudy	20	NW.	.10	Magdalen Islands (28.90)	330	400	Curve almost unbroken by midnight, a moderate gale still blowing from the N.W.; at time of forenoon high tide the curve was 1½ feet above normal.

From the tabulated data and the other tidal curves, studied in connection with the bi-daily weather charts, which bear out the increase of oscillations preceding the approach of atmospheric depressions, it appears that these secondary undulations are due to atmospheric waves or billows set up in the upper atmosphere.

We are told by the late Professor Von Helmholtz, (4) who has made a special study of these waves from theory and analogy with ocean waves, and has calculated their possible forms and dimensions, that "As soon as a lighter fluid lies above a denser one, with well-defined boundary, then, evidently, the conditions exist at this boundary for the origin and regular propagation of waves, such as we are familiar with on the surface of water. This case of waves, as ordinarily observed on the boundary surfaces between water and air, is only to be distinguished from the system of waves that may exist between different strata of air, in that in the former the difference of density of the two fluids is much greater than in the latter case. Since the moderate winds that occur on the surface of the earth often cause water-waves of a metre in length, therefore, the same winds, acting upon strata of air, say 10 degrees difference in temperature, maintain waves of from two to five kilometres in length. Larger ocean waves, from five to ten metres long, would correspond to atmospheric waves of from fifteen to thirty kilometres, such as would cover the whole sky of the observer."

Mr. Clayton, of the Blue Hill (Observatory (5) has graphically shown the coincidence and easterly progression of the larger atmospheric waves by means of the daily synchronous barograph traces from stations south and east of his, plotted upon the same time sheet, and has also shown that the maximum number of waves occur during a northeast wind, and the minimum when the wind is from the southwest, and that the greatest number were recorded during the winter months.

After referring to the above valuable investigations by two such well-known scientists, let us return to the foregoing table and frame a few leading questions, with the answers which appear to me most satisfactory. Further discussion will doubtless throw more light upon this subject.

1. Why do the secondary undulations become decidedly marked from noon of the 5th, although the barometer is steadily rising, and the wind at the earth's surface light or calm?

Because the upper part of the lower stratum of air, not being retarded by friction due to contact with the earth, and of greater specific gravity than that to the south and west of it, begins to move towards the region of lighter air, viz.: in a southwesterly direction, the barometric gradient being small, the movement is slow, but being in an opposite direction to the upper stratum, which is less dense, and rapidly moving polewards (mean winter rate, 112 miles per hour), (6) but inclined to the east. According to Helmholtz, this should be sufficient to produce along the boundary surfaces of the two strata, waves which may extend to the earth.

2. From 8:00 p.m., after the storm centre had passed to the north of Halifax, and a moderate gale still blowing from the northwest, why do the rapid undulations decrease until they almost form an unbroken curve by midnight?

The wind being westerly, a decided decrease of the undulations should be expected, on account of the lower stratum of the air, now moving approximately in the same direction as the upper layer, and as the force at the surface of the earth is still that of a moderate gale, greater velocities may be looked for at higher levels, where friction (viscosity not included), caused by contact with the earth, is inappreciable, thereby tending to equalize the easterly rate of movement of both strata; also well-defined boundary surfaces are not so likely to exist, owing to the more uniform temperature throughout both strata.

(4) Paper read before the Prussian Academy of Sciences at Berlin, on July 25th, 1889, and translated in the Smithsonian Reports by Professor Abbe.

(5) Blue Hill, Mass. Meteorological Observations. Vol. XL., Part III., Appendix E., 1893.

(6) From Blue Hill cloud observations.

3. Why do the greatest number of atmospheric waves occur during northeasterly winds, and the least number with southwesterly winds ?

A stratum of lower air, set in motion from the northeast towards the southwest, would be moving in an opposite direction to the upper or poleward stratum, therefore, the greater the velocity of the lower layer towards the westward, caused by the differences of atmospheric pressure, over the earth's surface, the greater will be the opposing forces at the boundary surfaces of the two strata, where great atmospheric billows may be found, especially when the densities vary greatly, caused by large differences of temperature between the two strata. The result would be similar to a high wind blowing against a strong surface current of water.

The minimum number of waves recorded during southwesterly winds is due to the lower stratum of air moving in the same direction as the upper, or poleward stratum.

4. Why do the greatest number occur during the winter months ?

The winter being the time of the greatest differences of temperature between the equator and the poles, and consequently a more rapid movement of the poleward current, slight changes of velocity of the lower atmosphere tend to set up waves along their boundary surfaces, where, in all probability, greater differences of temperature exist than in summer. As in the case of an important storm centre moving northeasterly from the Gulf of Mexico, bearing large quantities of heat and moisture, while pronounced anti-cyclonic conditions, attended by great cold, prevail in the northern portions of the continent.

5. How can these atmospheric waves, which correspond to only a few hundredths or thousandths of the barometric inch at the earth's surface, cause such rapid and extreme oscillations as appear upon the tidal records ?

The peculiar configuration of the coast line and varying depths of water, being the main causes of the different heights of the tides at separate stations, may we not apply the same to account for these peculiar oscillations, by asserting that the atmospheric waves or billows, in passing over the surface of the sea (in this case in the vicinity of Halifax harbour), tend to form minute undulations upon the surface, corresponding to the length of these billows, which, as they move farther into the bay, become magnified as they reach narrower and shallower portions, until finally they assume the proportions as found upon the tide gauge, a distance of about nine miles from the entrance to the harbour. That these oscillations do become more pronounced the farther one enters a long bay, have been noted by those in connection with tidal work. (7)

In conclusion, if the above explanations are correct, would it not be of great scientific and commercial value, in place of eliminating these secondary undulations, when tabulating the primary ones, to increase the amplitude of these secondaries, by lengthening the cylinder, use one sheet per day to prevent confusion of traces, and make a special study of them, respecting their intensity and time interval, in conjunction with synoptic charts during different types of weather ? It appears as if these gauges are extra sensitive barometers, locally forewarning the approach of important storm centres many hours previous, in fact, during a rising or stationary barometer and before the shift of wind.

Improved tidal gauges of such construction are likely to be of incalculable value at all coast stations, more particularly by those on a western seaboard, such as that of the British Isles.

(7) Among others by Major Baird, R.E., F.R.S., Manual for Tidal Observations, 1886.

NOTE ON THE PUBLICATIONS OF THE CANADIAN INSTITUTE.

In 1852 The Canadian Institute began publishing its Proceedings under the name of "The Canadian Journal" in quarto. In this form it issued forty-one numbers, making three volumes.

In 1856, with the same name, the form was changed to octavo, in which size, up to 1878, ninety-two numbers were issued, making fifteen volumes.

In 1879 the name was changed to "Proceedings of the Canadian Institute," under which title twenty numbers were issued, in seven volumes.

In 1890 the publication was enlarged and the name again changed to "Transactions of the Canadian Institute." In this form, up to the present, nine numbers have been issued, making four volumes and part of a fifth. It is now proposed to issue two sets of publications, the "Proceedings" to contain short papers and abstracts of longer papers, to appear more frequently than hitherto, and as soon after the reading of the papers as possible. The "Transactions" to be issued at longer intervals and to contain such extended papers as it may be deemed proper to publish in full.

SOME LAPSED NAMES IN CANADIAN LOCAL NOMENCLATURE. BY REV.
HENRY SCADDING, D.D.

(Read November 23, 1896.)

It is a matter of some curiosity to notice the vicissitudes which have taken place, in several instances, in the names of places, rivers, and other natural objects, during our short history here in Canada. In some cases, names imposed by royal proclamation, or other competent authority, have failed to be used, or have been displaced by terms and titles, resting solely on popular usage. It may be considered a matter of some interest to recall some of these now disused, or, as we may say, lapsed names, and to review very briefly their history.

The name of our own capital, Toronto, itself covers a lapsed name, so to speak. When first laid out as a town, Toronto, as we all know, bore the name of York, and was so known for a period of forty years. It was then, viz., in 1834, incorporated as the City of Toronto, which, singularly enough, was a return to a name which had lapsed, the locality having been for a considerable time previous to 1794, known by the appellation Toronto, of Indian origin. This, again, was a name, which there is good evidence to show, had fallen into disuse elsewhere, and had been adopted here. In the time of La Salle, 1680, the lake which we know as Lake Simcoe was known as Lake Toronto, while the site of our city was marked as Ti-ai-a-gon on the maps, a name which La Salle also employs. This word Ti-ai-a-gon, I am assured, signifies a landing, and it here denoted the landing place for voyageurs, bound for Lakes Toronto and Huron, via a trail or portage well known.

When the Wyandotte population, inhabiting between Lakes Toronto and Huron, was extirpated by the Iroquois, the name Toronto came to be gradually attached solely to its Ti-ai-a-gon, or landing place on Lake Ontario, where it survived. And here, again, we have a glimpse of another lapsed name.

The trading post at the landing had been officially named "Fort Rouillé," in honor of the then Minister of Marine of that name in Paris, but the popular use having become familiar with the word Toronto as applied to the landing, failed to adopt the expression, Fort Rouillé, and employed only that of "Fort Toronto" instead. Hence the survival of the beautiful word Toronto, hereabouts, to this day.

It may here be conveniently added that the neighboring Humber River is given in the first Gazetteer of Upper Canada, dated about one hundred years back, as "St. John's River," from a French settler named St. Jean, who had a wayside inn, or place of entertainment, at its mouth. "Humber" displaced a long and rather

uncouth Indian name, which appears on the maps ; at the same time "Don" replaced an equally unmanageable Indian name, describing the river at the eastern end of our harbour. The interpretation of these two lapsed Indian names I am not able at present to give, but doubtless they were both significant. At the same time that the names "Humber" and "Don" were imposed upon these two streams, the name "Nen" was, by authority, given to the next river to the eastward, previously known as the Rouge or Red River. "Nen," however, became a lapsed name, and the Rouge retained, and still retains, its original appellation. "Nen," like "Humber" and "Don," was the name of a river in Yorkshire. It was the evident aim of the authorities to Anglicise the river names, and the notable river, still known as the Grand River, entering Lake Erie from the north, was enjoined to be known only as the "Ouse," another Yorkshire river name ; but again popular usage prevailed, and "Ouse" became another instance of a lapsed name. "Grand River," of course, had nothing distinctive in it, and every river of a considerable size was, amongst the French, a "Grande Riviere." The Mississippi was so par excellence among the Indians, such being, in an emphasized way, the signification of that word.

A widely-received French appellation for our Canadian Thames was La Tranche, until forcibly over-ridden by royal proclamation.

More than one lapsed usage in regard to the River Niagara may be in place here. Wherever the name occurs in early English verse, the metre obliges us to make the penultimate syllable long in quantity, showing that such was the prevailing pronunciation at the outset. Further, it appears from the early records, that an O has been dropped off from the beginning of this word, as has happened likewise in the case of other Indian appellatives ; thus we have Miami and Omiami, Swegatchie and Oswegatchie, Chouegon and Ochouegoñ (the modern Oswego), Mimico and Omimico, Chippeway and Ochipway, Tessalon and Otessalon, and some others. So Niagara was once Oniagara, a form of the word now entirely lapsed. There is reason to think that a like clipping off of an O has taken place in "Toronto," together with the suppression of a final N. Sagard, in his *Huron*, or rather *Wyandotte* vocabulary, gives both "Toronton" and "Otoronton." The expression signifies a large quantity, whether of human beings or of provision for their sustenance, both O and N probably representing a nasal sound very familiar to us in former days, in Indian viva-voce utterances. Another substitution in modern times of a short A for a long one in an Indian name, seems to be shown in Moore's "Uttawa's Tide" (read Uttah-wa's tide) meaning the River Ottawa, the first syllable of which name he evidently caught as U and not O.

We are slowly becoming accustomed to the style and title of "Niagara-on-the-Lake," used in modern times for the purpose of distinguishing the old town of Niagara from what is now designated as Niagara South, meaning thereby Drummondville, which is expected hereafter to become a lapsed term, although, of course, it will take a long time to bring that about. Old Niagara might have fallen back upon a lapsed name of its own, viz.: Newark, the name borne by its site when the first Parliament of Upper Canada was held there. The place we now call Queenston was known aforetime as the "Carrying Place," the place of debarkation for the "Grande Portage" round the Falls of Niagara, in the voyageurs' route between Lakes Ontario and Erie. Another lapsed name for Queenston, in the same regard, was the "Lower Landing."

Burlington Bay, at the head of Lake Ontario, received that name by proclamation on July 16th, 1799. Previous to this date it had strangely borne the name of Geneva Lake ; so we are informed by the first Gazetteer of Upper Canada. The lapsed name, we may suppose, arose from the picturesque beauty of the sheet of water indicated.

On the north shore of Lake Ontario, close to Burlington Bay, a name has lapsed into disuse within the past few years. I refer to Wellington Square, now known as Burlington. The word "Square," I believe, referred originally to a square

tract of land granted to the Indian chief, Joseph Brant, at this spot. Wellington, of course, referred to the Iron-Duke, but we already had a memorial of him in the name of the County of Wellington, in Western Ontario. A general name for Burlington Heights, and the whole range of high land on the west side of Lake Ontario, appears to have been "Dorchester Mount," when D. W. Smith's Gazetteer was constructed, but that expression has now long since ceased to be heard. A familiar name for the swamp now traversed by the Des Jardins Canal, leading from Burlington Bay to Dundas, was "Coote's Paradise," an expression now fallen into disuse. Coote was an officer in the regular army, an enthusiastic sportsman, who found in the wild fowl and other game frequenting this marsh a never-failing means of indulging his favorite pursuits.

Two grand thoroughfares were marked off and partially cleared out, at the very outset, through the Province of Upper Canada, one named Dundas street, and the other Yonge street. The latter continues as a well-defined highway, leading from Toronto to the Holland Landing, and thence virtually across the country, via Shanty Bay and Penetanguishene, to Lake Huron and the far West.

I fear the railway authorities are doing something to render Penetanguishene a lapsed name, or at all events, partially so. They are encouraging the practice of writing and printing "Penetang," instead of Penetanguishene." The name, thus mutilated, can have no complete sense, the whole word being descriptive of a landmark at the entrance to the Bay, consisting of a bank where the sands run down. (1)

Dundas street as a grand thoroughfare has, unhappily, not retained its name throughout. For a long time the whole route, from Chatham to Dundas, and thence to Toronto, was pretty generally known as Dundas street. The popular name for a portion of it, among settlers in the west was, for a while, and, perhaps may continue still to be, the Governor's Road, and it will be remembered, possibly, by many of us, that what is now called Queen street in Toronto, was, in its western portion at least, styled Dundas street, although "Lot street" was its more customary designation, as it passed on eastward to the River Don, from which point the leading thoroughfare became better known as the Kingston Road; but in well-engraved early maps the line of road eastward is to be seen marked as Dundas street, all the way to where it strikes the Ottawa, a few miles from the entrance of that river into the St. Lawrence.

The whole route from Chatham, in the west, to the Ottawa, in the east, was designated a street, with allusion to the great Roman roads (*viae stratae*), remains of which are traced everywhere in the Island of Great Britain and throughout the Continent of Europe—paved roads securing an easy transit for armies, arms and ammunition, and at later periods for merchandise. A noted instance of these is Watling street, reaching from Dover all the way to Chester, and passing through London, where a fragment of this same Roman highway is still known as Watling street. It is to be regretted, perhaps, that our "Dundas street" has become a lapsed term in so much of its route, but, happily, Yonge street still remains to us an interesting reminder of the past. On this street, six miles to the north of Toronto, "Hogg's Hollow" has been changed to the more euphonious expression, "York Mills." Of these mills, Mr. Hogg was the original builder and proprietor. Along the great thoroughfare, originally known as Dundas street, proceeding eastward from Toronto, we meet every now and then with lapsed names.

In connection with Toronto itself, two may be mentioned, in addition to those already given. The township in which the city stands was, and is still named York, but previously, strange to say, it seems to have borne the name of Dublin. Thus, in our old, oft-quoted Gazetteer, we have, at page 55, "Dublin, now called the Township of York: which see." No further explanation is given. It was expected, per-

(1) Other lapsed names besides "Lake Toronto" are covered by Lake Simcoe's present name. The French styled it for many years *Lac aux Claires* (Hurdle Lake), from some arrangement for the capture of fish at the Narrows, a name sometimes corrupted by the English into *Lac le Clie*. Two islands in this lake have likewise lost names once borne by them: Francis Island (so called by Governor Simcoe from the name of his son), and Darline's Island (commemorative of a favorite aide-de-camp of the Governor's), are now respectively known as Grape Island and Strawberry Island.

haps, to be attractive to the Irish settler, but it quickly became a disused term. Previous to the setting off of Upper Canada as a Province, the region about here had been known as the District of Nassau, and various localities to the eastward had designations sounding very German-like given them, such as Charlottenburg, Lunenburg, Osnabruck, etc. Such names were simply compliments to the reigning Hanoverian family, or might be expected to attract German settlers; but if not actually become lapsed terms, they have ceased to draw. The other lapsed name in connection with Toronto is "Gibraltar Point," meaning the western portion of the Island in front of Toronto, and having a humorous allusion to the solitary Block House, erected there for the defense of the harbour and protection of a commissary storehouse. "Gibraltar Point" has lapsed into disuse, although we still occasionally hear Blockhouse Bay for one of the inlets at the "Point."

On the lake front of the Township of Whitby there was, for a time, the town of Windsor, on Windsor Bay, where it appears, thus named, on the engraved maps of Canada a few years since. Windsor is now a lapsed name, obliterated, possibly, by the greater importance of the western Windsor on the Detroit River. Its site is included within the limits of the modern town of Whitby. In passing, it may be mentioned that the site now occupied by Port Hope is marked on some of the old maps *Ti-ai-a-gon*, which, as we have already seen, simply meant "a landing," this having been a distinguished landing place for Indians and voyageurs en route to the waters to the north, entitled by us Rice Lake. (2)

The name "Cobourg" is not, as might have been supposed, a survival of one of those German-sounding names prevalent in Canada just after the taking of Quebec. Like Guelph, it appears to have been a modern compliment to the reigning Hanoverian family. It alluded, probably, to the husband of the lamented Princess Charlotte, Prince Leopold of Saxe-Cobourg. The place, we are told, was for a short time good-humoredly styled "Hard Scrabble," by settlers near the locality, but this was simply a transient jest.

At Kingston we have to recall the now lapsed names of Cataraqui and Fort Frontenac. An attempted Latinized form of "Kingston"—*Regiopolis*—was for a time heard of in ecclesiastical quarters, but, mongrel as it was, between Latin and Greek, it is now dropped. As to the name "Bay of Quintè"—the original word was an Indian one—*Kentè* or *Kanti*. French pronunciation produced the form *Quintè*, conveying some notion of "five or fifth." While passing Gananoque on our way east, it should be recalled that, strange as it may sound, the river which enters here and bore the name of Gananoque, was at a very early period styled the Thames. This we learn from a proclamation by Lord Dorchester, better known as Guy Carleton, bearing date July 24th, 1788, wherein he speaks of a boundary line running north and south, and intersecting the mouth of the River Gananoque, now called "The Thames." This seems to have become a lapsed name at the time when the Province of Upper Canada was set off and separated from the old Province of Quebec, when the previous arrangement of the region into four distinct sub-divisions was dropped, and the terms District of Lunenburg, District of Nassau, District of Mecklenburg, District of Hesse ceased to be heard. The town of Cornwall, just below the Long Sault Rapids, was formerly known as New Johnstown, from the name of a neighboring township. For the inhabitants of Cornwall the lapsed name, New Johnstown, must, of course, possess some interest.

In regard to the Long Sault Rapids, Guy Carleton, in the proclamation just above referred to, makes use of a good English word, now fallen somewhat into disuse. He speaks of "rifts," meaning thereby interruptions in the navigation of the

(2) The river at Port Hope still bears the homely name of "Smith's Creek." The Indian name of the stream, rightly treated, would have had a finer sound. Major Rogers, in his journey westward from Fort Frontenac to Toronto, in 1760, passed two rivers bearing respectively the names of "The Grace of Man" and "The Life of Man," according to the somewhat fanciful translation which he gives of their Indian appellations. It is not easy to identify these streams, but Smith's Creek may have been one of them. "Lyons' Creek," a little to the west of Smith's Creek, was once known by an Indian term signifying "the river of easy entrance."

river. He describes the mouth of the River Gananoque as being situated "above the rifts of the St. Lawrence." In early maps of Canada and North America generally, the term rifts is to be seen at the several points of a river, where now we should see the word "portage" used, indicating thereby that the navigation at that point was interrupted by cataracts or dangerous rapids. Apropos of rapids, it may be subjoined that a certain swift portion of the St. Lawrence, not far from Cornwall, used to be designated by an English-speaking lumberman, "The Mill Rush," thereby barbarizing the neat expression, "Les Mille Roches," used by the French when speaking of the same spot in the river. The same lumberman has made Bobcaygeon out of some such Indian term as *Baba-kad-juan*, descriptive of the lockage between Pigeon and Sturgeon Lakes.

We now approach Montreal and Quebec. The Indian term for the former place is stated to have been Hochelaga, and of the latter Stadacona. These two can scarcely be termed lapsed names, as they still maintain a good standing in the primitive and poetic accounts of Canada. The ecclesiastical title of Montreal, *Ville Marie*, like that of Regiopolis for Kingston, is now seldom employed by the English-speaking portions of the community. The name of a town, situated at the mouth of the River Richelieu, on the St. Lawrence, a short distance from Montreal, must be mentioned. This is Sorel, which is another instance of the prevalence of popular usage over authoritative decrees. The name imposed on the spot by the English-speaking authorities was William Henry, a compliment to a Prince of the Royal Family, but the earlier French name of Sorel has survived, as being doubtless the fittest.

I here bring to a close my list, after all, not by any means perfect, of lapsed local names in Canada. To enter upon the changes that have taken place in street names in our cities and towns would be an undertaking too large for the present occasion. I cannot refrain from remarking, however, a usage which I observe to be growing, in regard to the name of one great, conspicuous thoroughfare in Toronto. A few years since it was universally known as Spa-dee-na Avenue. Dr. W. W. Baldwin evolved out of some such Indian expression as *Eo-pa-dee-nong*, the quite elegant and shapely name of *S-p-a-d-i-n-a* (pronounced by himself and all his belongings, *Spa-dee-na*). It denotes, I am assured, a rise of land, and has reference to the slight ridge which bounds the site of Toronto on the north side. A considerable portion of this ridge was owned by Dr. W. W. Baldwin, and here was situated his family residence, Spadina House, exactly at the extreme northern terminus of the great avenue, bearing to this day the fine, modified Indian title just spoken of, the polite pronunciation of which seems to be threatened, although it is to be confessed that *Regina*, *Carolina*, etc., certainly favor the innovation. Below the shield of arms on Dr. Baldwin's book-plate is to be seen "Baldwin, of Spadina, in the County of York, Upper Canada."

One word in regard to the names of two outside cities, with which, in Canada, we are sometimes brought into very near relations—Buffalo and Chicago. In some respects it seems a pity that these names have not lapsed and been replaced by others of a more becoming form, and nobler significance. Buffalo took its name, no doubt, from the accidental circumstance that the stream, at the mouth of which its first buildings began to arise, was named Buffalo Creek, in French, *Riviere des Boeufs*, that is, the river of the Buffalos or Bisons. If the word Buffalo had to be retained in the composition of the place-name, it should have been furnished with some customary prefix or suffix, to denote the fact that it was a place-name. We have, in classical geography, the city or town of Elephantine. The termination denotes that it was the city or town of the *elephas* or elephant. The founders of the place would have had scruples as to calling it *Elephas* (Elephant) pure and simple. So, another rather famous classical name—*Bucephala*—really meant the city of *Bucephalus*, that is, the city rendered famous as being the burial place of Alexander's steed, *Bucephalus*. It would have doubtless been thought very anomalous to have

called the place *Bucephalus*, wholly unchanged. The name of the city of Buffalo might have been a modification of the native Indian term for the bison or buffalo, showing, by an affix or final syllable, that it was the name of a place, and not of an animal. In regard to Chicago, the name, it is sad to say, intrinsically has a significance somewhat ill-savored. It involves as its root element the Otchipway *Jikag*, which denotes a polecat or skunk, as Baraga informs us in page 572 of his *Otchipwe Dictionary*, Cincinnati, 1853. If Chicago should ever become a lapsed name, it is to be hoped that its place will be taken by one constructed on an entirely different basis. We hear of this city sometimes as the Windy City. Let now good Otchipwe be found for Windy City, and let that be transformed by a committee of experts into a euphonious place-name for the great capital of Illinois.

THE ORIGIN OF THE SALISHAN TRIBES OF BRITISH COLUMBIA AND WASHINGTON. BY JOHN CAMPBELL, LL.D.

(Read January 16, 1897.)

So little of the nature of history attaches to the aboriginal races of Canada as to make a survey of them a mere study of the baldest anthropology. Yet even mere anthropology is not biology; its object is man possessed of a soul and a soul's record. It is hardly probable that a race has passed through the four thousand odd years of post-diluvian history without taking some part in its historic events. The modern Chinese are supposed to be the descendants of the ancient Babylonians. The degraded Yeniseians and the ambitious Japanese are equally derived from those Hittite tribes that conquered Egypt and overthrew Assyrian Monarchy. In Mexico, the native Aztecs or Nahuatl are most of what remain of the Nahiri of Mesopotamia, who contended in ancient days with the Thothmes and the Tiglaths; while Homer's Dardanians, the expelled Toltecs from that same American state, are now to be found in the aborigines of Peru. The records of the League, which we term the league of the Iroquois, are engraved on the rocks of the Sinaitic Peninsula, some of them in characters as old as the patriarch Isaac. Old inscriptions and old books tell part of these stories, but most of them lie hidden in language, in proper and common names, in grammatical constructions, as well as in legends and traditions of the past. Just as old families fall into decay and poverty by the misbehavior of ancestors, so nations that once ruled the world become pariahs; *exempli gratia*, Amalek, the first of them all, whose name now lives in the Amalig-mut of the Eskimo. There are very ancient families with far more than sixteen quarterings among our most degraded tribes.

I have looked into the antecedents of the Salishans, not because I know anything of them personally, but because they live largely on Canadian soil, and because I know their grammar, and can thus reason back into their past history. If you would like to become acquainted with the books that treat of them, get the late James Constantine Pilling's "Bibliography of the Salishan Languages," published by the Bureau of Ethnology at Washington, and Major Powell's "Indian Linguistic Families," in the report of the same bureau for 1885-86. If language be your quest, consult the vocabularies of Gibbs, Tolmie, and Mengarini in the first volume of "Contributions to North American Ethnology," published by the United States Geographical and Geological Survey of the Rocky Mountain Region; and "Comparative Vocabularies of the Indian Tribes of British Columbia," by Drs. Tolmie and Dawson, given out by the Geological and Natural History Survey of Canada. According to Major Powell, the Salishans of the United States number 5,500, and those of Canada, that is, of British Columbia, 12,325. Of the latter, the larger number are connected with the Fraser River Agency, but the Kamloops Agency overlooks over 2,500, and others report to the Williams' Lake, Cowichan, Okanagan, and Kootenay Agencies. Major Powell gives the names of no fewer than sixty-four septa or tribes belonging to this family. The earliest record of them is that of Alexander Mackenzie, in his "Voyages from Montreal Through the Continent of North America," published in 1801. On page 257 he gives a brief vocabulary of the Atnah sept, and, on page 276, a shorter one of the Friendly Village Indians. The Salishans have erroneously been called Flatheads, a term that applies to their neighbours, the Tsinuks.

In attempting to affiliate the Salishans, I rely altogether on language. It has two parts—the grammar and the vocabulary. Father Mengarini's grammar I have not seen, but the "Niskwalli Dictionary" of Dr. George Gibbs exhibits the Salishan grammatical system sufficiently for comparative purposes. That system is preposing. It makes use of prepositions, not of postpositions. It also places the governing word before its genitive, the adjective before its noun, the temporal index before the verb. In these and in other particulars, Salishan grammar is not that of Northern Asia, as are Iroquoian, Dakotan, Muskogean, etc., nor that of Melanesia as the Haidah is, but that of the Malay-Polynesian area. Seventeen years ago I exhibited, in a paper read before the Institute, the relation of the Algonquian dialects to that same Malay-Polynesian family. It is not easy to draw a line between what is Malay and what is Polynesian, either in grammatical forms or in vocabulary, yet the Algonquian dialects may be called more Malay than Polynesian. This appears most prominently in the word for man, which in Malay is *oran* or *ulun*, whence the Ilianoans of Borneo have their name. But in America, the Delawares are the *lenni Lenape* or the Lenape men, the State of Illinois was so called after the Algonquian *Illeni*, and the Micmac calls himself *uhnoo*, a man. The Polynesian, on the other hand, terms himself *tangata* or *tamata*, and that seems to be the original of the Salishan *tamihu*, *tamekhw*, *tumikh*, *temokh*, *tobesh*, and *stobush*. If, therefore, a line is to be drawn between Malay and Polynesian, it may be inferred that the Salishans are more Polynesian than Malay.

In comparing the vocabularies, I have restricted myself, so far as the Salishan dialects are concerned, to the Niskwalli. This is not for lack of material, since I have vocabularies of over twenty other dialects, but for the sake of brevity and clearness. The Niskwalli is that of Dr. George Gibbs, and the Malay-Polynesian terms are taken from Crawford, Wallace, Belcher, Hale, and a variety of other sources too numerous to mention. The words compared are the commoner nouns and adjectives, a few verbs, the personal pronouns, the numerals, and some particles, altogether over 150 in number. The evolution of the Salishan term from the standard Malayan or Javanese is sometimes quite easy to follow, but in other cases my comparative vocabularies have failed to present all the links desired. Most of the distinctive Malay terms are conspicuous by their absence from the Niskwalli vocabulary, such as *kapala* head, *muka* face, *mata* eye, *talinga* ear, *idung* nose, *mulut* mouth, *lidah* tongue, *tangan*, *lima* hand, *langit* sky, *ayer* water, *api* fire. But there are many evident Malay analogies, as of the Niskwalli *kobatit* axe, to the Malay *kapak*; *toligwut* blood, to *darah*; *tus* cold, to *tijok*; *eluks* end, to *alos*; *ashuts* fear, to *coquet*; *silels* forehead, to *alis*; and *tsoks* seven, to *tujuh*. He would be a bold philologist who would identify the Niskwalli *skwallup* ashes, with the Malay *abu*; but *abu* becomes the Bali *habu*, the Sunda *labbu*, the Bouton *orapu*, and the Mysol *gelap*. A far more extraordinary metamorphosis is that of the Malay *kasih*, to give, into the Niskwalli *abshits*. It first becomes the Bali *sukahake*, then the Bisayan *maghatag*, next the Iloco *pannangted*, the Biajuk *manenga*, in another Bali dialect *bahang*, afterwards the Tagala *bigai*, the Tahitian *evaha*, the Hawaiian *hoatu*, and the Tobi *wacito*, which is not *abshits*, but is near enough to it for all practical purposes.

The Salishan dialects disguise their relationship with prefixes and affixes, the meaning of which is little known. Take, for instance, the words for moon and sun. The moon is *slok-walm*, in which the latter syllable is plainly the almost universal Malay-Polynesian *wulan*, *bulan*, *fulan*, *hulan*, the moon. The sun is *klok-watl*, and here again the second syllable is the Malay-Polynesian *mataari*, *matalo*, *watalo*, *batalo*, the sun. What *slok* and *klok* or *slo* and *klo* mean, the dictionary does not state. The peculiar progress from labial to sibilant and guttural through the aspirate effectually obscures the unity of roots. This is apparent in *chetla*, the

Niskwalli word for a stone. The Malay form is *batu*, the Timuri *fatuk*, the Javanese *watu*, the Fijian *vatu*, the Rotuma *hathu*, the Maori *kowatu*. But the *l* of *chella*, which otherwise might arise between *hathu* and *kowatu*, appears in the Biajuk *batro*, and, out of place, in the Malagasy *varlo*. A strange word is the Niskwalli *stoduk*, a slave. Its original was the Malay *budak*, which assumes in Javanese the form *abdi*, recalling the Semitic *ebed* and *abd*. The *b*, thus made non-initial, dropped out in the Bugis and Macassar *ata*, and in the Malagasy *andavo*, at first, probably, after the fashion of the Bouton *otuko*, a post runner. Some other law of the permutation of letters than that of Grimm must be found to enable the student to trace out Malay-Polynesian derivations in America. The term for nose in Malay, Javanese, Madura, and Lampung is *idung*, *irung*, *elong*, *egong*. This is paralled by the Cree of Moose Factory, the Plains, English River, and the East Main, whose relative word for man is *ililew*, *ininew*, *ithinew*, and *eyiyew*. The derivation of the Niskwalli *muksn*, the nose, from the Malay *idung* proceeds through the Lampung *egong*, the Bali *kunguh*, the Bugis *ingok*, the Bali ceremonial *hugas-un*, and the Samang *muk*, with the *san* of the preceding.

The Malay-Polynesian character of the Niskwalli numerals is incontestable, yet that denoting 5, namely *tsahats*, which means "the fingers," is utterly unrepresented by the various forms of *rima* and *lima*, which indicate the hand and five. It is probably derived with inversion of parts from the Tambora *roma-toha*, 5, answering to the Lariki *lima-hatu*, finger. Here *toha* and *hata* are governing words, and in true Malay-Polynesian, as opposed to Melanesian, order should stand first. The Tongan word corresponding to them is *cow*, and *cow-nima* denotes the fingers. Then the Tambora *toharoma* must by degrees have become *toharon* or *tohalon* and afterwards *tohalot*. In some vocabularies the Tambora word for five is given as *kutelin*, which is just an inverted form of the Lariki *lima-hatu*, with the *lima* fallen to *lin*. The Tidore *runtoha*, 5, exhibits the same phonetic decay, and restored to Malay structure, would be *toharun*. As *lima*, 5, becomes *lib* in one of the dialects of the Caroline Islands, *lin* might become *lit*, dental replacing dental in some other dialect. I confess, however, that I have not yet come across an instance of such conversion of *lima*, the numeral, within the limits of the Malay-Polynesian area. The nearest to it is the *lok* of the Lampung *chiu-lok*, the hand. To one conversant with Lower Canadian patois, who has heard *omelette* and *patate* pronounced as *omelaque* and *pataque*, the transition from *chiulok* to *ts-alats* will not appear strange.

The Salishan name is probably derived from that of the inhabitants of the Sooloo, or more correctly the Suluk, Archipelago, between Borneo and the Philippines, who are represented in the vocabulary by twenty-two words. The dialect under consideration, namely the Niskwalli, seems to be that of Mysol, which lies between Ceram and the north-western corner of New Guinea. It is represented by seventeen words, many of which closely resemble those of the Niskwalli. These might be largely increased. For instance, the Mysol name for man is *mot*, which in Salibabo becomes *tomata*. If, therefore, we find Niskwalli in Mysol, we may be justified in finding two other Salishan tribes, the Shwoyelpi and the Skoyelpi, in the people of the Salibabo Islands, between Gilolo and the Philippines. The *mot* of Mysol and the *tomata* of Salibabo furnish a beginning of the Polynesian word for man, as differentiated from the Malay, and that is the original of the Salishan term. The Mysol *motni*, belly, is probably the original of the Niskwalli *smukha*; *bit*, black, of *hitotsa*; *kachun*, boy, of *chachas*; *wai*, child, of *bibad*; *patoh*, cold, of *tus*; *yem*, dog, of *komai*; *gaf*, feather, of *stokw* (in Skoyelpi it is *stakapisten*, and in Salish proper, *skapussel*); *kanin*, hand, and *kaniuko*, finger, of *chalesh* and *shalatshu*, by *l* replacing *n*; *wamut*, flesh, of *beyets*; *kasebo*, finger-nails, of *kohwachi*; *gakawatu*, root, of *aspud*; *umblo*, soft, of *esmetlin*; *jiyu*, wife, of *chugwush*; *lu*, two, of *salew*; *fut*, four, of *bos*; and *tut*, seven, of *tsoko*. These 17 words are additional to the 17 of the comparative vocabulary, and thus

furnish evidence of the common origin of the Niskwalli, of the south-west corner of British Columbia, and of the natives of Mysol, in the Malay Archipelago.

The Salish are regarded by Latham and other writers as an inland people, although some of them, such as the Niskwalli, dwell on the sea coast and on islands. They are, however, to a certain extent, cultivators of the ground, as are the inhabitants of the Malay Archipelago. The latter use the word *jagung* to denote maize, but the absence of that English term in all my vocabularies of the Salishan, save the Niskwalli, forbids the tracing of *jagung* to this continent. The Niskwalli word for maize is *stulels*, and this is undoubtedly the Sapparua *halal*, the Liang *allar*, the Wahai *allan*, the Cajeli *halai*, and the Batumerah *allai*, which mean rice. In Polynesia the term is applied to the chief article of vegetable food, the *Colocasia esculenta*, called *taro* in Maori, *talo* in Tonga, and *telaa* in Rotuma. The Niskwalli *stulels* is an indication of a bread-making people, who are of necessity husbandmen. The principal Salishan deity seems to have been Dokwibutl. The first part of this word resembles *dugwe*, thou, and may thus represent invocation. Among the Dyaks of Borneo the chief god is Battara; the Tagalas worshipped Bathala Meycapal; and the people of Tobi called their divine progenitor, Pitakat. According to the Samoans, the first man was the product of the male principle Fatu and the female, Ele-ele, whence his name, Fatu-ele-ele. It is likely that these forms conceal the name of some eponym of the Malay-Polynesian people, or, at least, of a portion of them. In Sanchoniatho's Phœnician History, the second son of the ancestral Ouranus is called Betylus, and many things favour the derivation of the Malays from Canaanites of Semitic speech. Crawford says that Bataru Guru, whom the people of Celebes call the first of their kings, is a local name of Siva. This statement is worthy of more than doubt.

Indian invasions of the Malay Archipelago, both Buddhist and Brahman, took place in or before the twelfth century, and, towards the close of the fifteenth, the Mahometans followed. These invasions caused great displacements of population for it is the warlike code of the Pacific Islanders to offer the conquered party the alternative of expatriation or extermination. Doubtless such alternatives were offered prior to the Asiatic invasions. It is clear, however, that the Salishans have not been displaced since they reached the American coast, while the Algonquins, of similar origin, have been driven into the far East, even to the shores of the Atlantic. The immigrants from Northern Asia reached British Columbia and Oregon as early as the beginning of the eighth century, and, finding the Algonquins there before them, drove them inland and eastward. The tide of northern Asiatics, called Toltecs and Aztecs, Otomis and Chichimecs, Sonora and Pueblo Indians, Muskogean, Iroquois-Cherokees and Dakotans, continued to flow by Behring's Straits and the Aleutian chain for fully a century, so that the Salishans cannot have settled in America before the ninth century, and may not have settled before the fifteenth. No trace of either Sanscrit or Arabic appears in their language to shew that their period of emigration from the Malay Archipelago was posterior to the dominance of Hindoos and Mahometans. The divergence of their forms of speech from those of the present occupants of their ancient homes suggests a time when Malay forms were not so firmly rivetted in speech as has been the case since Europeans first knew the Pacific Islanders. It is likely that all our Indian tribes of oceanic derivation found their way to the shores of America before its coasts were known to Columbus and his followers. It is, of course, a guess in the form of a compromise, but it may be suggested, that the Salishans have been on this continent since the thirteenth century. The Maya-Quiches, of Yucatan and Guatemala, and the Algonquins must have preceded them some six hundred years.

The Rev. S. J. Whitmee, an authority on matters Polynesian, leaving the Malay Archipelago proper out of sight, has proposed a three-fold division of the insular

area. The people of negrito features and a postposing grammar in New Guinea, New Caledonia, the New Hebrides, Australia, etc., who have been termed Melanesian, he classifies as Papuan. The other islanders he divides into two groups. Those of Eastern Polynesia and New Zealand he calls the Sawaiori, a name compounded of the words *Sa-moa*, *Ha-wai-i*, and *Ma-ori*, denoting three representative peoples belonging to the race. To those of the north-western islands he gives the title Tarapon, from *Tara-wan* and *Pon-ape*, representative islands in the Gilbert and Caroline groups. A judgment based on partial vocabularies can hardly be a definite one; still a court must decide on the evidence before it, and render a verdict liable to revision should fuller testimony afterwards be forthcoming. At present the Malay element in the Niskwalli is represented by 51 Javanese, 45 Malay, 22 Sulu, 21 Sunda, 17 Bali and Mysol, 15 Tagala, 14 Bugis, 12 Bisayan, Madura, Wahai, and Tidore words. This decides nothing but the general fact of the Malay-Polynesian origin of the Salishans, save that in Tagala, Bugis, Macassar, Mysol, Menado, Salibabo, Saparua, Awaiya, Camarian, etc., the *tamata* or Polynesian form of the word for man appears, which is also Salishan. The Tarapon or Micronesian division of the South Sea Islands has but a small representation of some thirty words. But the Sawaiori division counts 51 Maori, 30 Tonga, and other verbal equivalents, showing that the Salishan stock is Sawaiorian. It has also verbal affinities to the languages of the Pelew islanders and the Malayan aborigines of Formosa, which suggest the route by which the Niskwalli and their brethren passed from the Malay Archipelago to the Hawaiian Islands and thence to the American coast.

The Malays have been called the Phœnicians of the East, and I have already hinted that Phœnician blood is in them. The enterprise that carried them to Madagascar in the west, and to Easter Island in the east, which sent them to the fishing grounds of Australia and to the ports of China, which pirate-wise swept the seas with hundreds of large war prahus and well-provisioned craft of many sails; that enterprise which brought to Central America the culture of the Maya-Quiches, and overflowed into the West India Islands long before Columbus reached their shores, became paralyzed when European voyagers, headed by the Portuguese, invaded their domain. Before they came, Hindoos, Arabians and Mongols had effected large displacements of population, but till late in the Sixteenth Century, fleets of three hundred sail, carrying fifty thousand combatants, were not unknown in their eastern seas. Of the Malay-Polynesian tribes, however, there is no such thing as continuous history. Their traditions blend with their mythology, and it is little to be wondered at that they and their widely-separated relatives should have preserved no record of their migrations, when the same is true of some of the most highly civilized nations.

Like the Malay-Polynesians, the Salishans are not scalpers, but decapitators or head-hunters, as were the extinct Beothiks of Newfoundland. Their canoes, also, are dug-outs, as originally were those of all tribes of insular origin. They tattoo the jaw and wear scanty clothing. When first met with they were not hunters and looked upon venison with disgust. Their fish-hooks, made of wood or bone, were similar to those of the South Sea Islanders. In regard to their mortuary customs, Dr. Franz Boas says: "The face of the deceased is painted with red and black paint. * * *

* A chief's body is put in a carved box, and the front posts supporting his coffin are carved. His mask is placed between these posts. The graves of great warriors are marked by a statue representing a warrior with a war club. * * * After the death of husband or wife, the survivor must paint his legs and his blanket red. At the end of the mourning period, the red blanket is given to an old man, who deposits it in the woods." The Salishan lament of a mother over her dead child is, "*Ah seahb! shedda buddah ah ta bud! ad-de-dah!*" or, "Ah chief, my child is dead! Alas!"

So, one of the verses of a Tonga mourning is, "*O iaooe! gooa male e!*" or, "Alas! he is dead!" The funeral customs of the Maoris of New Zealand, so far at least as chiefs are concerned, are, as described by Von Hochstetter, similar to those of the Salishans, even to the erection of a wooden image of the deceased over the grave and clothing it with his favorite articles of dress.

There are 18,000 Salishans in Canada and the United States, the result, it may be, of six centuries' development. Supposing their population to have gone on doubling within the reasonable rate of a century, or three generations, they must have landed on the Pacific Coast a little over 280 strong. Now, it is related that a Tonga chief set sail for the Fiji Islands, with two hundred and fifty followers in three large canoes, carrying also provision for the voyage. Four such canoes would have been ample accommodation for the Salishan immigrants, from whatsoever point they directed their course to the American shore. Their numbers can hardly have been less, in order to protect themselves from destruction by hostile tribes or incorporation in a stronger nationality. They do not seem to have come into contact with tribes of Northern Asiatic derivation to any extent, for their peculiar arts such as the birch canoe and the fabrication of pottery, were unknown to them. There is, therefore, nothing to traverse the testimony of language, which brings the Salishans from an ancient seat in the northern part of the Malay Archipelago.

COMPARISON OF NISKWALLI WITH MALAY-POLYNESIAN.

English.	Niskwalli.	Malay-Polynesian.
adze	kwalius	galeleh <i>Salibabo</i> (axe)
all	bokwi, bebkw	kabeh <i>Java</i> , <i>Madura</i> ; fooabe <i>Tonga</i> .
ant	mitchilola	misisin <i>Massaratty</i> , mosisin <i>Cajeli</i> , pokoma <i>Maori</i> , mokohoola <i>Tonga</i> .
arm	chalesh	kaligh <i>Formosa</i> .
arrow	shauks nokwed	tkugh <i>Formosa</i> . anakpanah <i>Malay</i> , gnahow <i>Tonga</i> , ngasau <i>Fiji</i> .
ashes	skwallup	gelap <i>Mysol</i> , orapu <i>Bouton</i> , labbu <i>Sunda</i> .
axe	kobatit	kapak <i>Malay</i> , <i>Sulu</i> ; badog <i>Sunda</i> , badi <i>Baji</i> , beda <i>Ahtiago</i> .
bad	kullub	hala <i>Java</i> .
belly	kwiyukh smukha klatch	awak <i>Bali</i> , <i>Sunda</i> (body), hatuaka <i>Liang</i> . cheong <i>Samang</i> , nanaka <i>Liang</i> (body). troke <i>Malagasy</i> , raga <i>Bali</i> (body), kaleh <i>Salayer</i> , kalakalath <i>Pelew</i> (body).
bird (water)	stlekelkub skwakwelush	kakep, tekayap <i>Mysol</i> (fowl), topatopa <i>Maori</i> . walilis <i>Sunda</i> (teal).
black	hitotsa	hitam <i>Malay</i> , hidung <i>Sunda</i> , kokotu <i>Tidore</i> , kitkudu <i>Gani</i> , kokotu <i>Sahoe</i> .
blanket	salitza	klosso <i>Java</i> , kalasa <i>Gani</i> (mat).
blue	hitotsa	kotteetow <i>Pelew</i> .
blood	toligwut	darah <i>Malay</i> , gute <i>Java</i> .
boat	kelobit klai	yalopei <i>Teluti</i> , lopi <i>Salayer</i> , <i>Bugis</i> . saloi <i>Borneo</i> , hol <i>Teor</i> .
body	dautsi	dada <i>Morella</i> .
bone	sblauyu	balung <i>Java</i> .
bow	tsatsuts	tito <i>Atui</i> .
boy	chachas (little)	cheka <i>Sahoe</i> , ichi ichi <i>Ternate</i> (little).
bread, food	satld	telaa <i>Rotuma</i> .
to break	ohwutl	patah <i>Malay</i> , whawhati, ngawhere <i>Maori</i> .
breast	skubo	uma <i>Maori</i> .

English.	Niskwalli.	Malay-Polynesian.
to burn	ohod	jotiug, <i>Bali</i> , tahu <i>Maori</i> , katia <i>Fiji</i> .
child	minan	ninana <i>Sulu</i> .
	bibad	bibigi <i>Tonga</i> .
cloud	skwushub	hapas <i>Rotti</i> , hambubu <i>Bali</i> , kapua <i>Maori</i> , yabbath <i>Pelew</i> .
cold	tus	tiis <i>Sunda</i> , toe <i>Atui</i> , tijok <i>Malay</i> .
to come	atla, utla	haere <i>Maori</i> , iraua <i>Formosa</i> , alowei <i>Awaiya</i> , dirawoei <i>Java</i> .
crab	beskwa, beskhu	papaka <i>Maori</i> , bokoti <i>Wahai</i> (prawn).
	hawetsa	kapiteng <i>Java</i> , <i>Bali</i> .
	hauwilo	ulai <i>Cajeli</i> (prawn).
day	slahel	allo <i>Salayer</i> , alli <i>Moluccas</i> , lilew <i>Teor</i> , kluh <i>Mysol</i> , kila <i>Teluti</i> , kaseiella <i>Wahai</i> , malal <i>Gah</i> , liar <i>Massaratty</i> , ari <i>Malay</i> .
dog	kobai	kapuna <i>Menado</i> , kafuni <i>Gah</i> .
	komai	kamia <i>Rotuma</i> , segawon <i>Java</i> .
door	shugwtl	batal <i>Mysol</i> , yebuteh <i>Gah</i> .
ear	kwillade	herenatia <i>Amblaw</i> , karin <i>Teor</i> .
earth	swatekhwtan	cootoom <i>Pelew</i> , thanthan <i>Rotuma</i> .
to eat	oatld	tauri <i>Fiji</i> .
egg	oos	gosi <i>Tidore</i> , hua <i>Maori</i> .
end	eluks	alos <i>Malay</i> , hilianga <i>Tonga</i> .
eye	kalus	karu <i>Maori</i> , lau <i>Tidore</i> , lako <i>Galela</i> .
face	satzus	soty, socho <i>Java</i> (eye), gati <i>Sanguir</i> .
father	man	amana <i>Bouton</i> , mam <i>Mysol</i> .
	bad	pito <i>Java</i> , medua <i>Tahiti</i> .
fear	ashuts	takut, coquet <i>Malay</i> .
	ashekwub	magtahap <i>Bisayan</i> , hopohopo <i>Maori</i> .
feather	stokw	hokai <i>Maori</i> , dokoi <i>Sanguir</i> , gogo <i>Tidore</i> .
field	makwob	twawfa <i>Tonga</i> , kabun <i>Sulu</i> , sabah <i>Lampung</i> , sawah <i>Java</i> .
finger	shalatchi	jariji <i>Bali</i> , garikih <i>Madura</i> , saranga <i>Bouton</i> , koroiti <i>Maori</i> .
fire	hod, hot	hatete <i>Maori</i> , kidjaik <i>Mille</i> .
		nggatu <i>Fiji</i> , putun <i>Sanguir</i> .
flesh	beyets	paa <i>Tagala</i> , mbithi <i>Fiji</i> , wat <i>Formosa</i> , waouti <i>Awaiya</i> .
flower	sekaisim	puspo-kusumo <i>Java</i> , kaotutun <i>Massaratty</i> , sekar <i>Java</i> .
fly	hwaio	tawon <i>Java</i> (bee), tuiau <i>Maori</i> (flea), owei <i>Mysol</i> (mosquito), guphu <i>Tidore</i> .
foot	shid	siki <i>Sulu</i> , kadan <i>Wahai</i> , hoots <i>Malagasy</i> , wed <i>Gani</i> , oweda <i>Matabello</i> .
forehead	silels	alis <i>Malay</i> , lae <i>Tonga</i> , <i>Fakaafu</i> .
girl	chachas slane	lehani <i>Rotuma</i> (daughter).
to give	abshits	haweh <i>Java</i> , wacito <i>Tobi</i> , evaha <i>Tahiti</i> , anna-bookeeth <i>Pelew</i> .
to go	ookh	iigkau <i>Sulu</i> , jog <i>Mysol</i> , iko <i>Wahai</i> , ako <i>Ahtiago</i> , wiko <i>Massaratty</i> .
	ohob	bo <i>Mysol</i> , aou <i>Wahai</i> , taboi <i>Borneo</i> , ngawa <i>Maori</i> .
good	klob, tlob	malopi <i>Saparua</i> , rap <i>Tarawan</i> , taloha <i>Galela</i> , rawe <i>Maori</i> .

English.	Niskwalli.	Malay-Polynesian.
grasshopper	kekowuts	kakopi <i>Liang</i> , kohati <i>Wahai</i> (butterfly), gososo <i>Galela</i> .
grease	swus	agang <i>Malay</i> , daco <i>Bisayan</i> , koiwi <i>Maori</i> , jackabey <i>Malagasy</i> , bagewa <i>Salibabo</i> .
great	hekwi	hutu <i>Tidore</i> , <i>Galela</i> .
hair	skadzo	couder <i>Malay</i> .
beard	kwed	chiulok <i>Lampung</i> , ala <i>Awaiya</i> , harau <i>Java</i> , ngalan <i>Tagala</i> , arsiu <i>Rotuma</i> .
hand	chalesh	hagal <i>Madura</i> , mukola <i>Wahai</i> .
hard	swagwil klukhu	karas <i>Lampung</i> , kereh <i>Kiisa</i> , kras <i>Malay</i> , las- elasea <i>Fiji</i> .
head	shaiyus	chetuk <i>Madura</i> , jahe <i>Mangarei</i> , kahutu <i>Mysol</i> , oyuko <i>Teluti</i> .
heaven	shukh	hakoso <i>Java</i> , shurga <i>Sulu</i> .
hot	skwul, otsgulla	wera <i>Maori</i> , vela <i>Tonga</i> , pelah <i>Mysol</i> , asala <i>Alfuros</i> .
house	nuskwullum alal	mogall <i>Pelew</i> . balay <i>Bisayan</i> , fale <i>Fakaafo</i> , falle <i>Tonga</i> , are <i>Raratonga</i> .
husband	chesthu	as-auah <i>Tagala</i> , essah <i>Salibabo</i> , heieiti <i>Wahai</i> (man), tahu <i>Maori</i> .
insect	slitlalkub	lalangow <i>Borneo</i> , ralugoh <i>Menado</i> (fly).
iron	snokw	saloko <i>Java</i> (silver).
kettle	sialt	kwali <i>Malay</i> , quall <i>Pelew</i> , gooloo <i>Tonga</i> .
knee	lakalotsid	lukut, lutut <i>Malay</i> .
leaf	chuboba	chafen <i>Teor</i> , lai obawai <i>Amblaw</i> .
life	hale, halikh	ara <i>Tahiti</i> , ora <i>Maori</i> .
louse	beskchad	okutu <i>Bouton</i> .
maize	stulels	halal <i>Saparua</i> , allar <i>Liang</i> (rice).
man	stobsh, stobush	taowe <i>Bugis</i> , tumata <i>Saparua</i> , tomata <i>Salibabo</i> , taumata <i>Menado</i> , tamata <i>Fiji</i> .
chief	siab	sau <i>Rotuma</i> , <i>Fiji</i> , how <i>Tonga</i> .
people	atsiltelmu	tiyang-jalmi, jalmo <i>Java</i> , jalama <i>Sunda</i> .
mat	kot skwegwut	katini <i>Massaratty</i> , junguto <i>Galela</i> . savata <i>Sulu</i> , moamata <i>Tarawan</i> , takapau <i>Maori</i> , <i>Tonga</i> .
moon	slokwaln	wulan <i>Java</i> , hulani <i>Batumerah</i> , hulan <i>Wahai</i> , allong <i>Mille</i> .
mosquito	kwad	seugeti <i>Massaratty</i> , suti <i>Cajeli</i> , kias <i>Borneo</i> .
mother	skoi	koka <i>Maori</i> , nggei <i>Fiji</i> , yaiya <i>Tidore</i> .
mountain	skwatutsh spokwab	vohicht <i>Malagasy</i> . chubuk <i>Samang</i> , buguid <i>Bisayan</i> , waukein, <i>Formosa</i> , eothiva, <i>Fiji</i> .
mouth	kadhu	igad <i>Sulu</i> (lips), gnootoo <i>Tonga</i> , nhoutou <i>Ticopia</i> , ngutu <i>Fakaafo</i> , ngutu <i>Maori</i> (lips).
nails	kohwachi	kuku <i>Malay</i> , kuyat <i>Gani</i> , wuku <i>Gah</i> , oggok <i>Mille</i> .
name	sda, sdas	wasta, <i>Java</i> , yatha <i>Fiji</i> .
neck	kaiukhkwa	kaki <i>Maori</i> , kia <i>Rotuma</i> , gia <i>Tonga</i> .
night	klakh, sklakh slakhhel, sklakhel	galap <i>Malay</i> (dark), marok <i>Mille</i> (dark). garagaran <i>Gah</i> , kloowaizeris <i>Tobi</i> (dark).
no	hwe	hea <i>Tonga</i> , akea <i>Tarawan</i> .
nose	inuksn, mukshid	muk <i>Samang</i> , hungasan <i>Bali</i> .

English.	Niskwalli.	Malay-Polynesian.
old	lolutl tusak	kolot <i>Sunda</i> , lakalaki <i>Cagayan</i> . tuhak <i>Samang</i> , tuah <i>Malay</i> , tawhito <i>Maori</i> , tuha <i>Lampung</i> .
* prawn	boluto saikh	burowi <i>Tidore</i> , filuan <i>Ahtiago</i> . kasaua <i>Mysol</i> .
rain	skal	kull <i>Pelew</i> , ulah <i>Amblaw</i> , hura <i>Galela</i> , karu <i>Tarawan</i> , golim <i>Mysol</i> .
rainbow	kobatshid, komachin	kuwung <i>Java</i> , <i>Bali</i> .
rat	skad pelkutchi	tikus <i>Malay</i> , tikuti <i>Massaratty</i> . warset <i>Java</i> , barut <i>Sunda</i> , balawu <i>Bugis</i> , blaha <i>Salayer</i> .
red	hekwetl	kula <i>Fakaafo</i> , <i>Fiji</i> , desoella <i>Galela</i> , kohori <i>Tidore</i> , coola-coola <i>Tonga</i> , whero, towhero <i>Maori</i> , habrit <i>Java</i> .
river	stolukw	lalalak <i>Rotti</i> , walungan <i>Sunda</i> , ylog <i>Tagala</i> , lungei <i>Borneo</i> .
root	aspuđ	gamut <i>Sulu</i> , aiwaht <i>Ahtiago</i> , eiwaati, <i>Morella</i> , aiwaat <i>Lariki</i> , owati <i>Amblaw</i> , hatimootoo <i>Tidore</i> .
saliva	kwulotsid	ludah <i>Malay</i> , tohulah <i>Saparua</i> , tehula <i>Liang</i> , haware <i>Maori</i> .
salt	kakam	garam <i>Malay</i> , asin <i>Bisayan</i> , teisim <i>Alfuros</i> , asing <i>Menado</i> , masima <i>Tonga</i> , <i>Fiji</i> .
sea	hwultsh	wolat <i>Gani</i> , belot <i>Mysol</i> , olat <i>Cajeli</i> , alud <i>Borneo</i> , lajit <i>Mille</i> .
to see	olabit	liat <i>Malay</i> , lewa, lelewa <i>Fiji</i> .
to sit	gwuddel	kuduk <i>Borneo</i> , tuturu <i>Maori</i> .
slave	stoduk	ata <i>Bugis</i> , budak <i>Malay</i> , taurereka <i>Maori</i> .
snake	betsuts	taksoko <i>Java</i> , ngata <i>Fiji</i> , tekoss <i>Gah</i> , katoun <i>Menado</i> .
	wekhpsh	ekeb <i>Samang</i> , savha <i>Bouton</i> , pok <i>Mysol</i> , dipa <i>Borneo</i> , tofagin <i>Matabello</i> .
snow	bako	huka <i>Maori</i> .
skin	hudzamid	usam <i>Wayapo</i> , usum <i>Cajeli</i> , asava <i>Batumerah</i> , mot-kehin <i>Mysol</i> .
small	miman	moemoe <i>Tonga</i> , meamea <i>Rotuma</i> , nohinohi <i>Maori</i> , anaanin <i>Alfuros</i> .
	mimad	munti <i>Tagala</i> , umit <i>Borneo</i> , mohintek <i>Belang</i> .
	chachas	cheka <i>Sahoe</i> , ichi-ichi <i>Ternate</i> , chiyut <i>Java</i> .
soft	esmetlin, asbetlil	lam-but <i>Malay</i> , lem-but <i>Madura</i> , malumu <i>Wahai</i> , mamalin <i>Ahtiago</i> .
sour	ochapab	dakiopi <i>Galela</i> , mateibi <i>Gah</i> , pep <i>Mysol</i> , asam <i>Java</i> , kawa <i>Maori</i> .
to speak	ohothot	kata <i>Malay</i> , taitai <i>Tarawan</i> , whakatu <i>Maori</i> .
spear	tseakwuts	wahos <i>Java</i> , tawaki <i>Amblaw</i> , sagusagu <i>Tidore</i> , hoata <i>Maori</i> , tcao <i>Rotuma</i> , kwukeou <i>Fiji</i> , bakabota <i>Tarawan</i> , taofotoi <i>Tonga</i> .
	tatl	tara <i>Tarawan</i> , golo <i>Java</i> , tite <i>Wahai</i> , galagala <i>Teor</i> .
	stetkwub	tuba <i>Ahtiago</i> , tabi <i>Tarawan</i> .
squirrel	skadzu	katek <i>Java</i> (monkey), keso <i>Amblaw</i> , kesoi <i>Cajeli</i> , kesi <i>Awaiya</i> , kuyad <i>Borneo</i> (monkey).

English.	Niskwalli.	Malay-Polynesian.
star	chusud	chetu <i>Atui</i> , tahwettu <i>Tahiti</i> , tuitui <i>Tarawan</i> , tokun <i>Teor</i> , hetu <i>Paumotua</i> .
stone	chetla	selo <i>Java</i> , batro <i>Biajuk</i> , batu <i>Malay</i> , wahto <i>Formosa</i> , hathu <i>Rotuma</i> , kowata <i>Maori</i> .
sun	klokwatl	matalo <i>Macassar</i> , lacloh <i>Rotti</i> , adlao <i>Bisayan</i> , matalou <i>Borneo</i> , kaliha <i>Sanguir</i> , kluh <i>Mysol</i> , woleh <i>Gah</i> , yaro <i>Tobi</i> , komaru <i>Maori</i> .
sweet	okwagwab	masoma <i>Camarian</i> , masuma <i>Lariki</i> , mosuma <i>Saparua</i> .
teeth	dzadis	gigi <i>Mabay</i> , isi <i>Sanguir</i> , <i>Bugis</i> , ngisi, <i>Menado</i> , ngedi <i>Sahoe</i> , ngutu <i>Savu</i> , dongito <i>Bolanghitam</i> , danto <i>Java</i> .
tongue	klalap	lila <i>Bugis</i> , <i>Macassar</i> , hilat <i>Bali</i> , lilah <i>Sulu</i> , kelo <i>Garam</i> , alelo <i>Sandwich</i> , lella <i>Malagasy</i> , elelo <i>Tonga</i> , alele <i>Rotuma</i> .
tree	tsukhwul	tangkhal <i>Sunda</i> , garager <i>Pelew</i> , kalu <i>Sanguir</i> (wood), ngahere <i>Maori</i> (wood).
	stukhum	pohon <i>Madura</i> , ayun <i>Timuri</i> , chuk <i>Samang</i> , cago <i>Iloco</i> , tawhao <i>Maori</i> (wood).
water	ko	chai <i>Sunda</i> , hoi <i>Timor</i> , aki <i>Ratahan</i> , akei <i>Menado</i> , aki <i>Sanguir</i> , <i>Tidore</i> , komo <i>Paumotua</i> .
white	hokokh	puteh <i>Malay</i> , maydac <i>Batan</i> , babut <i>Ahtiago</i> , botcibotc <i>Tobi</i> , savasavu <i>Fiji</i> , kowse <i>Pelew</i> .
wind	shukhhum	angin <i>Malay</i> , kanging <i>Bali</i> , kalm <i>Bali</i> , hangin <i>Tagala</i> , matangi <i>Marquesas</i> , kohengi <i>Maori</i> , koyyoo <i>Pelew</i> .
wing	tsetsal	teyholi <i>Awaiya</i> , keheil <i>Wahai</i> , tula <i>Sanguir</i> , wakul <i>Gah</i> ,
wife	chugwush	sawah <i>Sulu</i> , sawa <i>Sanguir</i> , sawa <i>Borneo</i> , sowom <i>Cajeli</i> , sengwedo <i>Java</i> , ahehwa <i>Matabello</i> .
woman	slade, sklane	lanjang <i>Sunda</i> (girl), lehani <i>Rotuma</i> (daughter), rin <i>Mille</i> (wife), leva <i>Fiji</i> , erire <i>Paumotua</i> , elwinyo <i>Amblaw</i> , lako <i>Baju</i> (wife), gallu <i>Java</i> , loh <i>Bali</i> , lubawe <i>Biajuk</i> .
yellow	hokwats	bahendak <i>Biajuk</i> , koothoo <i>Pelew</i> .
young	babaad	muda <i>Malay</i> , punua <i>Maori</i> .
I	atsa, kets, chid	aku, saya, <i>Malay</i> , kito <i>Java</i> , gita <i>Tonga</i> , atu <i>Tahiti</i> , tia <i>Tarawan</i> , zaho <i>Malagasy</i> .
Thou	dugwe, kats, chu	diko <i>Java</i> , dika <i>Madura</i> , kowe <i>Java</i> , <i>Ponape</i> , kow <i>Pelew</i> , kwe <i>Mille</i> , coy <i>Tonga</i> , koe <i>Maori</i> , sia <i>Sunda</i> , iko <i>Bugis</i> , go <i>Tarawan</i> .
He	tzil, tzinil	ini <i>Malay</i> , anre <i>Macassar</i> , kania <i>Sulu</i> , tena <i>Tarawan</i> , diri, sandiri <i>Malay</i> .
	shi, sha	dia <i>Malay</i> , iya <i>Lampung</i> , siya <i>Sulu</i> , yca <i>Tagala</i> , izi <i>Malagasy</i> .
We	debetl	giwotoloo, <i>Tonga</i> , kendaru <i>Fiji</i> .
	sutshid	kita <i>Malay</i> , <i>Sulu</i> , <i>Ponape</i> , tatou <i>Tahiti</i> , <i>Paumotua</i> , <i>Maori</i> .
	shil, chitl	kula <i>Java</i> , sira <i>Batan</i> , tautolu <i>Tonga</i> , derro <i>Mille</i> , ara, ngaira <i>Tarawan</i> .
You	gullapo	kowe <i>Java</i> , korua <i>Maori</i> , <i>Paumotua</i> .
They	detl, tsataditl	nautolu <i>Tonga</i> .

English.	Niskwalli.	Malay-Polynesian.
	ulgwa, delgwa	eris <i>Rotuma</i> , la, latou <i>Samoa</i> , raua, ratau <i>Tahiti</i> , Paumotu, <i>Maori</i> .
1	dutcho, asdutcho	tadday <i>Cagayan</i> , tatsaat <i>Formosa</i> , tasi <i>Fotuna</i> , <i>Fakaifo</i> , tahi <i>Maori</i> , <i>Uea</i> , <i>Marquesas</i> , taha <i>Tonga</i> , tot <i>Caroline</i> , tseekae <i>Malicollo</i> .
2	assale, salew	kaleh <i>Java</i> , serou <i>Papua</i> , dalaua <i>Tagala</i> , kalae <i>Tambora</i> , rua <i>Lampung</i> , golu <i>Tobi</i> , heluk <i>Yengen</i> , oroo <i>Pelew</i> , erooa <i>Otaheiti</i> .
3	klekhw, asklekhw	telu <i>Java</i> , kolu <i>Sandwich</i> , atlo <i>Philippine</i> , tatlu <i>Tagala</i> , gatil <i>Sulu</i> , kal <i>Kissa</i> .
4	bos, asbos	pat, papat <i>Java</i> , opat <i>Sunda</i> , epat <i>Biajuk</i> , effats <i>Malagasy</i> , upat <i>Sulu</i> , <i>Bisayan</i> , opats <i>Bugis</i> , pobits <i>Yengen</i> , ebats <i>Malicollo</i> .
5	tsalats	luwi <i>Malagasy</i> , kuklin <i>Tambora</i> , lailem <i>Mille</i> , delima <i>Salibabo</i> .
6	dzelachi	loacha <i>Uea</i> , chalemen <i>Lifu</i> , dildjino <i>Mille</i> laen <i>Rotti</i> , <i>Timuri</i> , hol <i>Caroline</i> , gurum <i>Tuham</i> .
7	tsoks	tujuh <i>Malay</i> , tuju <i>Sunda</i> , tik <i>Papua</i> , tuju <i>Sambawa</i> , tujuh <i>Samang</i> , tujoh <i>Salayer</i> , hiku <i>Sandwich</i> , iko <i>Kissa</i> .
8	tkachi	hasto <i>Java</i> , kutus <i>Bali</i> , tofkangi <i>Ternate</i> , koneho <i>Tambora</i> , gatahua <i>Sulu</i> , tufkangi <i>Tidore</i> , itupangi <i>Galela</i> .
9	hwul	jalatien <i>Biajuk</i> , asera <i>Bugis</i> , lali <i>Tambora</i> , siwer <i>Teor</i> , sior <i>Malagasy</i> .
10	paduts	sadasu <i>Java</i> , dasa <i>Bali</i> , painduk <i>Yengen</i> , putusa <i>Serang</i> , manud <i>Tuham</i> , mackoth <i>Pelew</i> , boto <i>Cajeli</i> , hutusa <i>Awaiya</i> , hutu <i>Teluti</i> , fotusa <i>Alfuros</i> , huta <i>Teor</i> .
20	salachi	kalehdoso <i>Java</i> , calohaam <i>Bisayan</i> , oloyuck <i>Pelew</i> , ruatekau <i>Maori</i> , sisarone <i>Tambora</i> .
100	sumkwachi	sangagasut <i>Iloco</i> , hangutoos <i>Sulu</i> , sangdaan <i>Tagala</i> , usakagatos <i>Bisayan</i> , magatu <i>Cagayan</i> , mahasu <i>Menado</i> , <i>Sanguir</i> .
this, that	ti	itu <i>Malay</i> , eta <i>Sunda</i> , heto <i>Biajuk</i> , tudelh <i>Samang</i> , taua <i>Maori</i> .
	ki, kwi	iki, ika, <i>Java</i> , iyak <i>Sunda</i> , iya <i>Batan</i> .
	la, le, til	reyah, rowa, girowa <i>Madura</i> , yari <i>Tagala</i> , raua, tera <i>Maori</i> .
who ?	gwat	sinten <i>Java</i> , yewe <i>Biajuk</i> , isiu <i>Sulu</i> , siapa <i>Malay</i> , kohai <i>Tonga</i> .
here	hwulte	hiriki, diriki <i>Bali</i> , korini <i>Bugis</i> .
there	todi, altodi	ditu <i>Bali</i> , disitu <i>Malay</i> , ditu <i>Sunda</i> , disah, kahdisah <i>Madura</i> , didto <i>Bisayan</i> , didtoo <i>Sulu</i> , dita <i>Iloco</i> , etonai <i>Tobi</i> .
near	chicht	jauh, dakat <i>Malay</i> , chadak, <i>Java</i> , asideg <i>Iloco</i> , tutatu <i>Maori</i> .
far	lel, lalel	bela <i>Macassar</i> , mabela, <i>Bugis</i> , halayo <i>Bisayan</i> , arayu <i>Cagayan</i> , malayo <i>Tagala</i> .
above	shishukh, shikabuts	asa <i>Bugis</i> , atas, <i>Malay</i> , kepeng <i>Samang</i> , ybabao <i>Tagala</i> , saitaas <i>Bisayan</i> , hataas <i>Sulu</i> , hage <i>Tonga</i> .

English.	Niskwalli.	Malay-Polynesian.
behind	lak, tulak	licuc <i>Cagayan</i> , licudan <i>Iloco</i> , licurran <i>Tagala</i> , blakang <i>Malay</i> , iligan <i>Mille</i> , tukalek <i>Tobi</i> , tuara <i>Maori</i> .
below	klep	ngandap <i>Java</i> , dibawah <i>Malay</i> , andap <i>Sunda</i> , rawa <i>Macassar</i> , oleekem <i>Pelew</i> , gilalo <i>Tonga</i> , lausilopo <i>Rotuma</i> , kabawah, <i>Sulu</i> , sulib <i>Tagala</i> .
by	twul	ulih <i>Malay</i> , ri <i>Bugis</i> .
from	tul	dari <i>Malay</i> , <i>Madura</i> , huleh <i>Bali</i> .
in	dekhw	di <i>Malay</i> , <i>Sunda</i> , <i>Lampung</i> .
to	ta, tud tul, gwul	dateng <i>Java</i> , tako <i>Java</i> , di <i>Batan</i> , atoo <i>Tonga</i> , wor <i>Tobi</i> .
with	twul	karo, kalih <i>Java</i> , kalawan <i>Lampung</i> , barang <i>Bali</i> , <i>Madura</i> .
within	dekhw	dalam <i>Malay</i> , <i>Madura</i> .
without	shalbekhw	salebetting <i>Java</i> (within), saliwang <i>Bugis</i> .

MOSS LITTER. BY THOMAS W. GIBSON, ESQ., BUREAU OF MINES.

(Read January 30th, 1897.)

Agriculture and mining are the chief members of a group of arts which lie at the base of all others—without which, indeed, none others could exist. Agriculture supplies the primal necessities of man by giving him food and clothing, and both together furnish him with the raw materials for that wonderful and complex series of manufactures, with which his ingenuity strives to gratify his tastes or satisfy his wants—tastes and wants which enlarge with his expanding civilization. They have both the same arena—the capacious bosom of Mother Earth—and both strive to turn to advantage the substances which nature there has placed. One enlists in her service those vital forces which draw the atoms of inorganic matter from air and soil, and which raise them from the mineral into the vegetable, and from the vegetable into the animal kingdom; the other deals directly with the mineral substances themselves, and by the mere act of changing their situation and separating them from one another, rescues them from inutility and makes them subservient to the wants of man. One may be called an adaptive industry, whose processes, if rightly conducted, move in a circle, and appear capable of being carried on for all time; the other may be termed a destructive industry, concerned with large, yet strictly limited quantities of material, which, once brought into play, are forthwith made subject to decay and waste, and are scarcely, if at all, capable of being restored to their original condition. Agriculture and mining touch each other at many points. The farmer feeds and clothes the miner; the miner warms the farmer, supplies him with fertilizers, keeps him in ploughs and harrows, and puts gold and silver into his purse. No market is worth so much to the tiller of the soil as a mining camp in full blast. Miners usually want the best, and are quite willing to pay for it.

There are processes performed on the surface of the ground which, in their nature, seem intermediate between agriculture and mining, and to partake of the character of both. One of these is the reclamation of peat bogs, and the utilization of the material of which such bogs are composed. As agricultural operations, such processes restore to cultivation considerable areas of land, previously lying waste and barren, while, viewed as incidents of mining, they convert to man's use actual portions of the earth's crust unchanged except by a certain amount of manipulation.

The origin of peat bogs is well understood. They are found chiefly in the colder parts of the globe, where evaporation goes on less actively than in the more tropical regions, and occur in low situations, or where some natural or artificial obstacle impedes the drainage. The abundant moisture favors the growth of a low order of plants, such as the sphagnum mosses, of which some fifty or sixty varieties are known. This plant is distinguished above all others by its capacity for absorbing and storing water, for which its peculiar structure eminently fits it. The epidermis of the stalk and the leaves of the plant are mainly composed of large, empty cells, into which the water is drawn through a number of small holes. The cells are provided with ring or spiral-formed thickenings on their inner sides, which keep them from collapsing. They are consequently always distended, and always ready for use. Smaller cells occur between the larger ones, which contain chlorophyll and supply the plant with nourishment, but these occupy comparatively little space. The whole arrangement is that of an aggregation of reservoirs in successive layers, which are kept filled by the force of capillary attraction, even when the plant itself is above the water level.

It is curious to note that the properties of the sphagnum moss, which render it so well adapted for living in a low and moist situation, tend also to bring its existence to an end. It requires a constant supply of moisture, yet it is continually

pumping up to the surface of its tufts the water in which it stands, thus promoting evaporation ; while at the same time, by regularly decaying at its roots, it deposits the detritus which adds to the solid contents of the bog. This process continues until the bog is raised above the level of the surface water, when the sphagnum vegetation ceases, having exhausted the conditions which made it possible. In this way bogs of considerable depth are formed in process of time. As the mass increases, decomposition takes place in the lower portions, which become consolidated into a black or dark-brown earthy substance, that in various parts of the world is extensively converted into fuel. The usual method of utilizing it as such is to dig up the peat in cakes, or blocks, and dry them by exposure to the wind and sun, after which they are stored and used as required. Hand labor is generally employed, though numberless attempts have been made to facilitate the process by the introduction of various kinds of machinery. The great difficulty in the economic employment of mechanical processes is the tenacity with which the peat retains the degree of moisture remaining after it has yielded all that naturally evaporates in the air. Pressure and artificial heat have been resorted to in order to overcome this difficulty, but, while the end aimed at is capable of achievement, it has usually been attained at too great an expense for economic results. A process which would put us in possession of a good and cheap peat fuel would be a national benefit to Ontario, destitute as the Province is of workable beds of coal.

It is these absorptive properties of the sphagnum moss which have led to its employment as litter, or bedding for cattle, in lieu of straw or other materials commonly used for such purposes. Its suitability for litter was doubtless recognized at an early date by people living in the vicinity of bogs, but it was as late as 1880 that the preparation of moss litter as an article of commerce was first begun by Hollman at Gifhorn, in Hanover. Since that time it has come rapidly into use in the countries of Continental Europe, and in Great Britain, as well as to some extent in America. The advantages claimed for the litter are that it affords drier and healthier bedding for horses and cattle than any other material ; that by reason of its great power of absorbing moisture, it binds the valuable portion of the animal excrements, and consequently yields the best manure ; that it acts as a disinfectant and improves the air of the stable, and that a smaller quantity of it is required than would be needed if straw were used. Experience with the litter in European countries seems to show that the claims made for it are well founded, and that it is the best article for the purpose yet introduced.

The cells of the sphagnum moss in the manufactured article retain much of their power of attracting and holding water, and the litter is in consequence able to take up ten or fifteen times its own weight of moisture. It has the faculty of absorbing gases as well, and hence fixes the ammonia always present to a greater or less degree in the atmosphere of buildings in which animals are confined and fed. The soft, springy, elastic moss litter forms a more comfortable bed for cattle than straw, and greatly facilitates the task of keeping the animals and stables clean, a fact which has an important bearing on the welfare of man, as in the case of milch cows whose product is used as an article of human diet.

Careful trials of moss litter in army stables in Germany, where formerly straw was employed, showed its superiority in the following respects : dry beds, and dry, fresh air, free from ammonia ; the ceilings, walls and leather trappings remained free from moisture and mould. If proper care was taken to remove those portions of the litter which became charged with moisture, to shake it up every day and fork it from one part of the stall to another, the horses found their quarters very much improved. Their skins remained clean and in activity, catarrhs of the nose and eyes, generally the result of bad air in stables, were less frequent ; wounds on the legs healed more speedily ; colic was almost eliminated ; inflammations of the glands seldom occurred, and rotting of the frog was almost entirely prevented. In cases of contagious disease, the litter proved of great value, and surpassed all other

disinfectants. In other cases, too, moss litter, mixed with superphosphate, has had the effect of protecting cattle from foot and mouth diseases, even while the infection spread to an alarming extent on neighboring farms. This property would doubtless make it valuable for use in railway cars employed in the transportation of live stock. Many cases have been known in which disease was introduced or spread by cars in which infected animals had been carried.

The manurial value of moss litter, after it has served its purpose in the stable, is greater than that of straw, for the reason that there is less evaporation of the liquid and volatile constituents. It would appear that no greater proportion of the potash, lime, or phosphoric acid is recoverable by means of the litter, but the easily-soluble nitrates are retained to a much larger extent than in the straw, which allows of their escape in the form of ammonia. As the agriculturist well knows, the nitrogen thus rendered available for plant food is a most valuable element of manure.

In the manufacture of moss litter, as carried on in Europe, a fine dust is sifted out at a certain stage of the process, which, as well as the litter itself, is used as a deodorizer and absorbent of sewage and fecal matter, especially in small cities, where no proper systems of sewerage or drainage exist. Accumulation of noxious matter of this sort often gives rise to epidemic and infectious diseases. The use of moss litter and peat dust not only remedies this evil, but actually transforms deleterious waste into valuable fertilizers. The absorbent properties of the litter check the growth of bacteria, and retard the decomposition of organic substances. Fresh fish, fruit, and vegetables are all said to have been preserved in excellent condition for a long time by being packed in peat moss. There are many other uses to which moss litter is put, such as raw material for coarse textile fabrics, a non-conductor of heat or noise in house building, paper pulp, etc., with greater or less success.

The peat bogs of Canada, and of Ontario in particular, are of vast extent. By virtue of their immense stores of carbon, they constitute a potential source of fuel supply when the right process of manufacture shall have been invented and applied. Meantime, a beginning has been made in the utilization of these bogs in the manufacture of moss litter. In the townships of Wainfleet and Humberstone, in the County of Welland, between the feeder of the Welland Canal and Lake Erie, and about five miles from the town of Welland, lies a peat bog of some 5,000 acres, owned by the Canadian Peat Fuel Company of Toronto. At the northern edge of this bog the company has erected a plant for the manufacture of the litter, according to a process which in some respects differs from that prevailing in Europe. The upper layer of the bog consists of undecomposed sphagnum moss, varying in depth from 18 inches to 4 1-2 feet, is said to be free from sand or inorganic material, and to be well fitted for litter. The works have been erected and put in operation, and a considerable quantity of product has been turned out. The first stage of the process is to cut the moss into pieces about eighteen inches square, which are piled together in rows on the surface of the bog. When the moisture has sufficiently evaporated these blocks are gathered and wheeled in small cars, over a portable tramway, to the storing sheds. They are then passed through the picking machines, two of which stand side by side. These are provided with heavy revolving cylinders, armed with strong teeth, which act upon similar teeth set in the concave surface of a breast, against which they work. In the pickers the moss is torn and loosened apart, the object being to separate the fibres, rather than break them. The pickers discharge the moss upon moving carriers, three in number, to each machine, ranged above one another, which carry it horizontally through a drying chamber, or tunnel, 116 feet in length, 8 feet high, and 16 feet wide. These carriers travel against a current of hot air, drawn through the tunnel by a disc fan revolving at the farther end, the object being to remove the greater part of the moisture remaining in the moss. The heat for this purpose is generated by a furnace, situated parallel to the tunnel, whence the hot air is drawn by the suction of the fan into a mixing chamber, where the temperature can be

regulated by the admission of cold air. The hot blast, after passing over the moss, emerges, laden with moisture, into a wooden shaft, and so into the outer air. At the end of the drying tunnel the moss falls into a conveyer, from which it is elevated into a weighing bin, or hopper, situated above a baling press, or packer. The hopper works automatically, and as soon as a sufficient weight is received it deposits its load in the press, which is a machine of peculiar design, worked by steam power. On a revolving circular platform are four stout wooden moulds. In one of these wooden slats are placed to assist in securing the bale after it is pressed; it passes under the press, the workman above moves a lever, and a plunger descends with a pressure of 200 tons, forcing the moss firmly into the mould. The platform makes a quarter revolution, and while the second mould is being filled, number one is being secured with wire, and at the third turn the finished bale is removed, ready for shipment. The weight of a bale is 250 to 260 pounds. A knuckle-joint press is subsidiary to the steam press, but is seldom required. The bales are stored in the sheds, whence they can be shipped as called for, over the Michigan Central Railroad, a spur of which runs into the property.

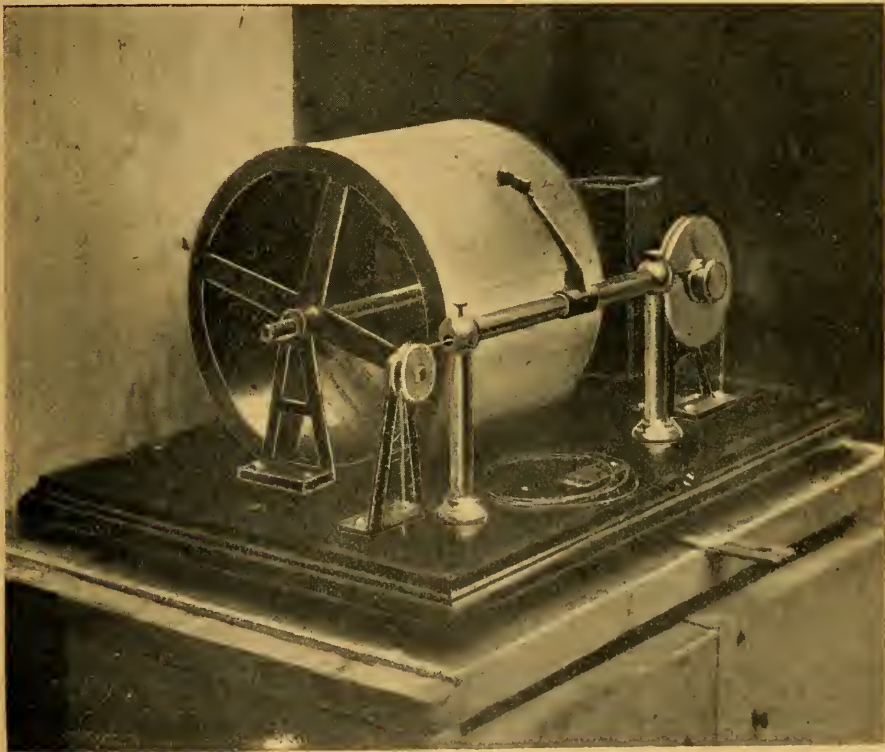
In the finished state the litter contains about 30 or 35 per cent. of moisture, and in this condition it goes into use. It is said to take up liquids more readily in this state than when the cells of the plants are completely deprived of water, and it is not so easily broken up under the feet of horses. The output of the factory is about 40 tons per day of ten hours, but can easily be increased. The consumption in America is about 18,000 tons a year at the present time, and the article has hitherto been imported exclusively from Europe. New York, Brooklyn, Boston, Baltimore, Philadelphia, Chicago, and other large cities, are the chief places of use in the United States, but the market for litter is rapidly growing. It is employed in the stables of milk and transportation companies, liverymen, and other large owners of cattle and horses, and even in the stables of many private individuals. The Canadian Peat Fuel Company has entered into a contract for supplying an average quantity of 22,000 tons per year, for five years, in the United States. They do not anticipate any trouble in marketing this quantity. One difficulty in the way of a more general use has been the cost of storing cargoes at the point of importation. Moss litter is a bulky article, and the rates charged for storage in large cities are high. These will be evaded in the case of the Welland factory, as the litter can be kept on hand there and shipped only as required to customers. The price at which it retails in New York is \$15 per ton. In London, England, it sells at 35 shillings per ton. The factory at Welland is the only one of the kind in America. The machinery used in it is from the designs of Mr. A. A. Dickson, the President of the company, and is patented in Canada, the United States, Great Britain, Germany, and other countries of Continental Europe. Beneath the layer of moss suitable for litter on the Welland bog, lies a very large quantity of dark, decomposed peat, which it is the intention of the company to manufacture into fuel. The depth of this peaty section varies from a foot or two at the edge of the bog to 20 feet in the centre. The process of converting the crude peat into fuel is also one patented by Mr. Dickson, and, as now perfected, does away with the use of artificial heat. The peat is cut and air-dried, after which it is pulverized by being passed through a picker and automatically deposited in a hopper, which feeds a steel tube about two inches in diameter, and fifteen inches long. The pulverized peat is forced through this tube by pressure and formed into cylindrical blocks about three inches in length, almost equal in density to anthracite coal. This part of the business has not yet been brought into operation. Below the bed of peat lies a deposit of clay, which experiments have shown to be of fine quality for the manufacture of vitrified brick, pottery, etc. The prospect is that a very large business will be done by the company in the manufacture of moss litter, and, perhaps, eventually also in peat fuel. In the utilization of such dormant resources this company by its operations is really adding to the wealth of the community, and whether it can command success or not, it certainly deserves it.

THE GREAT LAKES AS A SENSITIVE BAROMETER. BY NAPIER DENISON, ESQ.,
TORONTO OBSERVATORY. [ILLUSTRATED.]

(Read February 6th, 1897.)

For many years fishermen and sailors upon our Great Lakes have noticed, with intense interest and curiosity, the rapid rise and fall of the water, most marked at the head of shallow lagoons, as at our Island, and have considered it to be an inexplicable phenomenon. While in the vicinity of Lake Huron last summer the writer's attention was attracted by what appeared to be a regular ebb and flow, at rapid intervals, at the mouths of rivers. At Kincardine, by means of a special float, a set of readings were taken, and a variation of level of over three inches obtained, averaging nine minutes (that is, eighteen minutes for a complete undulation); the float moving up stream at the rate of a mile and one-half per hour. Upon returning to Toronto, by permission of Mr. Stupart, Director of the Meteorological Service, a simple in-

FIG. 1.



strument was devised for automatically recording upon paper these peculiar oscillations, and was set up at the mouth of the Humber river.

The following is a brief description of this instrument (Fig. 1). It consists of a recording cylinder 24 inches in circumference and six inches wide, placed horizontal-

ly, which by means of clockwork completes one revolution every 24 hours, the hour intervals being, therefore, each one inch. Resting upon this cylinder is a self-inking pen, attached to an arm, which slides freely upon a horizontal tubular guide. To one side of this arm is fastened a silk line, which is attached to and wound several times around a small, grooved pulley, which is part of one-fourth its diameter. Upon the grooved circumference of the larger pulley is fastened another line, which, after several turns around it, passes down through the case to a float, enclosed in a special shaft, so constructed as to admit the water only through several small holes, and thus to prevent any sudden movement of the float being caused by local wave motion. To the other end of the sliding arm is fastened another line, which, after passing over a small grooved pulley (shown at the left of the illustration), descends through the case, and has attached to it a weight sufficient to balance the float. The record is obtained in the following manner: As the float rises and falls, the pen correspondingly moves up and down upon the paper, which is revolving at the rate of one inch per hour.

The ratio of movement between pen and float is as 1 to 4, so that an actual rise of one inch of water level corresponds to a movement of one-fourth of an inch upon the paper on the cylinder. To facilitate the measuring of these traces, one-quarter inch squared paper is used, the vertical lines marking fifteen-minute intervals, and the horizontal, one inch change in water level. To prevent the water from freezing in the shaft during the winter months, oil was used, which had the effect of depressing the water level below the frost line.

In order to increase the value of these records, a similar instrument was set up at the Burlington Canal last September. Before bringing before you some interesting tracings taken from these instruments, permit me to summarise previous investigations in other countries.

This phenomenon had been noted by Duillier as early as 1730, upon the Swiss lakes, where it obtained the name of *seiche*, owing to the apparent "drying up" or recession of the water upon one side of the lake, when rising at the other. In 1779 De Saussure remarks that he believes local variations in the air pressure may be the cause. In 1804 Vaucher published his researches on the subject. His conclusions are briefly as follows:—

- (1) *Seiches* more or less considerable occur in all lakes.
- (2) They occur at all seasons and at all hours, but most frequently in spring and autumn.
- (3) The condition of the atmosphere is the governing cause; the more settled this is the less are the *seiches*, and the more variable it is the more marked are they.
- (4) Although most frequent in spring and autumn, the greatest oscillations usually occurred in July, August, or early in September.
- (5) Although the duration of these *seiches* is extremely variable, their intervals do not exceed 20 to 25 minutes, and are frequently less.
- (6) They varied much in amplitude at different points on the lake shores, being on the Lake of Geneva greatest at the mouth of the Rhone.

Vaucher supposed that the atmospheric pressure diminished over one part of the lake, while over another it remained constant or increased. If this change in pressure, occurred suddenly, the water which had thereby been set in motion would not come to rest again until after a number of oscillations.

Professor Forel agrees with this theory, which has also been accepted by Studer, Meyer and Favre. From 1854 to 1856 an important series of observations were made by six observers, placed at different points on the shore of Lake Geneva, who, using a system of signals to warn each other of the approach of an oscillation, noted the variations of the barometer and of the lake level. As Professor Forel in his article entirely disregards these barometric observations, they do not appear to have been published. In 1870 Professor Forel studied the *seiches* at the

Harbour of Morges, upon Lake Geneva, and obtained a mean of 4 min. 24 sec. for their total duration. At Geneva Vaucher's observations give a mean duration of 26 1-2 minutes. De Saussure and Duillier refer to seiches of 1 1-2 metres in amplitude, and M. Venie mentions one at Geneva of 2.14 metres, but usually they vary from about four inches to one foot. He (Forel) suggests that these are not true waves or progressive undulations of the water surface, but a movement of "oscillation of balance," or fixed oscillation, which may be both longitudinal and transverse. (*Archives des Sciences Naturelles*, Geneva, 1874.)

In 1876 Forel set up an automatic instrument to register these movements, and from records extending over four months, he deduced the existence of three varieties; intermediate, duration 25 minutes.

Upon this instrument he also observed movements of what he terms "vibration," caused (1) By steamers. The interval between these is from 9 to 60 times greater than that between ordinary waves, and they preceded the approach of a vessel by about 25 minutes, or when it was 9 1-2 kilometres distant, continuing for two or three hours afterwards.

(2) By wind, having no regular time or rhythm, and varying in amplitude from nothing to 10 millimetres, and in duration from 45 seconds to three or four minutes. He remarks that "sometimes there are little or none with a strong wind."

It may be mentioned that Guthrie has experimented upon this movement of oscillation, or balance in water, using, however, vessels in which the depth exceeded half the length, thereby eliminating the influence of depth altogether. (*Proceedings Phys. Soc.*, Vol. I., 1875).

Lord Kelvin gives a theoretic law for the duration of these seiches in any lake, viz.: the semi-period of an oscillation is equal to the time that a body, travelling at the rate which it would acquire in falling from a height equal to half the mean depth of the lake would take to traverse the length of the lake. Thus, the duration of a seiche is proportional to the length of the lake, and inversely proportional to the square root of its mean depth. (*Archives des Sciences Naturelles*, Geneva, 1876). Applying this to Lake Ontario, and assuming the mean depth to be 300 feet, we obtain a theoretical duration for a longitudinal seiche, of over five hours. As will be shown later, the mean interval between the longest undulations, as taken from the Humber traces, is about 4 hours and 49 minutes.

In 1880 Professor Forel, in a letter, states that the smaller and more rapid oscillations may be accounted for by dividing the lake surface into more than one nodal point. (*Archives des Sciences Naturelles*, Geneva, 1880).

That you may more fully understand the following illustrations, it is necessary to become somewhat familiar with the movements of the upper atmosphere, where the chief cause of these lake oscillations is to be found. Permit me to quote a few lines from the late Professor Helmholtz, of Berlin (although previously cited in an earlier paper), who made a special study of atmospheric waves from theory, and analogy with ocean waves: "As soon as a lighter fluid lies above a denser one, with well-defined boundary, then, evidently, the conditions exist at this boundary for the origin and regular propagation of waves, such as we are familiar with on the surface of water. This case of waves, as ordinarily observed on the boundary surfaces between water and air, is only to be distinguished from the system that may exist between different strata of air, in that in the former the difference of density of the two fluids is much greater than in the latter case. Since the moderate winds that occur on the surface of the earth often cause water waves of a metre in length, therefore the same winds, acting upon a stratum of air of 10 degrees difference in temperature, maintain waves of from two to five kilometres in length. Larger ocean waves, from five to ten metres long, would correspond to atmospheric waves of from thirteen to thirty kilometres, such as would cover the whole sky of the observer, and would have the ground at a depth below them less than that of one wave-

length." He also states that "waves of smaller and smallest wave-length are theoretically possible."

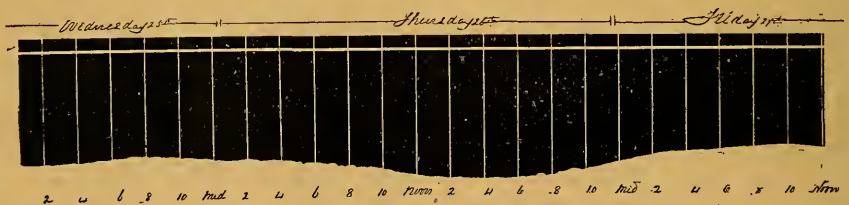
His theory is borne out by observations taken at the Blue Hill Observatory, near Boston, by Mr. Clayton, who has found that the larger waves, as marked upon the barograph traces, have a maximum frequency with northeasterly winds, and a minimum frequency when the wind is from the south-west, and also that the greatest number occur during the winter months.

Too much importance cannot be placed upon the above statements, as they are likely to prove of inestimable value in helping us to a better knowledge of the mysterious forces at work in the upper atmosphere.

In the accompanying diagram the upper, or poleward current, is represented as moving approximately from the south-west to the north-east, in its spiral course around the globe. Its average velocity is 60 miles per hour in summer, which increases to 112 miles per hour during the winter months.

The heavy lines indicate the lower stratum of air as travelling in an opposite direction to the upper current, which would be the case during the approach of a storm from the south-west. At the upper surface of this lower stratum huge atmospheric waves, or billows, are set up, due to the rapidly moving, opposing, upper poleward current of a lesser density. The influence of these huge waves often extends to the earth's surface, where they have been recorded upon barograph traces. The lighter lines represent a second form of wave movement in the lower stratum of air (say cumuli level), caused by the two subsidiary strata of the lower air travelling at different velocities and directions to one another, as is often observed during the approach of an important storm centre. These waves also extend to the earth's surface, where the larger ones are found recorded upon the barograph traces as short and rapid oscillations. These are well shown upon the Observatory photographic trace, now before us (Fig. 2), which is a record during

FIG. 2.

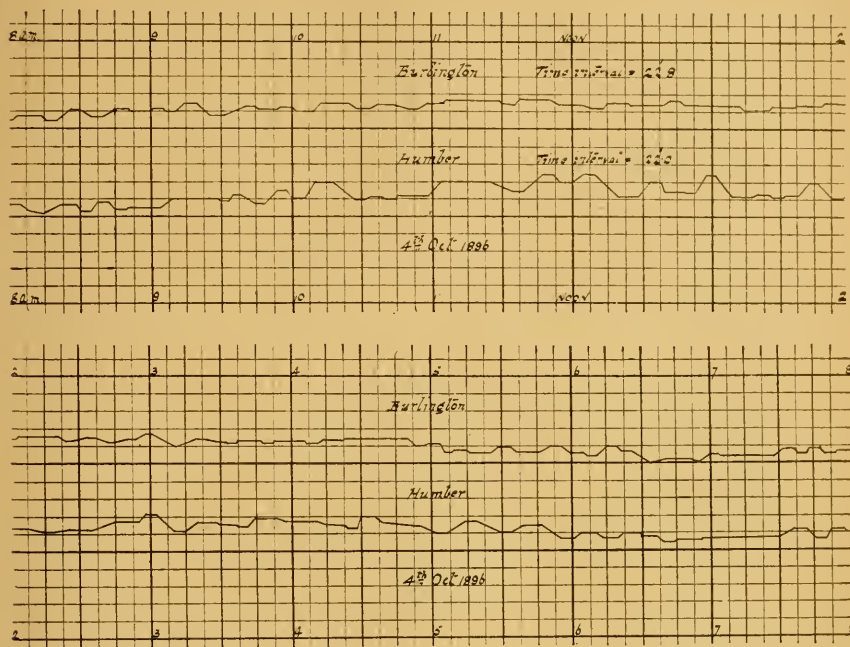


the approach of a storm from the south-west, upon which you will observe the larger undulations begin before the barometer falls, and are evidently caused by huge billows, set up at the boundary surfaces of the upper poleward current and the lower air stratum, which, owing to the position of the storm centre, would be rapidly moving in opposite directions. As the storm approached the undulations become more rapid, with a marked time interval of 10 minutes. These appear to correspond with the waves set up along the still lower, or cumulus level. As well as from the barometric record, the existence of these atmospheric waves, under certain conditions, may often be observed in the formation of the clouds above us; for instance, during fine, anti-cyclonic weather, one has frequently noticed great parallel bands of cirri appear in the west, and rapidly extend eastward, in advance of a cyclonic area, then over the Southern States. These represent the crests of the larger billows mentioned by Helmholtz, and are caused by the lower, denser stratum of air being forced up into a lighter and colder level, where condensation takes place. The following illustrations plainly demonstrate the existence of air waves found along the cumulus level. These forms, no doubt, are familiar to all present.

and, as you will observe, in the second one they are of such a regular character as to be commonly termed "roll cumulus."

Let us now examine the Burlington and Humber records for the 4th of October, 1896 (Fig. 3), during fine settled weather throughout the continent, plotted upon the same time sheet.

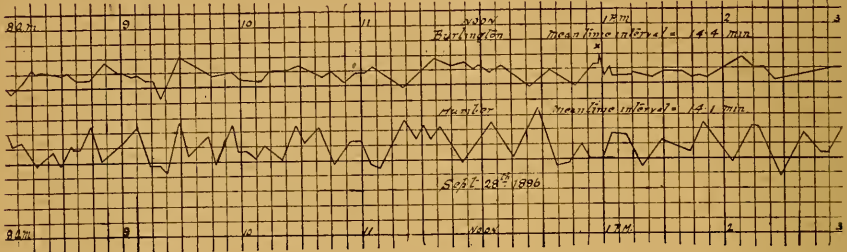
FIG. 3.



measured vertically, correspond to one inch change of water level, and, horizontally, to every fifteen minutes of time. It is interesting to note, not only the marked coincidence of these undulations, but the agreement of their time intervals, viz.: 22.8 and 22.0 mins. The greater amplitude of the Humber trace is due to the configuration of the adjacent shores and shallowness of the Bay. To obtain an idea of the prevailing atmospheric conditions, let us look at the morning and evening synchronous weather charts for this day. At 8 a.m. you will observe an important high area over Northern Ontario, while to the west of Lake Superior there is a well-defined area of low pressure. The weather is fine, and the direction of the wind northerly, throughout the lake region, but immediately to the westward the winds are from the southward. At 8 p.m. the high area has moved eastward, while the western low is dispersing over Lake Superior. As the winds have become southerly, the upper and lower strata of air are moving approximately in the same direction, therefore, according to Helmholtz, the upper atmosphere should be in an undisturbed condition. As a fair type of rapid undulations upon the lakes, during light winds and fine weather preceding a severe storm, let us take the Humber and Burlington traces from 8 a.m. to 3 p.m. of the 28th of September, last (Fig. 4). Here, again you will observe a decided coincidence between the two traces, and a wonderful agreement of time intervals, being 14.4 and 14.1 minutes respectively; also, the oscillations are much more rapid than when preceding settled weather. The movements upon the Humber instrument appear to be about double those upon the Burlington one. On the latter trace at 1 p.m. a peculiar rapid rise and fall of over an inch is seen, due to the passage of the Hamilton boat. In fact all vessels, large

and small, are duly registered upon this instrument. You see by this chart for 8 a.m. of the 28th that the centre of the storm which is causing these violent lake undulations is over the State of Florida, a distance of 1,300 miles from Toronto.

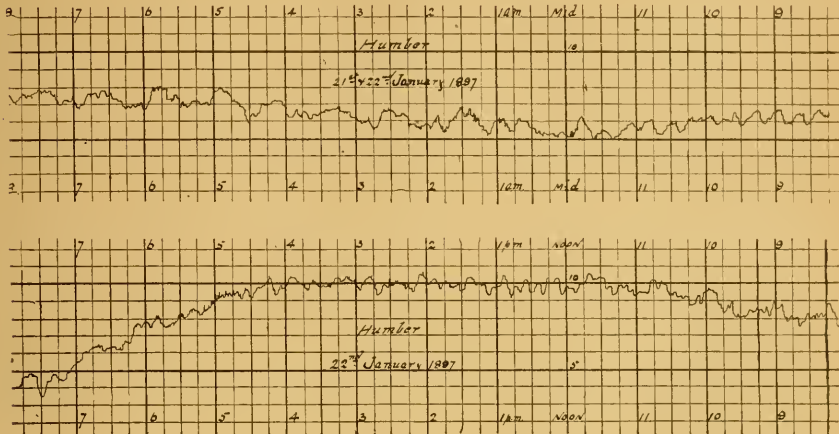
FIG. 4.



The lowest isobaric line, when drawn to tenths of an inch within this disturbance, was only 29.90, but owing to this time of year being favourable for the northerly movement of West India hurricanes, a careful watch was kept upon it by our forecast officer, who, finding after completing the 8 p.m. chart a slight development of this depression, warned all our lake stations for a heavy easterly gale. This chart for 8 a.m. of the 30th of September shows how the storm centre travelled slowly but directly to the lake region, where it caused a severe gale and a heavy general rainfall. To illustrate the value these lake instruments are likely to prove when studied in conjunction with the daily weather chart for assisting in the successful forecasting of precipitation as well as wind storms, let us examine the chart for 8 p.m. of the 19th of January last. Approaching the lake region from the north-west is a well-defined low area (centre about 29.70), while to the far south-west there is what appears to be a minor depression (centre about 30.00). Under such conditions it would be of great value to know if this latter area were going to develop and move towards us, as then it would be an easy matter to predict easterly winds with precipitation for the lake region, while, on the other hand, one would base their prediction upon the approaching north-west low, which usually gives southerly winds and fair milder weather. In this case, upon looking on the chart for 8 a.m. next day, you will observe the south-western low had developed, and was rapidly moving up the Mississippi valley, while the north-west low was quickly dispersing. The 8 p.m. chart for the 20th shows a still further development of the southern low, which has moved to the State of Ohio (centre, 29.70), while the northern depression appears to have completely dispersed, or to have been absorbed by the former. At 4 p.m. of this day it began to snow, and continued till next morning, when over six inches had fallen at Toronto, and a general snowfall prevailed throughout the lake region. A few days later, upon receiving the Humber records, marked abnormal oscillations were noticeable during the night of the 19th; also similar but minute undulations were found upon the Observatory photographic barograph trace. These records prove that, although the surface air was moving from the south, the upper or boundary surface of the lower air was rapidly moving southward, that is, in opposition to the superincumbent upper poleward current, therefore causing atmospheric waves or billows upon its boundary surface of sufficient magnitude to disturb the air nearest the earth. These lake records appear to prove conclusively, some time before the ordinary mercurial barometer and direction vane showed the change, that the southern low area was developing and the northern one dispersing. As the atmospheric conditions for the next few days are very much disturbed, and are followed by a most pronounced anti-cyclone and great cold in the North-west Territories, which eventually extended to the lakes, we shall look at a sequence of weather charts in conjunction with some very interesting Humber records. As

will be seen (Fig. 5) the trace began to rise at midnight of the 21st, and continued till noon of the 22nd, when it had risen over five inches : during this period large undulations of forty-five minutes' interval and from one and a half to two inches in amplitude are very marked. From noon to 4.15 p.m. the water level remained

FIG. 5.



stationary, while the oscillations became more rapid ; then the water commenced to fall quickly, reaching its lowest point, a distance of nine inches, at 9.30 p.m., that is, in five hours and fifteen minutes. From this hour you will observe a decided undulatory curve, not merely due to the small rapid oscillations, but marked large undulations, whose average height from trough to crest equals three inches, with a mean time interval between crests of four hours and forty-nine minutes. (Fig. 7.) As previously stated, these appear to be the longitudinal "seiches" for our lake. From a careful study of the lake records from their beginning in July last this phenomenon is not to be found except at a time preceding or during tremendous atmospheric disturbances, similar to those at which we are about to look. In the present case this curious phenomenon lasted for three days, and was the precursor of a heavy northerly gale, which at this time of the year also means intense cold.

Let us hurriedly look at the weather charts during this period. At 8 p.m. of the 21st the low area which had given us snow had moved eastward, causing a snowstorm throughout the Maritime Provinces, while another depression lay east of Manitoba. In the far North-west an important high area, or anti-cyclone, had appeared. Qu'Appelle reported 10 degrees below zero and a heavy gale blowing. The water of the lake began to rise at midnight. By 8 a.m. of the 22nd the storm centre was over the State of Michigan, causing a high southerly wind with snow throughout Ontario, while the North-west anti-cyclone had developed and extended eastward, Winnipeg reporting 18 degrees below zero and a gale of forty miles per hour.

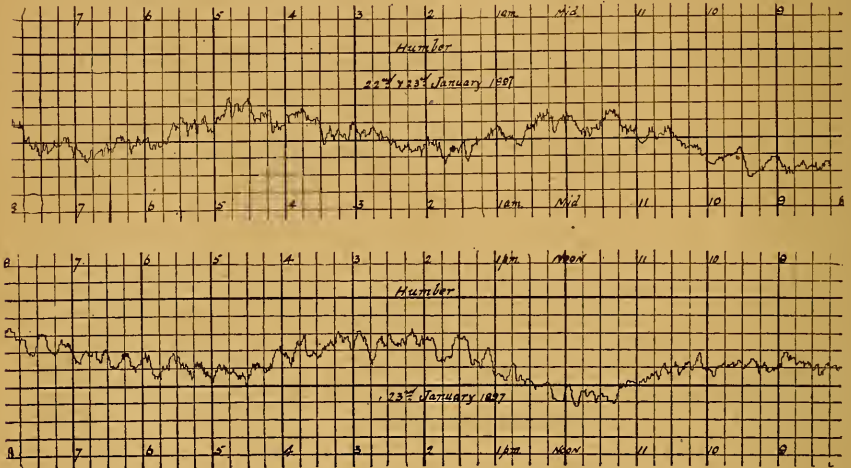
At 8 p.m. of the 22nd the wind was westerly in the lake region, but blowing a heavy gale. At 9.30 p.m. the water had reached its lowest point. At this hour these large undulations, or longitudinal "seiches," appeared, and were noticeable during the following three days. In the North-west the pressure was increasing and the temperature falling, while a heavy north-westerly gale prevailed from Manitoba to the lake region.

At 8 a.m. of the 23rd a north-westerly gale still was blowing over Ontario, while in the North-west the barometer had risen to over thirty-one inches, and the temperature fallen to 40 degrees below zero.

At 8 p.m. of this day Medicine Hat reported 52 degrees below zero. On the 24th and 25th the cold wave, though greatly diminished by lake influence, had reached Toronto, giving a minimum temperature of 8 degrees below zero.

After carefully measuring and tabulating the duration of the larger wave intervals taken from a great number of these lake records, it was surprising to find a

FIG. 6.



marked 20-minute interval. There appears to be a correspondence between these time intervals and those marked upon the barograph records for the same period.

Professor Forel suggests that the smaller, and more rapid oscillations observed upon the foregoing traces, may be due to the lake surface becoming divided into many nodal points of rest, similar to the nodes upon a violin string, when set vibrating. Although these researches cover too short a time to make any definite assertion, there seems to be a wonderful correspondence between the lake waves, as recorded at the Humber, and those found upon the Observatory photographic barograph traces. To illustrate this, let us look at the Humber record, plotted with the photographic barograph trace, during a thunderstorm on the 29th of July last. Here you will observe a marked coincidence between the two; that is, as the atmospheric pressure varied, so did the water rise and fall. The smaller and more rapid movements are not recorded upon the barograph, as it is not sufficiently sensitive. The sudden fluctuations and great range of water level preceding and during thunderstorms, are almost beyond conception until graphically shown, as before us. Here you will note, shortly after 4 p.m., a rise of water of five and a half inches in six minutes, followed by a fall of six inches in five minutes; the rise almost exactly corresponding to the crest of a decided barometric wave. This certainly points to local action, which would not be of sufficient extent to set the whole surface of the lake into multi-nodal vibrations.

These peculiar oscillations appear to be probably due to the action of atmospheric waves or billows, in passing over the surface of the lake, which tend to form minute undulations upon the surface, corresponding in length to these billows, and as they move farther into the bay, become magnified as they reach narrower and shallower portions, until, finally, they assume the proportions recorded upon the instrument. If not thus, how are we to account for the secondary undulations found upon the ocean tide gauges situated at the end of bays, where the shores cannot encircle the disturbed body of water, save at three sides at most? (1)

(1) "A Probable Solution of the Secondary Undulations Found Upon Tide Gauges." Read 16th January, 1897. *Supra*, p. 28.

As neither the ordinary mercurial nor aneroid barograph is sufficiently sensitive to record the more rapid and smaller atmospheric waves, I have devised, by Mr. Stupart's permission, a simple form of self-recording air barometer, which is seventeen times more sensitive. Most interesting results are now being obtained from this instrument, which may furnish material for a future paper.

To form some idea how sensitive even the photographic barograph is, you will notice two large and well-defined atmospheric undulations upon the trace before us. These are due to a great atmospheric wave, which was formed over Krakatoa, in the Indian Archipelago, during the tremendous eruption there, which caused such fearful loss of life and property in its vicinity. This catastrophe is vividly recalled to our memory by the brilliant red sunsets observed here for many months afterwards, caused by the volcanic dust in the air. This wave reached Toronto in fourteen hours, on its way to the antipodes of Krakatoa, from whence it was reflected back, repassing Toronto on its return, 8 hours and 20 minutes later. It was reflected back and forward, between its point of origin and antipodes, several times, leaving in all seven traces upon our barograph record.

Finally, permit me to draw a few conclusions in connection with what has been brought before you to-night. Meteorologists are unanimous that further advance or improvement in weather forecasting is not to be expected without a better knowledge of the movements of the upper atmosphere. The foregoing investigations seem likely to prove of service in this direction. In connection with the international system of cloud observations, now being carried on throughout the world, interesting and useful results might be obtained by careful observations of the undulatory forms assumed by clouds, and probably due to atmospheric billows, of the kind to which reference has been made to-night.

Since these peculiar undulations almost certainly occur upon all waters and lakes, large and small, if simple instruments, similar to that in use at the mouth of the Humber, were placed at several points on the shores of our great lakes; or, still better, if it were possible to have them in different parts of the world, and especially along a western seaboard, such as that of Great Britain, or our own British Columbian coast, results of great interest might be expected, and our knowledge of the extent, direction, and rate of movement of these atmospheric waves very greatly increased.

Fishermen also would find such instruments of great service, since their records furnish approximate indications of the probable force and direction of an approaching high wind. Already, those fishermen who live near the Humber have learned the advantages of consulting the records before going out to set their nets. A rise of the water level at the west end of the lake precedes, by many hours, the arrival of an easterly storm; as, on the other hand, a coming westerly wind is marked beforehand by a fall.

These phenomena are evidently due to differences of barometric pressure over the extremities of the lake, although, of course, at a later stage, the change of level is augmented by the direct action of the wind.

MINERALOGICAL NOTES ON SUDBURY ANTHRACITE. BY G. R. MICKLE, B.A.

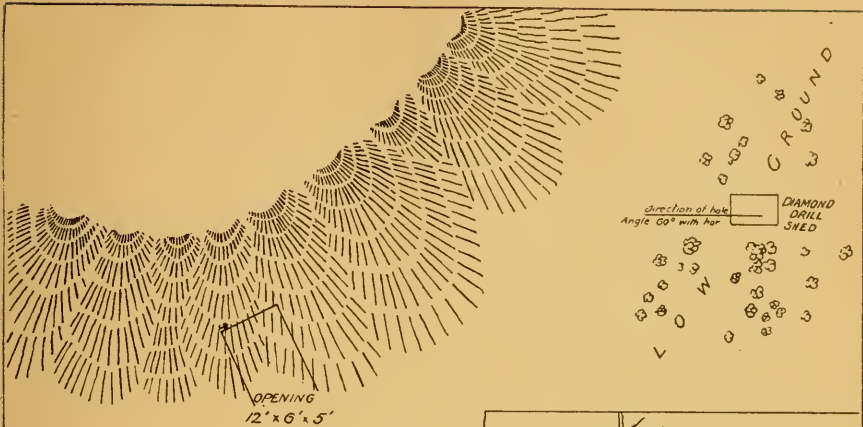
(Read February 27, 1897.)

On the map of the Sudbury District, published by the Geological Survey Department, an oval area about 8 miles wide and 30 miles long will be observed. This oval area is made up of a central part of "dark argillaceous and gritty sandstones" and a border of "blackish, siliceous volcanic breccia and black slate in places." The rocks found in this area are possibly Cambrian, but no fossils have been found to determine the age definitely. The deposit, or vein, which will be here described, is in the border. Another deposit or vein has been found about five miles further west, near the shore of Vermillion Lake.

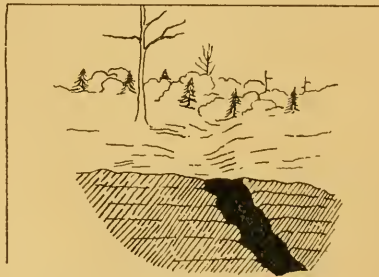
The writer's attention was first called to this occurrence of coal-like substance early in June last year, when he made some preliminary tests on this peculiar mineral, which showed that it acted like anthracite. Shortly after this the surface soil was stripped off, and when visited by the writer, early in July, there was a considerable quantity of this mineral in sight. During the summer the vein was uncovered for about 70 feet, the average width being probably about 9 feet. The strike is about N. 20 degrees W., and the dip apparently about 45 degrees to E. Intermixed with the coal there is in places a considerable amount of quartz, and occasionally a little iron pyrites. The quartz forms, sometimes, a network, in which rectangular fragments of coal are imbedded; in other places the coal is almost free from quartz. If one of these rectangular fragments is partially burnt, and then examined by a glass, minute veins of quartz can be seen traversing it.

The mineral has a lustre like anthracite, only higher. Its hardness is between 3 and 4. This is considerably harder than ordinary anthracite, which is given as 2—2.5. The specific gravity, as determined by Mr. Lawson, is 1.865, the specific gravity of anthracite being 1.4—1.7; the average of ten commercial samples from the western middle coal fields of Pennsylvania was found to be 1.658; from the other coal fields of that State it was less (Penn. Geol. Survey, 1895, p. 1929). Some Rhode Island anthracite has specific gravity 1.81 (Dana). A mineral closely resembling this one was found in the Huronian formation near Lake Onega, in Russia. The lustre is described as adamantine metallic; hardness, 3.5-4; specific gravity, 1.84, and chemical composition similar to the Sudbury mineral (Naumann Mineralogie). The hardness and specific gravity of this interesting mineral from Sudbury are, therefore, on the extreme outer limit of anthracite. Another coal-like substance, which is shown in the sketch, is classed by Mr. Miller, of Kingston, as anthraxolite. Mr. Miller says: "The anthraxolite which I sent was collected by me 'in situ,' about six miles north of this city. It occurs in a vein which has been worked for barite on the farm of John Woodruff, the north part of lots 16 and 17, in fourth concession of the Township of Kingston. The vein, which is nearly vertical, is about 2 1-2 feet wide, and cuts the limestone of the Black River formation of the Silurian system. This limestone is very fine grained, and lithographic in character, and forms a comparatively thin layer over the Laurentian gneiss, which is exposed at places in the valleys. The most abundant mineral in the vein is barite, but calcite and fluorite are also found, as well as anthraxolite. This vein can be traced across country for over one and a half miles in the limestone; it is, however, not found in the valleys where gneiss is exposed.

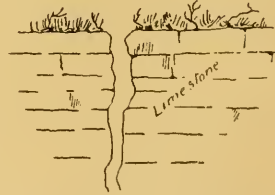
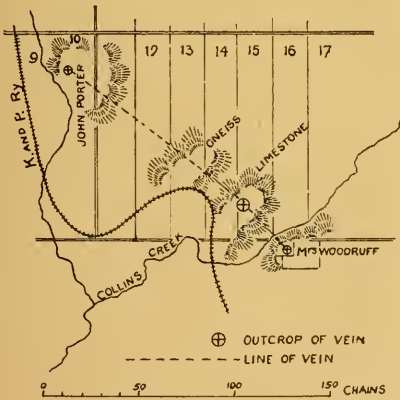
The anthraxolite has been deposited after the barite and other minerals, as it coats them and fills crevices in them. It is probable it has been derived from the



OUTCROP OF COAL
LOT 10 CON. 1. BALFOUR



SKETCH OF OUTCROP AND SECTION OF VEIN



SECTION OF BARITE VEIN AT WOODRUFFS

bituminous matter in the limestone. Crystals of fluorite in the Niagara limestone have been found which enclosed small amounts of petroleum."

This anthraxolite of Mr. Miller's has a duller lustre than the Sudbury mineral, has conchoidal fracture, and resembles bituminous coal more in appearance. It is considerably softer than the Sudbury mineral; its specific gravity is 1.365, and, chemically, it is entirely different. The anthraxolite described by Chapman is "black, lustrous, resembling anthracite in general characters, but very brittle. H. 2.25—2.5; specific gravity, 1.35—1.55; generally decrepitates when heated B.B., a small fragment loses its lustre, but exhibits no further change. Composition essentially carbon, with from 3 to 5 per cent. volatile matter, including a small amount of moisture. The ash, as at present observed, varies from 0 to 10 per cent. When present it exhibits under the microscope no trace of organic structure. This substance, in all probability a product of alteration from petroleum or asphalt, occurs in narrow veins in rocks of various kinds, and in small masses and thin layers or coatings in strata of the Utica and other formations. * * * As it differs essentially by these conditions of occurrence from anthracite proper, the name anthraxolite has been given to it, but simply as a convenient term for present use." (Chapman, *Min. and Geol., Ont. and Que.*, 3rd ed., p.143.) The Kingston mineral is evidently the anthraxolite of Chapman. An analogous occurrence of coal in a vein and not in a bed, and which shows no trace of vegetable origin, is the well-known Albertite of New Brunswick, in appearance, specific gravity and chemical composition widely different from the Sudbury coal. Messrs. Bailey and Ells say in their report: "There can, we think, no longer exist a doubt that the deposit here so extensively worked is a true vein, occupying irregular fissures among highly disturbed strata, and in no way presenting any analogy to an ordinary coal bed." They regarded Albertite as an altered petroleum. This Albertite was discovered in 1849, had its maximum production in 1863-5, when 17,000 tons were produced annually, and in 1876-7 was producing 6,000 tons; the depth was then 1,260 feet, and a trial hole put down 100 feet further showed its continuance. In extent the vein was 2,800 feet long, and was very irregular in size, thickening from a few inches to ten or fifteen feet in a few yards, and much fractured and broken by faults. (*Geol. Sur. Rep.*, 1876-7, pp. 368-388.)

With regard to the origin of the Sudbury anthracite, which occurs in quantities which compel attention, its presence in rocks which are supposed to belong to the Cambrian period, and in which no fossils or traces of vegetable remains have ever been discovered, is very surprising, and cannot be accounted for by the usual theory of the formation of coal from vegetable matter. There are two absolute facts which should be kept in mind, and our theories should be moulded to suit them. In the first place, this mineral occurs certainly in quantities of some hundreds, probably thousands, and possibly an indefinite number of tons; and secondly, the chemical analysis and physical characteristics agree with some anthracites closely; it has, in fact, become more anthracitic than most anthracites. The conclusion which is inevitably forced upon one is that coal can be formed in some other way than by decomposition of vegetable matter. Possibly the development of these veins or deposits will throw some light on this subject.

NOTE.—The sketch of the Sudbury deposit or vein was made by Mr. J. W. Evans, and the sketch of the Kingston vein by Mr. W. G. Miller.

CHEMICAL NOTES ON THE SO-CALLED SUDBURY COAL. BY W. HODGSON ELLIS, M.A., M.B., AND WM. LAWSON, B.A.SC.

(Read February 27, 1897.)

Prof. E. J. Chapman has described (Canadian Journal, Vol. X., p. 410) a vein of anthracite from the lower copper-bearing rocks of Lake Superior, an analysis of which gave :

Moisture	2.08
Volatile matter	3.56
Fixed carbon	94.36
Ash	0.00
	100.00

In his "Minerals and Geology of Central Canada" Chapman applied the name "Anthraxolite" to this and similar substances occurring "in veins, with quartz, in the altered strata of Lotbiniere, in the Eastern Townships, and also in regularly banded veins with quartz and iron pyrites on Thunder Bay, Lake Superior" and elsewhere. He regarded it, probably justly, as a "product of alteration from petroleum or asphalt."

In Bulletin No. 2 of the Ontario Bureau of Mines on "Anthracitic Carbon, or Anthraxolite," Dr. A. P. Coleman describes a coaly deposit occurring in a vein in slate in Balfour Township, near Sudbury, to which he applies Chapman's name of Anthraxolite.

We have received specimens of this substance from Mr. Blue, Director of the Bureau of Mines, from Mr. J. M. Clark, from Dr. Coleman, and from Mr. G. R. Mickle, which we have submitted to chemical examination. The samples differ greatly with regard to the amount of minerals, chiefly quartz, with a little iron pyrites, associated with the coaly substance, on which account the ash varies greatly. We found 36.5 per cent., 30 per cent. and 20 per cent. of ash in different samples given us, otherwise the composition of the substance is quite uniform.

The following is the proximate analysis of an average and of a selected sample :

	Average.	Selected.
Moisture	4.00	4.00
Volatile matter.....	1.30	1.80
Fixed carbon	74.20	90.10
Ash	20.50	4.10
	100.00	100.00

We have also made an ultimate analysis of a carefully-picked specimen, freed as much as possible from associated quartz, etc. The following are our results :

	I.	II.	Mean.
Carbon	94.90	94.94	94.92
Hydrogen.....	0.55	0.48	0.52
Nitrogen	1.04	1.04	1.04
Sulphur	0.30	0.33	0.31
Ash	1.54	1.50	1.52
Oxygen, by difference	1.67	1.71	1.69
	100.00	100.00	100.00

The specimen contained 2.48 per cent. hygroscopic moisture. Its specific gravity was 1.865.

The combustion was made in a current of oxygen, the nitrogen was determined by Dumas' method, and the sulphur by Nakamura's method.

The striking characteristic of the mineral, as shown by this analysis, is the very small percentage of hydrogen it contains, a quantity much less than that contained in ordinary anthracite.

With a view to comparison we made an analysis of a specimen of anthraxolite from Woodruff's farm, near Kingston, kindly given us by Mr. W. G. Miller, of the Kingston School of Mining. The specific gravity of this mineral was 1.365; it contained 0.96 per cent. of moisture. The analysis of the dry substance gave :

	I.	II.	Mean.
Carbon	90.27	90.23	90.25
Hydrogen.....	4.18	4.14	4.16
Nitrogen	0.52	0.52	0.52
Sulphur.....	0.66	0.66	0.66
Ash	0.63	0.80	0.72
Oxygen, by difference	3.74	3.65	3.69
	<hr/>	<hr/>	<hr/>
	100.00	100.00	100.00

In this sample the percentage of hydrogen is higher than in most anthracites, and very much higher than in the Sudbury mineral, which, indeed, differs from it as much as the average anthracite differs from bituminous coal.

We have determined the calorific value of the Sudbury "coal" by means of Fischer's calorimeter. We found that one gramme of a sample containing 3.99 per cent. of ash gave on burning 7,490 calories. This will give a calorific value of 7,800 for the ashless fuel.

On the large scale, so far as the deposit has yet been examined, the ash runs from 20 to 30 per cent. The calorific value will, therefore, be correspondingly lower.

THE CONSTRUCTIONS WITH REFERT AND INTEREST. BY PROF. A. J. BELL,
PH.D.

(Read February 28th, 1897.)

The constructions in question are thus described in "Allen and Greenough's Latin Grammar":

"The impersonals *interest* and *refert* take the genitive of the person, rarely of the thing, affected,—the subject of the verb, being a neuter pronoun or a substantive clause, as *Clodii intererat Milonem perire* (Cic. in Mil., 21).

(a) Instead of the genitive of a personal pronoun the corresponding possessive is used in the *ablative singular feminine* after *interest* and *refert*: as *quid tua id refert?*—*magni* (Ter. Ph.); *vehementer intererat vestra qui patres estis* (Plin.).

(b) The accusative with *ad* is used to express the thing with reference to which one is interested: as *magni ad honorem nostrum interest*" (Fam. XVI. 1).

The question is: How is it that, while the person interested is expressed by the genitive of the substantive in *Clodii interest* or *eius refert*, it is expressed by the ablative singular feminine of the possessive adjective in *mea interest* or *tua refert*, while the thing concerned is expressed by the accusative with *ad* in *ad honorem nostrum interest?* Indeed, the question is really somewhat more involved; for in the last construction, instead of the accusative with *ad* we find the dative: as in *non referre dedecori* (Tac. Ann. 15.65.), and the dative is also used instead of the genitive to express the person interested: as in *quid refert intra naturæ fines viventi* (Hor. Sat. I. 1. 49.). Indeed the distinction given regarding persons and things, while the rule, is not universal: cf. *multum interesse rei familiaris tuæ* (Cic. ad Fam. 4. 10. 2.) with *quid id ad me aut ad meam rem refert* (Pl. Persa. 513), and in this inquiry we may disregard this distinction. There is, as yet, no agreement among grammarians about the solution of this question, though what seem to me to be correct solutions of the main difficulties involved have been stated or suggested by some of them.

Of the constructions mentioned above, those represented by *mea refert* or *mea interest* and *illorum refert* or *illorum interest* have always been felt to be the cardinal ones, those on the solution of which a correct understanding of the nature of the remaining constructions depends. And first let us notice some of the solutions that have been proposed. Donatus, whose grammar was the text-book of the Middle Ages, in a note on *Quid tua, malum, id refert?* (Ter. Ph. 753) suggests that *tua* is for *ad tua*; and his explanation is evidently based on the idea naturally occurring to anyone who examines these constructions, that, whatever constructions are in fact found with *refert* and *interest*, the dative is the case we should expect to find dependent on them. But in Donatus' day, in the first half of the fourth century of our era, in ordinary thought and conversation the dative had in all likelihood been supplanted by the accusative with *ad*, the construction that takes its place in the Romance Languages. A like view seems to have been in the mind of Scaliger, when he explained *tua nil refert* as equivalent to *tuas res non repræsentat*, i.e., *affert*. Sanctius, the famous Jesuit grammarian, and Ruddiman agree in thinking *tua* here an accusative; but Sanctius prefers to make *mea interest*, the more usual form of expression in Golden Latinity, his starting point, and explains it as equivalent to *est inter mea*. Vossius and Bentley showed that *mea* here could not be the accusative as the *a* is long, and the view was abandoned. It was revived, however, in our day by Emanuel Hoffmann, who, in a paper in the *Jahrbuch für Philologie* for 1878, suggests that *mea interest* is equivalent to *est inter mea*, and explains *interest omnium* as equivalent to *est inter omnium*, proceeding from a consideration of such phrases as *in Dianæ, ad*

Carmentis,—phrases in which he would not supply an accusative. But the quantity of the *a* in *mea* seems fatal to his view.

Priscian thinks of *mea* in *mea refert* as ablative, and would supply *in re*, making the full construction *mea in re refert* equivalent in meaning to *in mea utilitate refert*. In this he is followed by Valla, but Sanctius denies that *mea in re* can have this meaning; and Vossius, who thinks with Priscian that *mea* is ablative, prefers to supply *causa* or *gratia*. Later supporters of the view that *mea* is ablative—such as Reisig, Krueger and Schmalz—recognize that in the first syllable of *refert* the *e* is long, and that it is properly written as two words, *re fert*; and from the analogy of the Plautine phrase, *e re mea* “to my advantage,” they explain *mea refert* as for *e mea re fert*, “it bears to my advantage.” This explanation, which is the one now usually adopted, while it is a possible one, has no support from the ancients, and affords no explanation for the constructions in *refert viventī* or *ad me refert* quoted above.

A third explanation given by the Romans, and the oldest of all, is that found in Festus' Compendium of Verrius Flaccus' work, “*De Significatu Verborum*,” where we read (p. 282 M.) “*Refert cum dicimus, errare nos ait Verrius; esse enim rectum reifert, dativo scilicet, non ablativo casu; sed esse jam usu possessum.*” That is to say, in the phrase *mea re fert*, Verrius thinks *mea re* primarily a dative and equivalent to *mea rei*, but acknowledges that the words in question are—*jam usu possessum*—generally acknowledged to be ablatives, on account of their form, the identity of which with the ablative is obvious, while into their real and primary nature few pause to inquire. But Verrius was one of the few men who make it their business to inquire into the real nature of such phrases, and of all Romans who engaged in such investigations, his authority best deserves our attention. He lived in the reign of Augustus, who appointed him tutor to his grandsons, Gaius and Lucius Cæsar; and from the epitomes of his work, “*De Significatu Verborum*,” made by Festus and Paulus Diaconus, we can see that it was an exhaustive dictionary of Archaic Latin, made at a time when materials were best available for such a work. Gerard Vossius feels the weight of his authority, and is willing to acknowledge that *refert* may be for *rei fert*, being probably influenced by Cæsar's statement that the proper and usual endings of the dative singular in the fourth and fifth declensions is not *ui* and *ei*, as given in the compendia of later grammarians, and as written by later scribes, but *u* and *e*. But *mea*, Vossius thinks, cannot be the dative, and for this reason he rejects Verrius' explanation. But, in the light of the testimony afforded by older Latin inscriptions, Vossius' reason for rejecting this explanation becomes, it seems to me, our strongest reason for accepting it. In the first volume of the *Corpus Inscriptionum Latinarum* we find eleven instances of undoubted datives of the first declension ending, not in *ae*, but in *a*, as for example in *Fortuna dedi* or *matre matuta dono dedro*. W. M. Lindsay, in a paper in the *Classical Review* of December last, recognizes in old Latin two forms of the dative singular for *a* stems, represented by *Fortunai* and *Fortuna*, both derived from the primary *Fortuna + ai*, but for the differentiation of which he cannot account. So we find for *o* stems two forms of the dative in old Latin, *populoi* and *populo*, both derived from the primary *populo + ai*; but here it is the shortened form that has held the field. *Mea re* is, then, if we accept the testimony of Cæsar, and of the oldest inscriptions, as good a dative as *mea rei*; and *mea re fert* is, according to our oldest authority, equivalent to *mea rei fert*, “it bears to the advantage of my affair”; which is precisely the explanation of the meaning of the phrase now generally accepted, but attained without resorting to the Jesuit's trick of the ellipsis, and presenting us with a noteworthy confirmation of the latest view with regard to the form of the dative in Archaic Latin. This explanation seems to me, moreover, to be confirmed by some of the parallel constructions that are in use for *mea*, the ablative so-called. Horace, as we have seen, wrote *re fert viventī*, using an undoubted dative. As far back as Plautus we find, used as a substitute for the dative, the preposition *ad* with the accusative, which takes its place in the Romance languages. And it is

used as a substitute for *mea* in *mea refert*, for we read in Plautus, *quid id ad me aut ad meam refert* (Persa. 513). Two of the constructions, then, that can take the place of *mea*, in *mea refert*, are the dative itself and the ordinary substitute for the dative, a fact strongly confirming Verrius' view that *mea* here is itself a dative.

But what of the genitive with *refert*. It appears much later than the genitive with *interest*, belonging properly to Silver Latinity, while the genitive with *interest* is very common in the Golden Latinity of Cicero. No instance of a genitive, other than the genitive of value, is found in Archaic Latin in connection with *interest* or *refert*, if we except the following example in the Lex Acilia Repetundarum (C. I. L. 198. 32), *quod eius rei quaerundai censeant refere*, where the genitive *eius rei quaerundai* is certainly not parallel to that in *eius interest* or *illorum refert*, but seems rather a predicative use of the genitive of characteristic, parallel to *imperium regium quod initio conservanda libertatis fuerat* (Sall. Cat. 6, 7). If this is correct, the use of the genitive with *refert* is the older construction of the two. Hoffmann's view as to its origin we have already noticed, and he is certainly correct in thinking that it cannot be connected in origin with the older construction of the dative with *interesse* in its personal use, as in *interfui praelio*. An example in Cicero (ad Fam. 4. 10. 2), *suspicaret multum interesse rei familiaris tuae*, leads Schmalz to explain it as primarily a partitive genitive, and he evidently understands the passage as meaning, "I should suspect that much of your estate was involved." But this is not a typical example of the construction, being a genitive of the thing, not of the person. Most probable seems a solution suggested to me by Mommsen's version of the Lex Acilia, and which I find hinted at in Allen & Greenough's Grammar (P. 222 Remark), that the genitive with *interest* is formed after the analogy of the predicative genitive with *est*. The analogy, is, perhaps, best stated in the following way: The idea of possession is originally distinct, in the mind of the Romans, from that of ownership, but later by *usucapio*, i.e., by possession for a number of years, two at most in Gaius' day, ownership is acquired. *Res est alicuius (jure Quiritium)* is the Roman formula for ownership; *res est alicui (in bonis)*, that denoting possession. But what of the thing that, being in the possession of anyone, is passing into his ownership? Can we say, *Res fit alicuius*? We read in the Lex Acilia (66), *res populi fiet*. Did the Roman, then, come to feel that, in the thing then in his possession and passing into his ownership, he had any proprietary right? Gaius speaks of a thing as being subject to a *duplex dominium*, that of the person in whose *potestas* it is,—its owner in the proper sense,—and that of the person in whose *possessio* it is, and into whose *potestas* it is consequently passing. It seems to be this latter *dominium* which finds its expression in the phrase *interest alicuius*. Or, to put it more briefly, *est Marci* means "it is the property of Marcus"; *fit Marci*, "it is becoming the property of Marcus"; *interest Marci*, "it partly belongs to Marcus," or "Marcus has a proprietary interest in it,"—a meaning closely related to the usual meaning of *interest eius*. That *refert*, as early as Plautus' day, was not regarded as two separate words, but as one, is clear from such a construction as *quae ad rem referunt* (Persa, 591), or *quod rei te adsimulare refert* (Truc., 394). In Cicero's day its meaning differs but little, if at all, from that of *interest*. In such an assimilation of meaning the influence of analogy usually leads to a confusion of constructions originally distinct. The way in which this influence would work may be stated as follows: *refert* = *interest*, therefore *mea refert* = *mea interest*; and so for *mea refert*, the only form occurring in Archaic Latin, *mea interest* comes into use in Cicero's time. In like manner *interest* = *refert*, therefore *omnium interest* = *omnium refert*; and so beside *interest* with the genitive, the usual construction in the Golden Latinity, there appears in Silver Latinity the genitive with *refert*. And as *interest* has thus acquired a regimen that is primarily and really a dative, it is not strange to find it joined with a construction commonly used as a substitute for the dative, viz. the accusative with *ad*, as in *ad honorem nostrum interest*. That it is never joined with the dative itself, is probably due to a fear of confusion with the ordinary personal use of *interest* in *interfuit epulis*.

THE OCCURRENCE OF RABIES IN ONTARIO. BY J. J. MACKENZIE, B.A.,
BACTERIOLOGIST TO THE PROVINCIAL BOARD OF HEALTH.

(Read December 12, 1896.)

There is good evidence that there have been at least five outbreaks of this disease in Ontario since 1890. We have knowledge of eight individuals having been bitten by rabid dogs and having been subsequently treated at the Pasteur Institute, New York. A study of the Registrar General's returns for the Province of Ontario since Confederation does not show that rabies has ever been set down as a cause of death.

The evidence that rabies occurs in Ontario rests chiefly upon the results of inoculations made upon rabbits in the Laboratory of the Provincial Board of Health, in the case of an outbreak in the County of Middlesex, in 1895, and another in the town of Paris in 1896.

It has not been possible to trace any connection between these various outbreaks, although it seems probable that the one which occurred in Paris, in 1896, was preceded by one in 1895, in the district surrounding that town. This outbreak, however, was not investigated.

The question as to the origin of the disease in Ontario is a difficult one to decide. It does not seem probable that it is due to wild animals, as all the outbreaks occurred in the southern and older parts of the Province. It is more likely due to the introduction of the virus in imported dogs, chiefly from the United States.

In regard to the prevention of the disease, it seems as if the destruction of masterless dogs and the enforcement of a muzzling law for some months after an outbreak in any district in which it occurs would be sufficient.

A general muzzling law cannot be regarded as necessary.

NOTE ON SCIRPUS DEBILIS AND SCIRPUS SMITHII. BY WM. SCOTT, B.A.,
VICE-PRINCIPAL OF THE TORONTO NORMAL SCHOOL.

(Read March 13, 1897.)

These two species were found by me last season. This is the first record of these plants being found in Canada. *S. debilis*, Pursh, was found growing in a ditch on the railroad near Queenston Heights, and *S. Smithii*, Gray, was growing on Toronto Island.

Regarding these two plants, N. L. Britton and A. Brown, in their "Illustrated Flora," say of *S. Smithii*: "Perhaps only a form of the preceding, *S. debilis*." A careful study leads me to the conclusion that they are entirely distinct species:

(1) Their mode of growth is very different. *S. Smithii* grew in detached plants, and tillered from the root like grain. *S. debilis* grew in clumps. Many plants were clustered together. Careful search on various occasions was made, but no isolated plants could be found in the one case and no clustered ones in the other.

(2) The involucreal leaf is almost a prolongation of the culm in *Smithii*; in *debilis* it is very divergent. It is almost always turned at right angles to the culm.

(3) In *Smithii* the scales are oblong; in *debilis* they are oval or elliptical.

(4) In *Smithii* the seeds are brown obovate, flattened, and have no glossy appearance. In *debilis* they are black, broadly obovate, rounded, and are glossy. Under a lens they are as easily separated as barley and wheat with the naked eye.

RECENT CONTRIBUTIONS TO GAELIC AND MANX LITERATURES. BY REV.
NEIL MACNISH, B.D., LL.D.

(Read March 20, 1897).

A veritable Renaissance has in recent years been observable in the study of Gaelic and of Gaelic literature. Never since Fingal was King of Seallama, and since Malvina gladdened the declining years of Ossian, has so much attention been paid to Gaelic, and to Gaelic traditions and folk-lore; and have so many men of scholarly ability and taste devoted themselves to the study, and, indeed, to the development of Gaelic. For it has always been conceded that Gaelic possesses intrinsic qualities of an extraordinary kind; and that, therefore, it can, in able hands, take on beautiful and diversified forms and developments. Evolution, in the truest acceptance of the term, is characteristic of Gaelic; insomuch that, were scholars of ability and ingenuity to turn their careful attention to it, it could continuously assume larger and wider proportions. Such a momentum in favour of the language and literature of the Gael has now been gathered, that anything like retrogression is not to be apprehended, so far as regard is had to the production of Gaelic poetry and prose. Eisteddfod is the appellation that is given to the annual gatherings of the Welsh—which, having their origin in the unrecorded past, call forth unabated enthusiasm wherever they are held. Prizes are wont to be given which are very much appreciated, as they deserve to be, for superior excellence in prose and verse; in vocal and instrumental music, and in other avenues of intellectual effort and research in connection with the history and language of the Cymri. The Gaels of Scotland have been very slow in instituting any gatherings similar to the Welsh Eisteddfod. Regrets are now unavailing, that the other members of the large Celtic family did not, centuries ago, follow the example of the Welsh in the way of holding annual gatherings for the honouring and perpetuating, in healthful and ever-increasing vitality, of their own particular language with all its literature, and with all its traditions, that could in that case be found to pertain to it. Had such gatherings been in existence for centuries, it may be confidently maintained that Scottish and Irish Gaelic as well would to-day have treasures of valuable literature in prose and verse of which too high an opinion could not be formed;—treasures which, unhappily, have sunk into the deep sea of forgetfulness. Much praise is to be awarded to those intelligent and enthusiastic Gaels, who were successful some six years ago in establishing the Gaelic Mod,—an annual gathering at which prizes are given, after the example of the Welsh Eisteddfod, for the best productions in Gaelic prose and verse, in vocal and instrumental music, as well as in other attainments of a literary and artistic character.

The fifth Mod was held in October of last year in Perth. It was very successful. Unmistakable indications are available that the Mod is growing in popular esteem, and that it promises fairly to intensify the ardour of Gaels for their language and their traditions, and thereby to subserve the patriotic and very commendable purpose which its founders had in contemplation. The next Mod is to be held in Inverness, which possesses the best and most intellectual Gaelic Society in the world—a Society that has already published some twenty volumes of Transactions, which contain papers of a very instructive character, dealing, as they do, with an extensive variety of Gaelic subjects.

In the centuries that have gone, there must have been a continuous intimacy between the Gaels of Ireland and the Gaels of Scotland. A reciprocal influence must have been thus created in the development of the literature and customs of the Irish and Scottish Gaels.

"Ultonian Hero Ballads, collected in the Highlands and Western Isles of Scotland from the year 1510 and at successive periods till 1870"; such is the designation of a book which was published some time ago by Hector MacLean, under the auspices of the Islay Association. The Gaels of Islay evince a laudable willingness and liberality to honour and befriend any native of their island who succeeds in making a name for himself in the domain of Gaelic learning. To that number belonged the late Hector MacLean, who arranged and translated the Ultonian Hero Ballads. He has rendered in other respects important services to the cause of Gaelic literature. He was an able coadjutor of the late Mr. Campbell, who compiled "Leabhar na Feinne." "The large amount," Mr. MacLean writes, "of Irish Saga literature belonging to the Ultonian cycle dates in its form back to the tenth century, and there is MS. tradition of part of it extending back to the seventh century. Different forms of the same Saga can be discriminated as far back as there are means of research, and these Sagas have undergone the same harmonising process, but not the same euhemerising process as the earliest annals. The same mediæval school was conspicuous in this one case as in the other. These ballads have for many centuries been sung and rehearsed in the Highlands." Mr. MacLean has made an important beginning in investigating a department of literature which concerns Irish and Scottish Gaels alike, and which demands much more extensive study than it has yet received.

Iain Lom MacDonald is one of the most talented and satirical poets in the entire range of Gaelic poetry. The largest and best collection of the poems of this famous bard was published some time ago in Antigonish, Nova Scotia. The Rev. A. MacLean Sinclair, who prepared the collection in question, has already gained for himself a great reputation for his unremitting devotion to Gaelic literature, and to the perpetuation of Gaelic poetry. He takes an affecting leave of his labours in behalf of Iain Lom in these words: "Beannachd leat Iain Luim, chuir mise d'orain a mach cho maith 's cho ceart 's a b' urrann mi. Tha mian doch as gu tig aon eiginn am dheigh a ni na's fhearr."

"Lyra Celtica" is the name of an anthology of representative Celtic poetry, which is edited by Elizabeth A. Sharp, with an introduction and notes by William Sharp. The "Lyra Celtica" was published during 1896. It is a large, varied and interesting collection of Celtic poetry, containing, as it does, ancient Irish and Scottish poems, ancient Cornish and early Armorican poems, early Cymric and mediæval Welsh; Irish modern and contemporary Scotto-Celtic (middle period), modern and contemporary Scotto-Celtic, contemporary Anglo-Celtic poets (Wales), contemporary Anglo-Celtic poets (Manx), contemporary Anglo-Celtic poets (Cornish), modern contemporary Breton, the Celtic Fringe. Miss Sharp has accordingly travelled over a very extensive field in her desire to gather poetical flowers for her Celtic anthology. It is remarked in the preface, that the volume "is no more than an early, and in a sense merely arbitrary, gleaning from an abundant harvest."

Of recent years, we have had many works of the greatest value in Celtic ethnology, philology, history, archaeology, art, legendary ballads and romance, folk-lore and literature. In the national libraries of Great Britain alone it is estimated that if all the unedited MSS. were printed, they would fill at least 1,200 or 1,400 octavo volumes. Though the songs and poems and ballads that the "Lyra Celtica" contains appear in an English dress, it is possible, however, for the student to discern the peculiarities of the mind and heart, of the thoughts and feelings, customs and manners of the various Celtic races. There are to be found

side by side in the "Lyra Celtica" translations of the songs and poems that were wont to be sung and to be admired in distant days of Celtic warfare and exploits by Welsh and Cornish and Armorican Celts, and by Irish and Scottish Gaels and Manxmen. There must be those who, elated by the strong vitality which is pulsating now through the arteries and veins of the Celtic races, will call in question the accuracy of the statement "that the Celtic race stands now with averted torch, and the light of it is a glory before the eyes, and the flame of it is blown into the hearts of the mightier conquering people. The Celt falls, but his spirit rises in the heart and in the brain of the Anglo-Celtic peoples with whom are the destinies of the generations to come."

It must be regarded as a strong indication of the present vitality of the Gaelic language that a translation of the Book of Common Prayer into Gaelic, for the benefit of the Gaelic members of the Scottish Episcopal Church, was published during last year. The translators have performed their work well, as a general rule. With commendable propriety, advantage was taken of the Gaelic version of the Bible, which is in common use in Scotland, for the purpose of presenting, in a Gaelic dress, those portions of Scripture that, along with the Psalms, go to form a considerable portion of the English Prayer-Book. It is, at least, interesting to know that in Argyllshire itself there are several Episcopal ministers who conduct religious services in Gaelic. It may be safely inferred, that if the bishops of the Scottish Episcopal Church were apprehensive that Gaelic was sadly on the decline, and was hurrying to the day of its death and consequent extinction, they would not have taken the pains of translating the English Prayer-Book into Gaelic.

As might be expected, owing to the great dissimilarity which exists between English and Gaelic idioms, the Gaelic translation of the English Prayer-Book is occasionally stiff. Praise rather than blame, however, is to be generously bestowed on the translators, who have done their work with much ability and accuracy.

In the introduction to his grammar—the first Gaelic grammar which was published—Shaw had this doleful statement to make when it was published in 1778: "But at present I much doubt whether there be four men in Scotland that would spell one page the same way. The taste, at this day, of the clergy—a lettered and respectable order—is to understand the English, content with what Gaelic enables them to translate of a sermon they originally wrote in English. And, although they are obliged to speak in public once in seven days, there are not five ministers in Scotland who write their discourses in their own tongue." Almost one hundred and twenty years have passed since Shaw had occasion to give such a lamentable account of the defective Gaelic scholarship of his time. Immeasurable progress has, in the interval, been made in the grammatical study of the Gaelic language, and in the acquiring of ability and facility to speak and write it fluently and accurately. It would be simply ridiculous to apply the strong condemnation which Shaw attached to the Gaelic scholarship of his own time, to the wide and thorough scholarship which obtains in our day. Were correctness in the understanding and in the writing of Gaelic to be taken as an infallible criterion of the utility of that language, the conclusion could not be resisted, that the chances of a prolonged existence are altogether on the side of Gaelic as we know and speak it now.

"A Course of Gaelic Grammar, by Duncan Reid, F.S.L.A., teacher of Gaelic in the High School of Glasgow:" Such is the writing on the title page of a very useful and intelligible grammar, which was published in August, 1895. The author thus writes in his preface: "In compiling this course of Gaelic grammar, I have adopted the plan which I have followed during the last few years in teaching the students of the Gaelic class in the High School of Glasgow. It is chiefly intended as a text-book for Highland schools and pupil teachers, and is designed to meet the requirements of the Scotch Education Code. The ordinary student will find here sufficient material to enable him to acquire a good knowledge of Gaelic grammar.

The exercises are carefully graded, and the selections for reading, towards the end, are from the standard works of some of the best writers of Gaelic prose and poetry." Though exception may be taken to portions of Reid's Grammar, it has to be admitted that it is very concise and simple, so that the ordinary student can easily obtain a sufficient knowledge of the language, whereby he can be enabled to appreciate its peculiar beauties, and to derive enjoyment from its treasures in prose and verse.

"Elementary Gaelic Grammar or the elements of Gaelic grammar, based on the work of the Rev. Alexander Stewart, D.D., by H. Cameron Gillies." Such is the name of an able and instructive Gaelic Grammar, which was published a few months ago. Dr. Gillies resides in London, England, and is engaged in the practice of medicine. He has for several years devoted much attention to Gaelic. He has a keen critical faculty, insomuch that he finds particular pleasure in prosecuting his studies in the somewhat abstruse domain of Celtic philology. The present position of Gaelic, favourable in a satisfactory degree as it is in London, the metropolis of the world—owes very much to the fine enthusiasm, the diligent learning and the unfailing earnestness of Dr. Gillies. According to his own averment, Dr. Gillies has based his grammar on the work of Dr. Alexander Stewart. It has always to be conceded that Stewart's Grammar, so far as it goes, is the best Gaelic Grammar which has ever been written. Dr. Stewart was minister of Moulin, in Perthshire, when he wrote his grammar, involving as it does—for the field of Gaelic grammar was at that time largely, if not entirely, fallow ground—great acumen and pains and reflection. The splendid Irish scholar, O'Donovan, found abundant reason in the honesty of his heart—able grammarian as he himself was—to bestow warm praise on the ability, industry and acumen of Dr. Stewart. It was Dr. Stewart who corrected the proof-sheets of what is known as "Sinclair's edition of Ossian," which was published in 1807. In the preface to his Grammar, Dr. Gillies thus writes: "The purpose of this Grammar is to afford assistance to such as may desire a living and intelligent acquaintance with the Gaelic language of Scotland. I endeavoured to have special regard to the phonetic basis of the language, and have always appealed to it whenever it was necessary to do so. As Gaelic Grammars are continually making their appearance, it cannot be denied that Gaelic still possesses the pulsations of a healthy and vigorous existence. If a language is dying, and, like the withered leaves of autumn, is showing unmistakable signs of decay and death, no man can have the courage and energy which the writing of the grammar of such a language involves. A decrepit language, an enfeebled and helpless language, a language which is on the brink of the grave, and which is suffering the loss of all its former friends, can by no reasonable possibility induce any man—unless he is enthusiastic to an unwonted degree—to consume the mid-night oil in preparing a grammar which, as he honestly thinks, is able to meet the requirements of his own time, and to impart even a moderate amount of life and strength to the language which he loves as the language of his ancestors, and, therefore, of those who are dearest and greatest in his imagination and memory."

The inhabitants of the Isle of Man are conspicuous for their zeal in collecting the literary remains that can be found in their island, whether they assume the form of poetry, or folk-lore, or historical narratives, or carols and ballads. Since the Manx Society was established in 1858, very much has been done to rescue from oblivion many of the literary links that connect the Isle of Man of to-day with the Isle of Man of the days that have gone. At an expenditure of endless energy and trouble, Mr. A. W. Moore, M.A., Cronkbourne, Douglas, has conferred great benefits on the literature of his native island. Through his indefatigable exertions much that will prove to be very valuable in the lore of Manxmen has been recovered and published. In addition to other publications with which he had to do he published in 1891, "The Carvalyn Gailchagh," or Manx carols. "Manx

Ballads and Music" is the name of another collection which he published toward the end of last year. "The object of this publication," he asserts, "as that of the Manx Carols, is to collect in one volume a curious literature, the greater part of which was threatened with almost certain loss." Though he has been assiduous in collecting those ballads, and in thus preserving from oblivion songs which were wont to be sung by the peasantry of Man, he has no high opinion of the poetical merit of many of them. He divides them into "mythical, semi-historical and historical ballads; children's songs and ballads connected with customs and superstitions; love-songs, patristic ballads, nautical ballads and miscellaneous ballads." He thinks more highly of the Manx melodies than of the ballads, forasmuch as they are in most cases older, as well as superior to the words which are now set to them. He has strong reasons for entertaining the hope "that the results of this little book will be to admit the music of the Isle of Man to a distinct though humble share in the great body of national music which is now being so generally collected," and that in it may be found, in the striking words of a recent writer, "the national idioms in their simplest and most unsophisticated expression." As the music to which ballads are sung intensifies the great regard that the peasantry of any country entertain for their songs, it may naturally be expected that the publication of their songs, along with their appropriate music, will increase the zest wherewith the inhabitants of the Isle of Man sing such songs as "Coayl jeh ny Baatyn-Skeddan," "Mannin veg veen," and "Na Kirree fo Niaghtey."

THE INDIAN CHARACTER. BY E. M. CHADWICK, ESQ.

(Read April 10, 1897).

This paper was read, as views on the same subject had been presented by a reader before the Institute some time previously. Such former paper had not, in the opinion of the present reader, exhausted the subject, nor treated it quite justly or in due proportion, but had rather enlarged upon the faults of the Indians without giving due weight to their better qualities, the reader being impressed with the importance of understanding and recognizing what good there is in those under our care and tutelage, and how many unfortunate mistakes may have been in the past, and possibly may be in the future, avoided by a better knowledge of what the Indian has been, is, and may be.

The Indian, as a subject of which so many have written, has been, in this respect at a great disadvantage, and has been treated with much injustice, because, firstly, his history has, for the most part, been written by his enemies; secondly, most writers have formed their impressions from tribes which have been deteriorated from contact with unscrupulous whites, diminished by intemperance and the diseases which have ever marked the advance of civilization, impoverished by the destruction of their accustomed means of subsistence, and disheartened and dispirited by the change in their circumstances; and lastly, because it has been a common practice to gauge the Indian by a European standard. This last, however, may be regarded as an unintentional but very marked tribute to the innate merits of the Indian, for other uncivilized people have been described either without reference to other conditions than those in which the writers happened to find them, or by comparison with people of similar circumstances.

The reader reviewed the various traits of the Indian character at length, and concluded as follows:

While the policy of our Government has ever been wise and commendable, and has been generally honestly carried out by the executive agents and officers, I cannot but think that in one respect a grave mistake has been commonly made by those charged with duties bringing them into immediate contact with the Indians, both officials and others, and perhaps especially missionaries, whose methods are apt to be unduly patronizing. The Indian is in many respects child-like, knowing that the white man's knowledge is superior to his, and, therefore, when his tutelage begins he enters into a relation as regards the whites similar to that of pupil and teacher. This condition is one of much difficulty, requiring management with a tact and skill such as few people are able to exercise. If the Indian were treated as a friend and equal rather than as a pupil or dependent, I believe his advancement would be more certain and speedy. Individual cases of Indians revolting, and perhaps with little or no apparent reason, from the guidance or control of agents or missionaries will no doubt occur in the experience of such people, without their perceiving that a certain amount of fault may lie with themselves. I do not wish to be understood as unduly criticizing either agent or missionary, for in Canada I am convinced that our Indian agents as a class are men competent and well worthy of the great trust and responsibility imposed upon them, as I certainly know some of them to be; and for the missionaries I have the highest respect, believing that upon the faithful performance of their

duties, more than anything else, depends the future welfare of the Indian as a civilized citizen. But even missionaries are human, and sometimes make mistakes, and they have many serious difficulties to contend with, for not only have they to overcome such as necessarily arise from the character of the Indians, and customs and circumstances of their former life, but they have also to fight the devil incarnate in the persons of evil and unscrupulous whites, who, for their own gain or gratification, do not hesitate to bring moral and physical ruin upon the Indian.

It is to me a matter of much regret that in the process of bringing the Indian into civilization there has been an effort to make him forget his past history and customs. Much of the history of some, at least, of the Indian nations is by no means a thing to be wiped out of memory, and, though some of their customs must necessarily be disused, as being inconsistent with both Christianity and civilization, the romantic and picturesque, which ever attended the life of the Indians, and surrounded them with a charm which has produced abundant material for writers of fiction and poetry, is surely worth preservation, and, in my judgment, should be no more a hindrance to their advancement than somewhat similar conditions have been in the case of the Highlanders of Scotland. I am convinced that an Indian who holds the memory of his forefathers in respect, and looks back with honest pride upon the antiquities of his nation, and is permitted to do so, will make a better citizen than one who is taught, as is evidently too often the case, to consider all such things as contemptible, and to be put aside and buried in the past. Among the Six Nations, those who are disposed to keep alive their traditions and such of their ancient customs as are not unsuited to their present manner of life, are subjected to a kind of mild social ostracism. I venture to believe that to be a great mistake, and for my part would regard an Indian who had the courage to appear in buckskin and feathers, without being paid for doing so, as excellent material from which a valuable citizen might be made if judiciously treated. The system which is followed, I believe, with all due deference to those who have more experience than I have, to be calculated to make such men and women useless members of society, and thus indirectly to lower the general social and moral tone of the people. A loyalist at heart, if injudiciously treated, may be made a rebel in act.

INDIAN GHOSTS AND CONCH FEASTS. BY R. G. HALIBURTON, F.R.G.S., ETC.

(Read April 10, 1897).

Had the natives of Jamaica any connection with the races of North or South America? This is a question which we cannot discuss in the limited state of our knowledge of West Indian natives. This arises partly from the fact that the cruel power that is now deluging Cuba with blood, succeeded in little more than a century in exterminating the friendly and peaceable natives of the West Indies.

No page in the history of our race presents such a blank as that which refers to those people. The Spaniards said that the natives reminded them of the people of Majorca; but that race was a small one, and no doubt an offshoot of the dwarf stock that, according to Professor Sergi, migrated from North Africa to the islands, and to the Northern shores of the Mediterranean. The Spaniards probably referred to the little Caribs. In the Atlas region of Morocco the dwarfs and their large offshoots are called "the little Haritin" and "the large Haritin." When I first, in 1890, saw one of the latter, I said "that man must be a Carib." The dwarfs range from 4 feet to 4 feet 10. Their larger kinsmen are from 4 feet 10 to 5 feet 4 inches, and both have that peculiar, bright-reddish complexion, that so generally characterizes dwarfs. My Berber servant (thanks to whom I became their discoverer) said, "they have a red complexion, quite different from that of other races in Morocco. It is like that of the red Indians of America." A recent color chart by a German anthropologist makes the Tupi Guarani and most other races of South America have the same tint as the Berbers. The fact that their names for spirits, or ghosts, *Cemis*, and *Tona*, are to be met with in Central America, and as far north as the Pueblos, leads us to suspect that the people of the islands, and of Central America must have sprung from the same stock.

Brasseur de Bourbourg's idea that the Popul Vuh was historical, even though he was backed up in it by Max Muller, he had to abandon in his old age. It was a mythical work, containing astronomical legends that are as wide-spread as the wanderings of our race. Within the past two years cave deposits and inscriptions have been found in Yucatan, that lead to the idea, that the Mayas, when they arrived there, were already a semi-civilized people.

We must be patient, and must collect in properly managed museums all that can be gathered together as to the aborigines of the West Indies. In time this great blank in anthropology will be filled up, but we now have tantalizing glimpses of affinities, that serve only to stimulate and baffle our curiosity.

Bishop Hanna was right in his conjecture, that aboriginal remains would probably be found, if sought for, in Pedro, Jamaica. The contents of the caves there are well-known, although it is possible that treasure-seekers, or even antiquaries, may a century or two ago have carried away or destroyed much in them that would have been of interest. On the top of a hill at Malvern Chase, it was said, when I was there eleven years ago, that there was an Indian burial place. I employed a couple of men for one or two days in opening some places that seemed promising, but the results were on the whole disappointing. On digging down in some places there, we found an almost solid mass of little shells, about two inches thick, in a regular layer. But we found no skeletons or human bones, although we came across a large quantity of broken pottery, which seemed to have been an offering to the

dead, for when an article is broken, it belongs to the spirits. On Haugmena night, New Year's Eve (for "Haug" means a "ghost," and the spirits then pay the earth a visit, as they do also at Hallow-eve, and the Eve of May-Day), it is a custom among Highlanders to drink a toast, and then to throw the wine-glasses over the left shoulder, no doubt once a mode of making an offering to ancestral ghosts. The Maori used to always offer a grace to ancestors by throwing a little food over the left shoulder. On spilling salt, many people, to avert ill-luck, throw salt over the left shoulder. All this dates back to an era when our ancestors were somewhat like the old aborigines at Pedro.

The ashes and a few bones were quite consistent with funeral, or memorial feasts. There were indications that the place had been opened before, and it is possible that skeletons may have been carried away.

The pottery we found was of singular interest. There were some dishes about six inches long, very shallow and graceful in shape, with handles formed of frogs' heads most artistically executed. I have not seen anything of the sort to equal them in the Peabody Museum collection from Central America.

The frog was the symbol of rain and of the rain-god in Mexico and in Central America. The pottery was evidently intended to be hung up, as it was pierced, or had handles for that purpose, like Guanche pottery. The gypsies, who, like the Berber tribes on the coast opposite the Canaries, hang up their drinking cups, believe that if they are allowed to touch the ground they are thereby consecrated to the dead, and must be broken in pieces.

Before I dismiss the subject of destroying articles as a mode of offering them to spirits, I may mention a singular custom of the Spanish gypsies, who at a certain feast collect many bushels of confections made (if I remember right) of white powdered sugar. These are thrown on the floor of the dancing room, until it is covered with a layer two or three inches deep. Of course the cost of this proceeding is a very heavy one. The Gypsies then, men and women, commence a weird, frenzied dance, in which they work themselves up into a delirium and then sink down exhausted. The sugar clogs their feet, and covers their legs and garments, and when they cease dancing, they present a most singular and sorry picture.

Though archaeologists cannot conjecture the origin of this custom, we may form a shrewd guess as to what this dance means. The ghosts are in for a big candy frolic, and the sweetmeats must be destroyed before the spirits can own them. The rationale of these ideas is, I think, capable of a very simple explanation. With primitive races of men everything in nature has its spiritual double. The soul of the hunter's dog goes to the Land of the Blessed and hunts game there for his master, just as he did on earth; and the warrior fights, loves, and feasts as heartily as he did when in the flesh. (1)

In the Peabody Museum of Anthropology there is to be seen half a bushel of pearls, some of large size, that have been subjected to the action of fire. They have not been destroyed; they have only been translated to the necks and arms of tawny warriors. Who knows that the only pale-faced ghost, that of the late George Washington, that ever found its way into the Red Man's Paradise, may not have often seen and admired them?

All this serves to explain the meaning of the Mysteries, or initiations of prehistoric man, and of antiquity. With Christians admission to the society of the blessed must be obtained through the atonement. With primitive man this was

(1) Maspero in "The Struggle of the Nations," a translation of which has just been published by Appleton & Co. (N. Y., 1897), since the above paper was read, says (p. 523) of the mummies of pets of the deceased placed in Egyptian tombs, "A few of the principal objects were broken or damaged, in the belief that by thus destroying them their double would go forth and accompany the human double, and render him their accustomed service during the whole of his posthumous existence."

This is a singular confirmation of my conjecture, and shows how much of prehistoric man survived in the Egyptian.

accomplished by initiation. To become a blessed spirit, a man must die. Hence "the death of the Mysteries," or "Cabeiric death," which was brought about by exhausting ordeals, long fastings, and the use of narcotics, under the effect of which the aspirant lost consciousness, and fell into a death-like trance. He was then buried and resurrected, but he returned a blessed spirit. An American Indian who has been initiated indulges in the boast, "I am a spirit." Death thenceforth has no spiritual terrors for him (2).

This was the Egyptian belief. The deceased worshipper of Osiris, who had been initiated into "the Mysteries of Isis," himself became an Osiris, and, as a "Blessed Osirian," reigned with the gods. These ideas can be detected in the Apocalypse, a work permeated by the astronomical imagery, the symbolism of numbers, and the allegorical spirit of the venerable Mysteries. Read by the light of primitive cults, the following significant passage becomes a little more intelligible than it has hitherto seemed.

"Blessed and holy is he that hath part in *the first resurrection*; on such *the second death* hath no power, but they shall be priests of God and of Christ, and shall reign with Him a thousand years" (Rev. 20 : 6).

In 1888 I mentioned to Professor Maspero verbally, and afterwards by letter, that the "*Osirian cult*" still existed in America. *Osiris* is the Greek form of *Hoesari* in Egyptian, which in Phoenician and in the traditions of southern Morocco and the western Soudan is *Isiri*. Among the Caribs and the Abipones of South America the name is *Hoscheiri*, or *Ischiri*, and the initiated becomes an *Ischeiri* after death.

I shall hereafter bring out these points in a paper on "Vestiges of the Osirian Cult in the New World."

Shell mounds are to be found from the icy North to the Straits of Magellan. At a suitable time of the year the Indians used to pic-nic for weeks on the seashore. In New England they bequeathed their indigestible but tempting "clambake" to the Pilgrim Fathers and their descendants; and their memory will be preserved green as long as "clam-chowder" endures.

On the shores of the Gulf of Mexico, where oysters took the place of the venerated clam, there are many "shell-islands" where there are enormous deposits of oyster shells. I spent the winter of 1882-3 on one called Tiger-tail Island, where that terrible Seminole Chief, Tiger-tail, was wont to roast and bake oysters, in place of Yankees.

In the Caribbean Sea the conch took the place of the oyster. I chartered a schooner in 1870 and explored the network of little islands and inlets in the British and Foreign Leeward and Virgin Islands, which no one ever visits. As Pere Labat speaks of heaps of shells left by the Caribs at Anegada, I thought I would take a look at them. The island is surrounded by a network of coral reefs extending ten miles to the seaward, and but few strangers reach it except those that have been washed ashore. I found the people there (about two hundred in number I should think), much disturbed by my visit, and they refused at first to come with me. But the next morning the whole population seemed to turn out to aid me. I afterwards learned that on my arrival they had held a meeting, at which it was resolved that, as no man in his senses would think of opening a heap of old conch

(2) The following passage, from Mr. Lyman Abbott's article in the Outlook (Mar. 1897), is applicable to the belief of prehistoric man: "What is God's way of doing things according to evolution? It is to develop life by successive processes, until a spirit akin to this appears in a bodily organism, akin to that of the lower animals from which it had been previously evolved. This bodily organism is from birth in a constant state of decay and repair. At length the time comes when, through disease or old age, the repair no longer keeps pace with the decay. Then the body returns to the earth, and the spirit to God who gave it. . . . But every death is a resurrection of the spirit. What we call death, the New Testament calls 'an exodus,' or an emancipation from bondage, an 'unmooring,' or setting the ship free from its imprisonment. The spirit is released from its confinement, and the release is death. Death is, in short, not a cessation of existence, not a break in existence: it is simply what Socrates declared it to be, 'the separation of the soul and body; and being dead is the attainment of this. When the soul exists in itself, and is parted from the body, and the body is parted from the soul, that is death.' (See *Phaedo*, Jowett's Trans.)"

shells, I must be in search of Captain Kydd's treasure. They then generously resolved that I be permitted to open these mounds, but at my own expense ; and they further resolved, that while they would help me to find the treasure, they would never allow me to carry off a penny. Anxious to have a hand in the "find," they flew upon the shell mounds like demons ; but I did not wish to pay all the people of the island, and therefore selected three or four, who opened half a dozen shell mounds, watched with intense anxiety by the rest of the people. We found only shells and ashes, nothing of interest, and, sad to say, no vestige of Captain Kydd and his hoards.

I encouraged that idea about Captain Kydd by looking very mysterious, consulting my notebook, pacing off the distance between certain objects, and behaving generally like a truant land-surveyor. My benevolent object was, I subsequently learned, most fully accomplished, for the people there are now the highest living authorities on the subject of Carib shell mounds. For a fortnight after I left, the whole population turned out, and overhauled all the numerous shell mounds in the island ; but, unfortunately, they found nothing. They then concluded that I had inherited some invaluable notebooks and maps from my worthy ancestor, Captain Kydd, and that I had slipped ashore in the night, and had carried off millions of "pieces of eight" and "Spanish Joes."

A friend, Chief Justice Semper of St. Kitts, warned me never to venture near that island again, and I have taken his advice. It was the cheapest bit of archaeological exploration on record.

This fish diet must have greatly contributed to the vitality and vigor of the Indians. The prevalent idea that fish is so little nutritious that, to dine on fish is equivalent to fasting, was a little shaken by the fact, that communities that live on fish are very prolific. A gentleman, whom I met recently at the Toronto Club, and who had spent some winters at Hudson's Bay, told me that it was a favorite amusement there to pit the fish-eating against the flesh-eating Indians in trials of strength, and that in every case the former came off victorious.

NOTE ON SOME BASIC DYKE AND VOLCANIC ROCKS OF EASTERN ONTARIO
AND QUEBEC. BY W. G. MILLER, M.A.

(Read April 18, 1897).

Dr. F. D. Adams, in his recently published "Report on the Geology of a Portion of the Laurentian Area Lying to the North of the Island of Montreal" (1), describes a series of post-archæan dykes which are stated to be "probably pre-Potsdam in age." The rocks in these dykes are of three different kinds, viz.: diabase, augite porphyrite (spilite type), and a rock which "is neither a diabase nor a gabbro, having neither the ophitic structure of the former nor the hypodiamorphic granular structure of the latter. The structure is rather a porphyritic one . . ."

It may be interesting to note that a similar series of basic rocks occurring in dykes is characteristic of the Kingston district, which is distant about 150 miles from the area referred to by Dr. Adams.

In a paper (2), published some time ago, Mr. R. W. Brock and the present writer described two rocks which with diabase are the characteristic basic dyke and volcanic rocks of the eastern part of Frontenac county and the adjacent portions of the counties of Leeds and Lanark. One set of dykes, which occurs near the village of Seeley's Bay is, judging from Dr. Adams' description, practically identical in character with those he has described in the district north of Montreal, and which he calls augite porphyrite (spilite type).

The rock referred to by Dr. Adams as being "neither a diabase nor a gabbro" is represented in the Kingston district by a rock which resembles it closely. The Quebec rock is apparently somewhat more basic than its Kingston representative, and contains phenocrysts of both augite and plagioclase, of which the former is the older. Unless, however, a series of analyses were made of specimens selected from different parts of the dykes, it would not be possible to make a satisfactory comparison of the acidity of the dykes in the two districts. One of the striking characteristics of these rocks from both districts is the occurrence in them of micropegmatite or a granophyric intergrowth of quartz and feldspar. Dr. Adams says, "This micropegmatitic or granophyric intergrowth of quartz and feldspar will probably be found very widespread in its occurrence in the dykes cutting the archæan in Canada, as it is known in diabases of Templeton, in the County of Ottawa, in the Province of Quebec, while Dr. Lawson describes it as occurring abundantly in the dykes of the Rainy Lake district to the west of Lake Superior."

Prof. C. H. Smyth has described a group of diabase dykes among the Thousand Islands, St. Lawrence River, in the southern part of the County of Leeds (3). These also have representatives in the area described by Dr. Adams.

Different varieties of plutonic rocks related to gabbro are found in the two districts. Letting the term gabbro stand for these, norite and anorthosite, we have an interesting series of rocks in the two districts, including—if we consider the rock containing micropegmatite to belong to the dyke division proper—plutonic, dyke

(1) Pp. 134 to 139. Part J. Annual Report, Vol. VIII., Geol. Survey of Canada.

(2) Canadian Record of Science, October, 1895.

(3) Transactions N.Y. Academy of Sciences, Vol. XIII.

and volcanic representatives of the gabbro group. Their relations may be shown in tabular form as follows:

Gabbro Group.	{	Plutonic.....Gabbro.
		DykeGabbro porphyrite.
		Volcanic.....{ Diabase. Augite porphyrite.

Whether the rock here placed under the dyke division be considered to belong there or under the volcanic division we have an interesting series which includes the characteristic pre-Potsdam basic rocks of the two districts. Representatives of other sub-divisions of the gabbro dyke rocks, viz.: gabbro aplite (or beerbachite) and gabbro lamprophyre (or odinite) have not as yet been found in the districts under consideration.

THE VAPOR TENSIONS OF LIQUID MIXTURES. BY W. LASH MILLER, PH.D.,
AND T. R. ROSEBRUGH, M.A.

(Read April 24, 1897).

Much of the recent remarkable progress in physico-chemical work is due to experimental and theoretical investigations on the vapor tensions of solutions, and Professor Van 't Hoff's paper showing the relations between the tensions, freezing-points, boiling-points, osmotic pressures and compositions of solutions marks a new epoch in the science. In his celebrated monograph "On equilibrium in heterogeneous systems" Prof. Willard Gibbs has deduced an equation (1) from which may be obtained a relation between the alterations produced in the vapor tensions of the components of a liquid mixture by altering the composition of the mixture. A close examination of this result of Gibbs' and of the method by which it was obtained, shows that his equation contains as special cases many of the results of Van 't Hoff referred to above; it is consequently very desirable to subject the equation in its most general form to a direct comparison with experimental results. Such a control would be afforded by a set of measurements of the tensions and compositions of the vapors given off at any constant temperature by mixtures of two liquids in different proportions, but curiously enough no complete set of measurements of the nature referred to seems as yet to have been published. We have undertaken to supply the requisite data by an investigation of the case of mixtures of alcohol and water; the present paper contains a short description of the apparatus employed, the results of the measurements, and their comparison with the theory will form the subject of a subsequent communication.

The apparatus, as finally constructed, consists of a cylindrical vessel to hold five litres, made of tinned copper, and provided with five openings. Of these, the first is fitted with a thermometer, the second with a means of filling and emptying the vessel, the third with means of electrical communication to a heating coil suspended in the liquid; while through the fourth passes a glass tube to convey the vapors to a condenser, from which the condensed liquid drops back through the fifth opening into the apparatus. When desired, small quantities of the condensed vapor may be removed and their composition ascertained; these analyses, together with a knowledge of the composition of the contents of the copper vessel and measurements of the temperature and pressure, give all the data necessary for testing the accuracy of the equation of Gibbs referred to above.

In order to protect the vapor from partial condensation (and consequent fractionation) on the way to the condenser, the tube through which it passes is wound with insulated wire and may thus be kept hot, electrically; errors due to splashing of the boiling liquid have been provided against by a special construction at the bottom of the tube; condensation on the walls of the copper vessel itself is prevented by surrounding the latter with a tin cylinder wound with wire and kept at the temperature desired by means of an adjustable, electrical current, while the absence of super-heating, and a thorough equilibrium between vapor and liquid, are secured by the use of perforated copper plates (under the surface of the liquid) through which the vapor must find its way.

(1) Trans. Connec. Acad. III. 143. Egn. No. 97.

As it is desirable that the boiling points of the mixtures should be varied at pleasure, a subsidiary piece of apparatus has been constructed by means of which the pressure in the boiling vessel may be maintained constant at any desired point from 20—1200 mm. This pressure-regulator consists of two five-gallon jars, of which the first is attached directly to an air pump, and the second to a U-tube manometer and to the boiling apparatus (between condenser and fifth opening); communication between the jars is afforded through a tap, which is usually closed, but may be opened by an electrical device set in motion whenever the mercury of the manometer (in the open limb) rises high enough to form contact with an adjustable platinum wire.

NEW SPECIES OF CANADIAN FUNGI. BY J. B. ELLIS AND J. DEARNESS.

(Read April 24, 1897.)

HYMENOMYCETES.

PORIA SUBRUF A, E. & D.

Resupinate, effused, mostly in small patches 2—4 cm across, inseparable, soft, juicy, creamy-white when fresh, becoming reddish when dry; margin thin, membranaceous, narrow, almost wanting. Pores round to sub-angular, $\frac{1}{4}$ — $\frac{1}{2}$ cm. long, $\frac{1}{4}$ — $\frac{1}{2}$ mm. wide, dissepiments thin, margin acute but not lacerate. Spores elliptic-oblong $4 \times 3 \mu$.

On a rotten beech log at Granton, Ont. Nov. 1896. No. 2442 in Herbarium of J. Dearness.

Apparently allied to *Poria cruentata*, Mont., but the pores cannot be called "very short," and their surface is uneven.

PYRENOMYCETES.

ROSELLINIA COMPRESSA, E. & D.

Perithecia scattered or often in small groups of 4—6 or more, sometimes 2 or 3 sub-confluent, superficial, rather depressed, globose, about $\frac{1}{2}$ mm. in diam., membranaceous, sparingly clothed with short (20—30 μ) spine-like, black hairs; ostiolum minute, papilliform. Asci cylindrical, 75×10 — 111μ , obscurely paraphysate. Sporidia uniseriate, elliptical, obtuse, brown, strongly compressed, 12 — 16×8 — 10μ and about 3μ thick,

On decorticated elm, Granton, Ont., Canada. Herb. D., No. 1791.

DIDYMOSPHERIA THALICTRI, E. & D.

Perithecia gregarious, depressed-globose, 200 to 250 μ in diam., visible through the darkened epidermis which is barely pierced by the papilliform deciduous ostiolum. Asci oblong, short stipitate, paraphysate, 8 spored. Sporidia biseriata, at first fusoid-oblong, sub-hyaline, 4-nucleate, but finally uniseptate and slightly constricted, sub-inequilateral or slightly curved, pale brown, 13 — $15 \times 3\frac{1}{2} \mu$.

On dead stems of *Thalictrum polygamum*, London, Can., Aug. 1895. Herb. D., No. 2297.

DISCOMYCETES.

PSEUDOHELOTIUM CANADENSE, E. & D.

Ascomata scattered, short-stipitate, whitish, with a yellowish tinge, about 1 mm. in diam., puberulent; margin fringed with tufts of short, pale hairs, and when dry the opposite sides rolled together so as to become elliptical or triangular in outline; texture, fibrous; apparently sessile, but short-stiped. Disk concave, yellowish. Asci, clavate-cylindrical, paraphysate, about $40 \times 4 \mu$. Sporidia biseriata, oblong, obtuse, mostly straight, hyaline, 8 — $12 \times 1\frac{1}{2}$ — 2μ .

On dead stems of *Arctium Lappa* L., London, Can., Aug., 1895. Herb. D., No. 2340

COCCOMYCES RUBICOLA, E. & D.

Ascomata covered by the adnate epidermis, hemispheric-prominent; the pustules pierced in the centre, then radiate-cleft and open, exposing the pale, whitish or wood-coloured disk, $\frac{1}{2}$ —1 mm. in diam., bordered by the toothed margin of the ruptured ascoma. Asci, oblong-cylindrical, sessile, 60—70 x 7 μ . Paraphyses, filiform, curved or bent at the tips. Sporidia fasciculate, linear, nucleate, hyaline, sub-attenuated below, 45—60 x 2—2 $\frac{1}{2}$ μ .

On dead stems of *Rubus strigosus*, Granton, Ont., Aug., 1895. Herb. D., No. 2352.

C. Rubi (Fr.) is a foliicolous species, having sporidia only 6—8 μ . long.

HYPHOMYCETES.

RHINOTRICHUM HERBICOLUM, E. & D.

Effused, light yellow, becoming brown in the centre. Hyphæ, coarse, septate, branched, nearly hyaline, 8—10 μ , thick. Fertile hyphæ, sub-undulate above, tips swollen and bearing the globose, sub-hyaline, finely echinulate, 7—9 μ , conidia.

On dead stems of *Solidago Canadensis*, London, Can., Aug. 1895. Herb. D., No. 2314.

This species differs from *R. Curtisii*, Berk., in its coarser hyphæ and its smaller echinulate conidia.

STYSANUS TUBERICOLA, E. & D.

Stem composed of parallel fibres, 700 to 800 μ high, 10—12 μ thick, tips of the fibres relaxed and bearing the elliptical, brownish, 4—5 x 2 $\frac{1}{2}$ —3 μ conidia, forming a terminal oblong head 110—130 x 35—50 μ . The fibres forming the stem spread out at the base forming a loosely interwoven grayish mycelium.

This fungus developed on pieces of potato in a moist chamber which had been used for culture purposes. Other pieces of potato were inoculated with it and thus a considerable quantity was obtained. London, Can., Apr: to June, 1894. Herb. D., No. 2261.

RAMULARIA ARISÆMÆ, E. & D.

Spots oval, tan coloured, turning pale or yellow-white by concentric rings from the centre outwardly, $\frac{1}{2}$ to 2 cm. Conidial tufts minute, very numerous, mostly epiphyllous, giving a grayish cast to the pallid area of the leaf, the tuft consisting of a few close, almost sessile, conidia. Conidia hyaline, grumous, nucleate, straight, 20—22 x 3—3 $\frac{1}{2}$ μ .

On leaves of *Arisæma triphyllum*, Torr., Granton, Ont., July 1893. Herb. D., No. 2139.

TORULA CARICINA, E. & D.

Hypophyllous forming dense dark olive, orbicular or elliptical patches, 1—2 mm. diam., composed of erect, simple or branched from the base, chains of closely connected, smooth, translucent, pale brown conidia, 20—30 μ long, consisting of 10 to 15 conidia about 3 μ in diameter.

On dead leaves of *Carex lupulinus* var.—; London, Can., Sept. 1896. Herb. D., No. 2403.

T. graminis, Desm., also occurring on species of *Carex*, has conidia 5 to 6 μ in diam., becoming black.

CLADOSPORIUM (?) MYRIOSPORUM, E. & D.

The fungus first appears as pale specks on the pea-pod; it soon becomes erumpent in small, light-coloured tufts, and finally confluent, forming a scurfy or faveolate scabby coat on the pod. From the first the much-branched, fertile hyphæ produce

abundantly minute hyaline conidia, little over 1μ long, but as the tuft develops the branches darken and the spores become larger, darker, and some of them septate. Their shape is mostly oblong, slightly pointed at one end, truncate at the other, showing the circle of attachment. Continuous spores vary from $1\frac{1}{2} \times 1$ to $1.4 \times 4 \mu$, septate ones from 10×3 to $30 \times 6-8 \mu$. Under a high power all except the smallest are seen to be rough or minutely echinulate. The hyphæ are sub-fasciculate, simple or septate, sub-geniculate, varying in colour from hyaline to olivaceous, sub-dentate or entire above, $40-80 \times 3-6 \mu$.

On pea-pods, communicated by Dr. J. Fletcher, Ottawa, from South Vancouver, B.C., and by B. C. Buffum, Laramie, Wyoming. Aug. 1896. Herb. D., No. 2395.

This fungus was so injurious in the British Columbia locality that the crop was not threshed.

CLADOSPORIUM ACUTUM, E. & D.

Black tufts, $\frac{1}{2}-1$ mm. diam., thickly scattered over the lower surface of the leaf, sparingly confluent. Fertile hyphæ cæspitose, olive brown, nearly straight, 3-5 septate, $80-110 \times 3\frac{1}{2}-4 \mu$, abruptly and mostly obliquely pointed at the apex. Conidia elliptic, 1-septate, becoming brownish, $10-15 \times 6-8 \mu$.

On fallen ash leaves, London, Can., Oct. 1896. Herb. D., No. 2441.

CERCOSPORA CARICINA, E. & D.

Tufts punctiform, minute, seriate between the parallel ribs of the leaf. Hyphæ cæspitose, mostly continuous, brown, notched and crooked above, 15 to 25×3 to $3\frac{1}{2} \mu$. Conidia slender, obclavate-cylindrical, hyaline, continuous, $34-73$ (mostly $35-50$) $\times 3 \mu$.

The leaves of the host are at first dotted with brown specks and blackened, finally becoming dead and then lighter in colour.

On leaves of *Carex rosea*, London, Can., Aug. 1896. Herb. D., No. 2390.

CERCOSPORA LESPEDEZÆ, E. & D.

Spots irregular, red, bounded by the veinlets, 2 to 5 mm. Tufts of conidia epiphyllous, hyphæ continuous, pale brown, $10-25 \times 4 \mu$. Conidia clavate-cylindrical, $35-50 \times 4\frac{1}{2} \mu$, 1-5-septate.

On leaves of *Lespedeza capitata*, Michx., London, Can., July, 1893. Herb. D., No. 2135; N.A.F., No. 3094.

SPHÆROPSIDÆ.

PHYLLOSTICTA HERACLEI, E. & D.

Spots large, 1-2 cm., reddish brown, indefinite, finally confluent and covering a large part of the leaf, which becomes pale and dry. The spots at first are margined with a faint yellowish zone. Perithecia mostly epiphyllous, nearly black, sub-erumpent, $110-125 \mu$. Spores hyaline, oblong, continuous, $3\frac{1}{2} \times 1\frac{1}{4} \mu$.

On leaves of *Heracleum lanatum*, Michx., London, Can., September, 1892. Herb. D., No. 2026.

PHYLLOSTICTA HISPIDA, E. & D.

Perithecia gregarious, innate, globose, with a broad round opening, small ($75-80 \mu$) visible on both sides of the leaf, but more distinct and prominent below. The leaf is clouded with dark, indefinite patches, but there are no distinct spots. Sporules oblong-cylindrical, obtuse, $3-4 \times 1\frac{1}{2} \mu$.

On leaves of *Smilax hispida*, Muhl., London, Can., Sept.-Oct., 1896. Herb. D., No. 2424.

PHOMA PANICULATA, E. & D.

Perithecia scattered, convex, hemispherical, about $\frac{3}{4}$ mm. in diam., covered by the epidermis which is raised into little black blisters and finally irregularly ruptured.

Sporules oblong, $20-30 \times 8-10 \mu$, rounded at the ends, hyaline, filled with granular matter.

On dead limbs of *Cornus paniculata*, London, Canada, May, 1893. Herb. D., No. 2099.

This differs from *Phoma Corni*, Fckl., and *P. Corni Succia* (Fr.), in its much larger sporules.

DENDROPHOMA POARUM, E. & D.

Perithecia erumpent superficial, papillate, hemispheric to conical, 150 to 200μ in diam. Sporules oblong-fusoid, hyaline, with a small nucleus in each end, $10-12 \times 2-2\frac{1}{2} \mu$, terminal and lateral on dichotomously branched basidia, $20 \times 1\frac{1}{2} \mu$.

On culms and inflorescence of *Poa annua*, London, Can., June, 1894. Herb. D., No. 2266.

VERMICULARIA SAMBUCINA, E. & D.

Perithecia gregarious, numerous, erumpent, hemispheric-depressed, $90-180 \mu$, thickly beset with dark dark-brown, short bristles $40-100 \mu$, mostly about 45μ . Sporules hyaline arcuate-fusoid, nucleolate, $24 \times 3-3\frac{1}{2} \mu$.

On dead young stems of *Sambucus* sp., London, Can., Aug., 1895. Herb. D., No. 2310.

DIPLODIA THALICTRI, E. & D.

Perithecia sub-gregarious, sub-cuticular, depressed-spherical or elliptical, small, $150-200 \mu$, visible through the thin epidermis which is raised into pustules and pierced by the papilliform, soon deciduous ostiola. Spores oblong-cylindrical, obtuse, 1-septate, pale brown, not constricted, $8-10 \times 3\frac{1}{2} \mu$.

On dead stems of *Thalictrum polygamum*, London, Can. Herb. D., Nos. 2211 and 2296.

ASCHOCYTA LEONURI, E. & D.

Spots $1-1\frac{1}{2}$ mm., numerous, thin, appearing as if the tissue were eaten out by a minute leaf-miner; round or angular, small, becoming confluent and then causing the part of the leaf to drop out. Perithecia $150-170 \mu$, visible from both sides of the leaf. Sporules oblong-cylindrical, uniseptate, pale, $14-17 \times 3\frac{1}{2}-4 \mu$.

Perithecia larger and spores different, otherwise like *Phyllosticta decida*, E. & K.

On leaves of *Leonurus cardiaca*, L., London, Can., July, 1893. Herb. D., No. 2160.

HENDERSONIA DISCOSIODES, E. & D.

Spots deep red-brown, definite, sub-orbicular or irregular in shape, $2-10$ mm. in diam. Perithecia epiphyllous, discoid, about $\frac{1}{4}$ mm. diam., bordered by the ruptured epidermis, black. Sporules oblong or clavate-oblong, 3-septate and slightly constricted at the septa, smoky-hyaline, $14-16 \times 4-5 \mu$, on slender pedicels about as long as the sporules. The spots finally become whitish in the centre.

On leaves of *Cratagus* sp. London, Can., Aug. 1893. Herb. D., No. 2186.

H. foliorum, Fckl., has curved, darker sporules than this species.

HENDERSONIA OSTRYIGENA, E. & D.

Perithecia scattered, about $\frac{1}{2}$ mm. in diam., buried in the bark which is blackened over them and raised into pustules pierced by the minute ostiola. Sporules oblong, 3-septate, not constricted, brown, obtuse, $10-12 \times 4 \mu$, exceptionally with one cell divided by a longitudinal septum.

On dead limbs of *Ostrya Virginica*, London, Can., May, 1893. Herb. D., No. 2170.

CAMAROSPORUM ULMI, E. & D.

Perithecia gregarious, subglobose, about $\frac{1}{3}$ mm. in diam., soft, slate-colour inside,

buried in the bark, their minute punctiform ostiola piercing but scarcely raising the epidermis. Sporules ovate, 3-septate, sub-muriform, brown, $12-13 \times 6-8 \mu$.

On dead branches of *Ulmus* sp., London, Can. Herb. D., No. 2286.

ASCHERSONIA CARPINICOLA, E. & D.

Stromata convex, erumpent, about 2 mm. in diam., seated on the inner bark, loosely embraced by the lobes of the ruptured epidermis, of carnose texture, nearly amber color when fresh, darker and sub-rufous when dry, easily deciduous. Perithecia minute, buried in the stroma with their dark-colored papilliform ostiola erumpent. Sporules elliptical, hyaline, $15-20 \times 6-8 \mu$ on short basidia.

On bark of dead *Carpinus Americana*. London and Dorchester, Ont. Herb. D., No. 2173.

SEPTORIA HYDROPHYLLI, E. & D.

Spots brown, at first 2-4 mm., circular, at last angular; smoky beneath. Perithecia epiphyllous, numerous, $50-80 \mu$. Sporules straight or curved, hyaline, $35-45 \times 1\frac{1}{2} \mu$.

On leaves of *Hydrophyllum Virginicum* L., London, Can., May, 1893. Herb. D., No. 2130.

SEPTORIA HELIOPSISIDIS, E. & D.

Spots irregular, beginning reddish brown, becoming darker, numerous, 2 to 5 mm. in diam. The part of the spot in which the perithecia develop becomes pallid so that the brownish spots become mottled with white areas. Perithecia amphiphyllous, on small whitish areas, sunken, dark-brown, $85-100 \mu$. Sporules, straight or flexuous, $23-54 \mu$, mostly $40 \times 1 \mu$.

On leaves of *Heliopsis laevis* Pers., Thamesville, Ont., Aug. 1892. Herb. D., No. 1981.

PIGGOTIA NEGUNDINIS, E. & D.

On leaves of *Negundo aceroides*. Perithecia minute, subglobose or subelliptical, $50-70 \mu$ diameter, connate in minute, flattened, punctiform tubercles thickly scattered over the lower surface of the leaf, and at first covered by the epidermis, but soon exposed. Sporules oblong, hyaline, continuous, $2\frac{1}{2}-3 \times 1 \mu$.

Differs from *P. Fraxini* B. & C. in its smaller sporules.

On living leaves of *Negundo aceroides*, London, Can., Sept., 1896. Herb. D., No. 2402.

MELANCONIÆ.

GLOEOSPORIUM CARPINICOLUM, E. & D.

Spots sub-orbicular, definite, dark brown, 2-5 mm. in diam. Acervuli innate, numerous, minute. Conidia minute, $3-4 \times 1\frac{1}{2}-2 \mu$, issuing on both sides of the leaf in snow-white tendrils.

On leaves of *Carpinus Americana*. London, Can., June, 1893. Herb. D. No. 2122.

Distinct from *G. Carpini* (Lib.) and from *G. Robergii* Desm., which have conidia over 10μ long.

GLOEOSPORIUM CONFLUENS, E. & D.

Spots small, $\frac{1}{2}-3$ mm., sub-orbicular, greenish at first, becoming horn-color and finally dull white and transparent in drying, often confluent over a large part of the leaf which then may become rusty brown. Acervuli minute, inconspicuous, soon confluent so as to be indistinguishable and filling the whole interior of the spot with the oblong elliptical, continuous, hyaline, $8-10 \times 3-3\frac{1}{2} \mu$, conidia.

On leaves of *Sagittaria variabilis*. The acervuli also appear on the petioles, and then the conidia are expelled in small white heaps. London, Can., July 1895, Herb. D., No. 2285.

ALAN MACDOUGALL.

Alan Macdougall, F.R.S.E., M. Can. Soc. C.E., M. Inst. C.E., for ten years Secretary of the Canadian Institute, died on 23rd April, 1897, at Exmouth, Devonshire, England, after a lingering illness. For a long time his health had been failing, and early in the summer of 1896 he went to Scotland in the hope that change of scene and a visit to his native land would lead to his recovery. But the hopes of his family and friends were to be disappointed, and he died at the comparatively early age of fifty-five. His services to the Institute as Secretary for ten years were of inestimable value, and numerous papers read by him on subjects more or less connected with his own profession of engineering bear testimony to his scientific zeal and diligence. He was son of the late Col. Macdougall, of Edinburgh, Scotland, and received his education in that city. In 1859 he entered the service of the North British Railway Company, and continued with that company till 1868, when he came to Canada, and became connected with the Toronto, Grey and Bruce Railway, then in course of construction, after which he was employed for about four years in some important lake and river improvements by the Department of Public Works of the Dominion. From 1877 to 1882 he was again in the employ of the North British Railway Company, but in the latter year he returned to Canada, and for a season was a divisional engineer on the Canadian Pacific Railway in Manitoba, after which he engaged in private practice in Toronto until, in 1887, he was made assistant city engineer. As such he conducted some interesting and valuable experiments to determine the velocity and direction of the currents in Lake Ontario, and made surveys in connection with the water supply of the city. He did not long retain his connection with the city service, and after his resignation he devoted his attention chiefly to sanitary science, being consulted as a sanitary engineer by many municipalities all over Canada, from St. John's, Newfoundland, to Victoria, British Columbia. To his enthusiastic devotion to civil engineering is very largely due the formation, in 1887, of the Canadian Society of Civil Engineers, and to the last he bent every energy to the elevation of the status of his profession in Canada. He was an ardent Scot, and took much interest in the work of the St. Andrew's Society, of which society he was elected Secretary for the year 1896; but, unfortunately, his failing health compelled him to resign after a few months' tenure of the office. He was also a member of the Gaelic Society. He was genial and kindly in his intercourse with his fellow-men, and will be long held in grateful remembrance by those who were associated with him on the Council Board of the Canadian Institute.

PUBLIC LIBRARIES IN CANADA. BY JAMES BAIN, JR., ESQ.

(Read December 11, 1897.)

There was a time, shortly after the discovery of printing, when it was possible for a man like Casaubon to say that he knew the contents, more or less thoroughly, of every printed book. But the limits of human endurance were speedily passed, and to-day the enormous mass of literature taxes the ingenuity of the librarian to mould it into organized form. Each successive generation adds its own stratum, and the whole forms the storehouse from which the new generation draws its inspiration and facts. This is especially true of the scientific worker, dependent on the accumulation of minute facts, recorded by long series of patient observers. It is for this reason, therefore, that I bring before you an institution devoted to science, a paper on the "Libraries of the Dominion."

The art of printing was introduced into the infant colonies at a very early period. In Halifax the *Gazette* was published in 1756, the first-born of a numerous progeny, and was followed by the *Quebec Gazette* in 1764. In 1779 a number of the officers stationed at Quebec and of the leading merchants undertook the formation of a subscription library. The Governor, General Haldimand, took an active part in the work, and ordered, on behalf of the subscribers, £500 worth of books from London. The selection was entrusted to Richard Cumberland, dramatist, and an interesting letter from the Governor, addressed to him, describing the literary wants of the town and the class of books to be sent, is now in the public archives, Ottawa. The books arrived in due course, and, while no catalogue survives, I think it would not be difficult to name a large proportion of them. The book world in which Dr. Johnson moved was yet a small one. A room for their reception was granted in the bishop's palace, and as late as 1806 we learn from "Lambert's Travels" that it was the only library in Canada. Removed several times, it slowly increased, until in 1822 it numbered 4,000 volumes. The list of subscribers having become very much reduced, it was leased to the Quebec Literary Association in 1843. In 1854 a portion of it was burned with the Parliament Building, where it was then quartered; and finally, in 1866, the entire library, consisting of 6,999 volumes, was sold, subject to conditions, to the Literary and Historical Society for the nominal sum of \$500.

Naturally, on the organization of each of the provinces, libraries were established in connection with the Legislatures. In Upper Canada the small library in the Parliament Building was destroyed by the Americans, and the one by which it was replaced by the fire of 1824, so that, when the two libraries of Upper and Lower Canada were united in 1841, there appears to have been little left of the early fugitive literature of the province. At the end of the past year the legislative libraries of the Dominion numbered nine, and contained 48,834 pamphlets and 309,395 volumes. By far the most important of these is the library of the House at Ottawa. Originally established on the union of the provinces of Upper and Lower Canada in 1841, it was successively removed with the seat of government from Kingston to Montreal, to Quebec, to Toronto, again to Quebec, and finally to Ottawa—a wandering life, which effectually prevented its attaining large proportions.

The unfortunate fires in Montreal and Quebec still further injured it, robbing it of much that was very valuable, and which could not be replaced. On the federation of the different provinces, in 1867, the library of the two provinces only passed into the hands of the Federal Government. The beautiful building in which it is placed behind the House of Parliament presents a prominent feature in the magnificent pile of buildings which crown the heights overlooking the Ottawa River, and from the windows the spectator gazes across the rocky gorge and the

Chaudiere Falls toward the Laurentide hills, forming one of the most picturesque scenes on the continent. In the eyes of the librarian the library has only one serious defect—it is complete—no arrangement has been made for extension.

On the confederation, in 1867, of the provinces which now form the Dominion, the union which existed between the provinces of Upper and Lower Canada was dissolved, and, as we have seen, the library passed into the hands of the Federal Government. Each of these provinces, now known as Ontario and Quebec, established new libraries in Toronto and Quebec city.

The sixty-two colleges and universities of the Dominion are provided with libraries containing 627,626 volumes and 24,894 pamphlets, an average of 10,123 volumes and 402 pamphlets. It is scarcely fair, however, to depend on an average of the whole number, as some half dozen universities possess at least half of the total number.

The senior of these, Laval University, Quebec, is famous as being, after Harvard, the oldest on the continent, being founded by Bishop Laval in 1663. During the dark days which witnessed the long struggle, first with the Iroquois and afterwards with the English and Americans, little progress was made in the collection of books, and it was not until it was converted into a university, in 1852, that its library commenced to increase rapidly. On the suppression of the Jesuit Order and seminary these books were transferred to it. It numbers considerably over 100,000 volumes, and is unrivalled for the extent and character of its French collection and its many scarce books in early French-Canadian literature and history. Their collection of the relations of the early Jesuit missionaries is only surpassed by the Lenox library, New York.

Our own Province of Ontario was for long the only one which attempted to grapple with the question of public libraries.

Miss Carnochan, of Niagara, has given an interesting account in the Transactions of this Institute for 1895, of the formation and history of the first circulating library in Upper Canada (1800-1820), established by some enterprising citizens of the Town of Niagara, for the supply of their own immediate wants and of those who could pay the small annual fee. It was successful until the destruction of the town by the American troops in 1813 wasted its volumes and impoverished its subscribers, so that it shortly after quietly passed out of existence.

In 1848 the late Dr. Ryerson drafted a School Bill which contained provisions for school and township libraries, and succeeded in awakening a deep interest in the subject. Ever anxious to impress on his hearers the importance of libraries as the keystone to a free educational system, he urged it on every opportunity. Lord Elgin, at that time Governor-General, was so strongly impressed with the importance of the movement that he styled it the "Crown and glory of the institutions of the province." In 1854 Parliament passed the requisite Act, and granted him the necessary funds to carry out his views in the matter. The regulations of the Department authorized each county council to establish four classes of libraries :

An ordinary common school library in each schoolhouse for the use of the children and ratepayers.

A general public lending library, available to all the ratepayers in the municipality.

A professional library of books on teaching, school organization, language and kindred subjects, available for teachers only.

A library in any public institution under the control of the municipality for the use of the inmates, or in any county gaol, for the use of the prisoners.

To aid this work a book depository was established in the Education Office to enable the smaller libraries to obtain readily good literature. The books were supplied at cost, and a grant of 100 per cent. on the amount remitted was added in books by the Department. During the thirty years of its existence 1,407,140 volumes were so supplied.

The proposal to establish the second class was, however, premature, and accordingly, finding that Mechanics' Institutes, supported by members' fees, were being developed throughout the many towns and villages, the Educational Department wisely aided the movement by giving a small grant, proportionate to the amount contributed by the members, for the purchase of books, and reaching a maximum of \$200, afterwards increased under altered conditions to \$400 annually. In 1869 these had grown to number 26, in 1880, 74, and in 1896 to 292. The number of books possessed by these 292 libraries was 404,605, or an average of 1,385 each, with a total membership of 32,603. The issue of books for home reading was 700,958, or an average of 2.6 for each member, which is a very creditable return, considering that only thirty per cent. of the books were fiction.

In 1895 the Minister of Education brought in a bill, which came into force in May, changing the name, "Mechanics' Institutes" into "Public Library." By this Act the directors of any Mechanics' Institute were empowered to transfer the property of the Institute to the municipal corporation on condition that the library be free. This can be done without passing a by-law or requiring a vote from the people. A large number have already availed themselves of it.

In the cities and larger towns, however, the Mechanics' Institute, with its limited number of subscribers, was found unequal to the task assigned it, and accordingly, in 1882, the Free Libraries Act was passed, based upon similar enactments in Britain and the United States.

The first Free Library established under the Act was in 1883, and in the period between that date and 1896 fifty-four have successfully come into operation. They contain 254,091 volumes and circulated during 1895, 1,216,407. Two of them, Toronto, and Hamilton, take rank, both in number and character of their books, among the best libraries of the Dominion.

Unitedly the 346 Public and Free Libraries of the Province of Ontario have on their shelves 658,696 volumes, and supplied in 1895, 1,917,365 books to their readers. Their revenue was \$183,688, of which \$42,741 was contributed by the Province, and they spent of this in books \$49,417.

The Province of Quebec has not yet introduced a Free Library Act, but the generosity of the late Mr. Fraser and of a number of gentlemen in Montreal has provided a fund for the establishment of a Free Library in that city, which was opened in October, 1885, under the title of the Fraser Institute. The Mercantile Library Association transferred to it 5,500 English books and L'Institut Canadien 7,000 French.

In St. John, N.B., a Free Library was founded in June, 1883, to commemorate the landing of the Loyalists a century previous, and in Halifax a Free Library owes its origin to the generosity of the late Chief Justice Young, both of which have been very successful. A sister society, the Library and Historical Society of Manitoba, has been the means of introducing a Public Library, and, with the assistance of the municipal authorities of Winnipeg, has laid the foundation of an extensive and valuable library.

In the lack of trustworthy information, I have not attempted to give any particulars of the Law, Medical, Scientific, Collegiate Institute and Young Men's Christian Association Libraries, further than they are summed up in the following condensed tables, showing the character, and the Province in which they are placed, of the 480 libraries of a more or less public character in Canada.

KIND.	No.	PAMPHLETS.	BOOKS.
Law	21	1,029	105,788
Legislation.....	9	48,834	399,395
Public	325	17,535	663,125
Collegiate, etc.....	62	24,894	627,246
Others.....	29	15,224	96,918
Special	2	14,330	18,500
Y. M. C. Associations	32	23,660
Totals.....	480	122,746	1,874,632

By provinces the 480 libraries are distributed :

PROVINCE.	No.	PAMPHLETS.	BOOKS.
Ontario	374	32,922	942,187
Quebec	39	31,841	531,356
Nova Scotia	26	17,756	97,521
New Brunswick	15	2,689	54,787
Prince Edward Island	3	500	8,528
Manitoba	8	5,014	34,730
British Columbia	10	1,554	11,303
North-West Territories	1	140	2,150
	476	93,416	1,682,572
Dominion	4	29,330	192,060
Totals.....	480	122,746	1,874,632

We may conclude, therefore, from these figures, that so far as the ordinary reader and University student are concerned, Ontario, at least in the cities and towns, is not badly served. The percentage of books per head is not unworthy of a Province which has only been redeemed from the wilderness during the past fifty years. In two directions, however, do we find shortcomings, if not actual want. Outside of the larger cities, towns and villages lies a large proportion of the population of this Province as well as in the others, which are entirely without access to books. There are whole townships and numbers of villages where the weekly newspaper is the only connecting link with modern science and literature.

If we wish to create an attachment by the farmer for his farm, to give an interest in life to his children in their surroundings instead of in the city, and, in other words, to lay the basis for a successful and pleasant country life, we must try to make his intellectual surroundings more attractive and profitable.

And this is not a new problem. Men who have had their country's good at heart have tried for years to meet the difficulty. The late Dr. Ryerson, as we have seen, attempted to make every school-house in the country a centre of "light and sweetness" by the school library, but failed because the effort was premature and because no effort was made to add to or exchange the books.

Since 1892 an effort has been made in New York State to meet it in a different manner. The State law of that year authorized the Regents of the State Library to lend for a limited time selections of books from the duplicate department of the State Library, or from books specially given or bought for this purpose, to Public Libraries under State supervision or to communities meeting required conditions. Out of \$25,000 appropriated for Free Libraries, a portion was at once set apart to buy and prepare books to be loaned under these rules.

The rules then adopted provide that a selection of one hundred books may be lent for six months to the trustees of any Public Library in the State on payment of a fee of five dollars to cover the expense of cases, catalogues, stationery and transportation both ways. Where no such library exists, the books will be lent on petition of any twenty-five resident taxpayers. Special collections of books may also be lent to the officers of a University extension centre, reading course or study club, if properly registered. A later rule offers selections of fifty volumes for a fee of three dollars. In 1893 the Librarian at Albany began to send out a number of small libraries, of 100 volumes each, to such of the small towns and villages as were not provided with Free Libraries. One of these small libraries remained in the community but six months, and was then exchanged for another—hence the name "travelling libraries," which has been applied to them.

The leading purpose seems to have been to incite communities to found permanent local libraries, but the scope of the work has been widened, and the system now provides smaller collections of books for rural communities. So successful has it proved that in 1895 the State of Michigan appropriated \$2,500 to buy books for a similar system and in 1896 the State of Iowa set aside \$5,000 for a like purpose.

In the same year Mr. Hutchins reports to the State Library Commission that in two counties of Wisconsin similar work had been commenced by private individuals. He says that each small library was put up in a substantial case, with double doors,

a lock and key, and so carefully packed that it could be safely shipped by freight. It was provided with a complete but simple system of blank records, so that it could be placed upon a table or counter, unlocked, and be ready for as effective and methodical work as any larger circulating library. In order to insure good care for the volumes and a continuous local interest, the libraries were only sent to communities which organized a local library association of twenty members who agreed to care for the books and to place them where they would circulate freely under the simple library rules prescribed. Each local association elected a secretary, who acted as its executive officer, and each paid a fee of one dollar for each library as a partial payment of the transportation charges.

Twenty-six libraries in one county were sent out in this way. They were visited about two months after by Mr. Hutchins, and he found them even more popular than had been expected. The most interesting accounts are given of the avidity with which the young especially seized the books. The movement is yet too young to allow of accurate statistics, yet they have proved that in Wisconsin, as in New York and Michigan, they supply an urgent need that has not been supplied by any other agency.

They have carried into hundreds of homes new thoughts and information, higher aspirations and ideals, new forces that are making for a better individual, family and social life. Their books are warmly welcomed by families whose doors are closed to the reformer or the missionary. Hundreds of small communities in Wisconsin have attempted to do such work for themselves, but have nearly always failed. They have raised money by entertainments or private subscriptions, and have started libraries with high hopes. In most cases their selection of books has been unfortunate, and when the few entertaining books have been read by most of the patrons and no new volumes are added the popular interest dies, and the library is either put in an obscure place or its volumes are scattered.

By the new system only wholesome and entertaining books are bought, and they are constantly appealing to new readers until worn out by use, and not merely shelf worn. Every six months a library is new to some public, and its arrival is a matter of comment and draws new interest to the library station. The books are bought at the lowest, and substantial editions are selected. They can be occasionally examined and repaired, an important economy, for with books as with clothing, a "stitch in time saves nine." In the making of rules and regulations a wide body of experience can be drawn upon, and in the printing much economy exercised.

Finally, it practically takes the selection of the reading of great numbers of untrained readers from the hands of blind chance, and puts it in the custody of trained experts, who can draw for assistance upon the library experience of the world. Our great and costly system of public schools works unceasingly to teach children how to read and then leaves too many of them to go through their adult lives without using that power to the best advantage, because of lack of opportunity.

The travelling libraries offer an unexpectedly cheap, efficient and practicable method of broadening our educational system to include in its beneficent purposes every one who goes out from the brief course of our common schools, and to enable them to pursue a life-long system of education.

Such a system as has been described seems feasible in Ontario. No part of the Province is beyond reach by rail or steamer, and in no part need there be lack of readers. Our school system, by providing school sections of moderate area, each with its school-house and teacher, seems to have placed the machinery ready to hand. In Wisconsin about one-third of the libraries are kept in the postoffice, one-half in farm houses and the remainder in small stores. But with the school master as librarian and the school-house as the distributing post, the most widely-scattered farm population could be easily reached, while the results of the daily tasks would be more satisfactory. By supplying also in this way the smaller existing Public Libraries, which are barely able to add to their collections, boxes of 100 new books

every six months, fresh life would be thrown into them and their readers brought into contact with the literature of the day.

The Minister of Education might justly consider the proposal to curtail the grants for libraries, amounting to over \$42,700, and devote the saving to the establishment of travelling libraries.

The second want is found at the other end of the scale. Our best libraries have not reached the stage of meeting the wants of our best scholars, and with the limited means at their disposal the time seems far distant when they will be able to do so. Rivalry is out of question with such great libraries as those of Harvard, the Astor-Lenox, Smithsonian, and others in the United States, not to speak of Great Britain, France and Germany, or even Russia; but if our students are to remain at home, some provision must be made to meet their wants. As a nation we cannot afford to be entirely dependent upon others for our highest culture, so that it is incumbent on us to consider carefully our position, and if possible, by combination and economy of energy, endeavour to supply our want.

We have in the City of Toronto some fifteen, more or less, public libraries, all of which, except four, are devoted to special subjects. These four are: the Legislative Library, the University of Toronto, the Public Reference Library, and the Canadian Institute. The first three mentioned are somewhat on the same lines, special departments being added to each to meet special requirements. In the past efforts have been made by the librarians to prevent the duplication of expensive books and sets; but necessarily a large proportion of the books are alike, and much waste of money, time and energy has ensued. The Legislative Library, established to supply the demands of our legislators, has been forced to add to its shelves quantities of general literature. It has now outgrown the chamber provided for it, and it will be necessary for the Government at an early date to provide further accommodation. The City Public Reference Library has in like manner grown to about 45,000 volumes, which are housed in a building unsuitable for the purpose—exposed to danger from fire and in need of additional space for expansion. The Canadian Institute, with its valuable collection of Transactions, is in much the same condition, with the additional disadvantage that the student finds here only a portion of his work, though an important one, and a lack of proper catalogues and literary assistance.

We have here three libraries which partially overlap and which fail to make full use of their opportunities by reason of special circumstances, and yet which if worked in harmony would do much to remove the present reproach.

It has seemed to me, after careful consideration, that the best interests of the Province and city would be served by adopting a proposal such as the following:

The Province of Ontario and the City of Toronto to unite in the maintenance of a common Provincial Reference Library, the books in which would be free to every person in the Province.

The Province, in consideration of the value of the books in the Public Library, to erect suitable buildings in a suitable locality.

The Legislative Library to be confined to such books as are actually required for legislative purposes, and the balance of the books transferred to the joint library.

The Canadian Institute to hand over their collection to the joint library, receiving in consideration a suitable meeting room.

Regulations made by which students in all parts of the Province could share in the use of the books, due regard being had for their safety.

In this way a library could be instituted—free to the citizens of Toronto, as their own is to-day—furnishing the highest literature to every student in the Province, properly housed with little more expense than the three libraries are at present costing, in which would be found room for extensive geological, mineralogical, botanical and other departments, so much wanted, forming a National Library worthy of the Province and of the City in which it is placed.

NIAGARA AS A TIMEPIECE. BY DR. J. W. SPENCER.

(Read January 22, 1898.)

Although probably a thousand papers have been written upon Niagara, commencing with the discoveries of La Salle and Hennepin, it is still less than twenty years since the physical history of the river began to be understood. La Salle and Hennepin visited Niagara, accompanied by an Indian chief, in 1678. Although they were the first white men who saw Niagara, its existence was made known by Indians to Jacques Cartier when he visited Montreal in 1535. Hennepin's rough sketch of Niagara appears to have been the only one made for a long time. The oldest drawing approaching accuracy, known to the writer, was one made by Lieut. Pierie in 1768.

In spite of the prejudices then existing against the antiquity of the earth, Andrew Ellicott, the surveyor and engineer, more than a hundred years ago, recognized that the gorge had been excavated by the river, and concluded that its age was about 55,000 years. Subsequent estimates were made, but that of Sir Charles Lyell became the most popular. Upon his conjecture that the Falls receded a foot a year, he estimated their age at about 35,000 years. Prof. James Hall made the first instrumental survey of the cataract in 1842, from which comparisons of the amount of recession can now be made. In 1890 the fourth survey was made, and the mean annual recession was found to be about four feet. This factor would reduce the age of the Falls to between 9,000 and 10,000 years, had it been a case of simple, uninterrupted recession. But as the volume of water and the descent of the river have varied so as to increase the time required, the estimate made by Lyell was nearer the true one. Subsequent to the classic writings of Lyell and Hall, of more than fifty years ago, one of the first papers which reopened the study of the physics of the river was written by the writer, in 1881, showing that the Erie basin was not drained by the Niagara river in pre-glacial times. This was confirmed by Dr. Julius Pohlmaes, who, two years later, discovered certain fragments of ancient streams, the valleys of which were taken possession of by the modern Niagara. Again, Prof. G. K. Gilbert found, in 1886, that the river had a greater descent at one time than now; but the earlier, long-continued and inferior height of the Falls was first pointed out by the writer. Upon the backing of the water after the maximum descent of the river, the surface of Lake Ontario rose above the present level, so as to again considerably reduce the height of the Falls. This second reduction of their height is, perhaps, the last discovery in the physics of the river, and has hitherto not been announced.

Perhaps the most important change discovered in the physics of the river was (in 1887-1888) that the three upper lakes—Huron, Michigan, and Superior—did not drain into Lake Erie until recently, but emptied, through Georgian Bay, towards the north-east. Thus for a long period Niagara river drained only the waters of the Erie basin. These discoveries show that the determination of the mean rate of recession of the modern Falls had to be greatly qualified in order to arrive at an approximate determination of the age of the cataract; but the difficulty remained of ascertaining the amount of work done during the different episodes. However, at Foster's Flats the bed of the old river and fragments of lateral terraces were found in 1893. From these and other features the key to the situation was partly obtained. Some of these results have since been confirmed by the estimate of the depths in the different basins of the modern channel made by Prof. Gilbert.

The modern Niagara took possession of the old Tonawanda channel, which had drained a portion of the Niagara tableland in pre-glacial times. Its valley was about one and a half miles wide and ninety feet deep, and crossed the course of the modern river. The rapids above the Falls represent the site of the modern waters, now descending over its side into the ancient Tonawanda channel, which had been filled with drift. This ancient valley is now buried, and continues westward of the whirlpool to form the St. David's Valley, about which so much has been written. The whirlpool gorge is only a modern enlargement of a small valley starting, in pre-glacial times, from near where the railway bridges are now located, and forming a little tributary of the Tonawanda channel, just mentioned.

The older geological features and the character of the strata have been known for fifty or sixty years, but the features here mentioned are those directly bearing upon the physics of the river, which were not formerly understood.

The episodes of the river may be briefly outlined. The first was of long duration, when the descent of the river was about 200 feet, and the volume of water one-fourth of that of the present amount (only the drainage of the Erie basin). Then we have all the waters of the upper lakes flowing over Niagara, and shortly afterwards the surface of Lake Ontario was lowered to 420 feet below the upper level of the river. Thus, in a general way, we have arrived at the time when the Falls had reached the foot of the whirlpool rapids, by which time the waters of the Ontario basin rose sixty feet or more above their present level. In the meanwhile there were three principal cataracts, the lower gaining upon the upper. But by the time the Falls had retreated to just above where the railway bridges cross the gorge the Ontario waters were again lowered, so that the modern descent of Niagara river is 326 feet. The physics of the short section along the whirlpool rapids is not yet understood; but even in spite of this, with the consequent errors in the theoretical determination, the age of the Falls so far has not been found to greatly differ from the computations made in 1893, which assigned the period between the time when the Niagara was a strait and the present day to be 32,000 years.

These changing episodes, which appear complex, are after all largely assignable to one cause, namely, the unequal elevation of the earth's crust in the lake region, the amount being greater towards the north-east than in the opposite direction. With the rise of the land, the Huron, Michigan and Superior, collectively named the Algonquin basin, was eventually drained by way of the Nipissing and the Ottawa valleys; and the waters of the Lundy basin, the name for the united Erie and Ontario basins, were lowered so as to leave only an insignificant Lake Erie, and the Iroquois gulf, extending in the Ontario basin to the foot of the escarpment at the mouth of the Niagara river, into which the Falls descended directly at their birth. With the continued rise of the land the waters of the Ontario basin sank, in so far as they affected Niagara, to eighty feet below their present level. The land, now rising more rapidly towards the north-east than the south-west, tilted the river of the Algonquin basin so as to raise a barrier across the Nipissing outlet (worked out by Mr. F. B. Taylor), which diverted the waters of the upper lakes into the Niagara drainage only some 7,000 or 8,000 years ago. The same kind of movement raised the barriers at the outlets of both Lake Erie and Lake Ontario so as to back their waters towards the heads of the basins; and, in the case of Lake Ontario, its surface rose some sixty feet or more in the lower part of the Niagara gorge. But a portion of the barrier at the outlet of Lake Ontario, being composed of drift, has recently been washed away by the St. Lawrence river so as to reduce the surface of Lake Ontario to its present level.

The movement is slow. The rise of the land in the Niagara district is about one and a quarter to one and a half feet a century; about the region of Lake Nipissing, nearly two and a half feet, and about the outlet of Ontario, between four and five feet a century. These upward movements were determined from geological observations made at Niagara, and their effect upon the tilted beaches, which had

been traced over the lake region; but until 1893 all attempts made at determining the rate of terrestrial changes defied investigation. The north-eastward movement is still continuing, as recently determined by Prof. Gilbert. Under these conditions further changes in the drainage of the upper lakes become imminent: thus the rocky barrier at Niagara Falls should be lifted so high in 600 or 700 years as to flood the country about the head of Lake Erie, and raise its surface to the same level as that of Lake Huron and Lake Michigan. In 1,000 or 1,200 years they should be high enough to overflow the low divide near Chicago into the Mississippi drainage. In about 2,400 years all the waters of the upper lakes promise to be diverted from Niagara to the Mississippi. The Chicago canal is not considered in this calculation, but will shorten the time of the last-named events. These calculations, based upon geological data, are very close to those of Prof. Gilbert, based upon other measurements. In the meanwhile the waters about Buffalo will rise somewhat higher than now, but in 5,000 years the whole of the Niagara river and the eastern end of Lake Erie will be turned into dry land, traversed only by insignificant streams. From the time when the whole discharge will be turned into the Mississippi there will be but little further excavation of the Niagara gorge. Before this change is accomplished, the Falls will have receded scarcely two miles farther southward; and thus for only a small proportion of their life history will they have been of use to man, or their grandeur remain as one of the wonders of the world.

The birth of the Falls was subsequent to the commencement of the lake history, which was posterior to the ice age proper. Upon the computation of the age of the Falls (32,000 years) it has been found that the end of the ice age was more than 50,000 or 60,000 years ago.

THE CREE LANGUAGE. BY REV. E. B. GLASS, B.A. (VICTORIA).

(Read January 29, 1898.)

I.

Of the Algonquin stock, the Plain and Wood Crees use, perhaps, the purest and most euphonious branch amongst the Cree dialects :

EUPHONY.

On the Saskatchewan 'duck' is 'sesep'; 'duckling,' 'sesepis.' At Moose Factory these words are 'sheshep' and 'sheshepish.' The former two words please the eye and ear, and are readily enunciated. There is a natural tendency to place a vowel between consonants in order to secure agreeable sounds. 'Iron' or 'metal,' is 'pewāpisk,' 'road' is 'māskunow' and 'rail' or 'iron-road' is 'pewāpisko māskunow.' 'Kīyās,' 'old,' 'kākwiya,' 'things'; 'old things' is 'kīyāse kākwiya.'

These Indians do not stammer—they are noted for ready utterance and eloquence. Rapid delivery is necessary on account of the syllabic character of the language, as distinct from the alphabetic of the English and most European languages; therefore euphony must be studied to aid pronunciation. I shall give an illustration :

"The new Government wishes to know how the Crees are prospering," has sixteen syllables. This in Cree is, "Kā ōske *puminā'kik weyusoowāwin wekiskāye'tum-wuk mā'te kespīn Nāheywāwā peyechechenā'koo'chekāyewānik," and contains thirty-seven syllables. Hence it can be seen that to convey the same idea in the same time as the Englishman, the Cree must speak more quickly.

PRECISION.

There is a definiteness about this tongue that is very striking, and in contrast to the ambiguity of many other tongues. If an elder brother is referred to it is 'nistās,' 'my brother,' if a younger brother, the word is 'nisēm.' My (elder) sister is 'nimis'; 'my (younger) sister,' 'nisēm.' It is observed that 'nisēm' is either 'my (younger) brother' or 'my (younger) sister'; but it is usual to add, in this case, by way of explanation, 'nāpāo,' 'man,' and 'iskwāo,' 'woman,' as 'nisēm iskwāo.'

All verbs are precise in first and second plural, and third singular and plural. In English, French, Latin, Greek, "we advise," for instance, is indefinite; but in Cree these forms of the verb leave no doubt in the mind of the reader or hearer addressed. "Ne se'ke'kāmūnān," "we advise," excludes second person or persons, including only first and third; "ke se'ke'kāmūnow," "we advise," takes in first and second only.

In addressing the Deity it is unpardonable to say "kemoostowinānow," "we desire it," which form embraces the first and second persons; "ne moostowinānān" must be used.

If I ask a friend whether Mr. Jackson's son is home, the answer is "āpēyewa," not "apēu"; the latter word is, in substance, "he is home," and refers to Mr. Jackson himself; but "āpēyewa" has the relative ending "yewa," relating to the second party mentioned, that is, the son.

My friend may then say, referring to Jackson and son, "nātawāye'tum kita pāetu'tāt ootā" "he desires to come here," that is, Jackson. If it is said, "nātawāye'tum kita pāetu'tāyit ootā," the relation extends to the son, and the meaning is that Jackson wishes his (son) to come here."

(*The Greek or Scotch aspirate [r] cannot be omitted in many words.)

No one can dispute the ambiguity of the following: "The chief spoke to the thief in his house." Such indefiniteness has no place in Cree. If the chief's house is meant the sentence is, "Okemow ke weche pekiskwāmāo okimotiwa weki'k"; if the thief's house is meant, the last word has the relative (relating to another) ending "yik" added, making "wekeyik."

Suppose that a man wishes to take a horse home. The form of verb he employs indicates whose horse. If his own horse he says, "Ne kā kewā'tahow," "I will take him home." If another's, "Ne kā kewā'tāhimowā," "I will take his (horse) home."

SYNTHESIS.

A few examples will give some idea of the constructive peculiarity of this language.

The root "wā" signifies "light" or "white colour." By a system, the Cree has added to this root endings that are significant and unique: "Wāpeo," "he sees"; "wāpewin," "sight"; "wāpamun," "mirror"; "wāpā'tum," "he sees it"; wāpamāo," "he sees him"; "wāpehāo," "he causes him to see."

Again, upon the root "pim," "coursing" or "going," is built another set of words: "Pimo'tāo," "he walks"; "pimo'tāwin," "walking," *i.e.*, the noun; "pimo'tahāo," "he causes him to walk," or go; "pimē'yow," "he flies"; "pimiskow," "he paddles"; "pimāsiw," "he sails or goes with the wind"; "pimipā'tow," "he runs"; "pimipā'towin," "running"; "pimipāyiw," "he passes running"; "pimipāyiw," the noun "running" in passing by.

II.—THE NOUN.

There is a disposition on the part of some to underestimate the importance of the noun in Cree. It is difficult to see the reason of this when it is considered that the language abounds in names of all kinds conceivable, and possesses the genius or ability of naming everything that civilization presents as new. It is true that many nouns are formed from verbs by prefixes and modified endings, but this fact is no argument (as will be seen) that the noun is not a prominent part of speech or that it does not naturally occur in the language.

1. Names are given "directly" to objects—*kēsik*, sky; *atim*, dog; *asinee*, stone; *nipē*, water; *nāpāo*, man; *kōna*, snow; *pimē*, oil, grease; *mūstūs*, a cattle beast; *mūswā*, moose; *muskwā*, bear; *minahik*, pine; *askē*, earth, a country; *pē'kō*, ashes; *mē'kō*, blood. In the last two words the "rough breathing" of the Greek is used, to secure the *h* sound in English, after *ē* in each word. The force of the breathing is exactly the same as that in the name *Lochaber*, a district of *Inverness*.

2. Names are given "indirectly"—that is, they are suggested or derived:

(a) Of these the verb originates many nouns by the prefix *ō*, as *kistekāo*, he farms; *ōkistekāo*, farmer; *āyamchow*, he prays; *ōtāyamehow*, one who prays, a Christian. The *t* is here inserted between two vowels for easy utterance, or euphony. *Mēyosoo*, she (mas. or fem.) beautiful; *ōmēyosoo*, the beauty. *Kēyāskēw*, he lies; *ōkēyāskēw*, a liar.

(b) The verb originates other nouns by an affix, or by both prefix and affix, to the third person, singular, present tense. *Nikumoo*, he sings; *nikumowin*, singing. *Chēkiēkāo*, he chops; *chēkiēkāwin*, chopping. *Tipahumākāo*, he pays; *tipahumākāwin*, payment. *Nipā'tākāo*, he commits murder (mas. or fem.); *ōipā'tākāsk*, a murderer. *Āyumēhā'kāsoo*, he pretends to pray; *ōtāyumēhā'kāsusk*, a hypocrite. The last three examples show that nouns may be formed by a prefix and the affix *sk* to a modified ending.

(c) By dropping the ending of the third person, singular, and adding *kän*, nouns are derived from verbs: *Këskëpoochëkão*, he saws (crosswise); *këskëpoochëkãn*, cross-cut saw. *Tãskëpoochëkão*, he saws (lengthwise); *tãskëpoochëkãn*, rip-saw. *Pëkopichëkão*, he plays; *pëkopichëkãn*, plow.

(d) In a number of cases the noun formation consists in omitting the pronominal prefix of a verb, third, singular, and adding *kun* or *chëkun* to the ending, from which the consonant is elided. *Ne mini'kwãn*, I drink; *mini'kwäkun*, or *mini'kwächekun*, a cup, or drinking vessel. *Ne käse'kwãn*, I wash my face; *käse'kwäkun*, wash basin.

(e) A class of nouns is formed from other nouns by adding *kän*, a vowel being inserted between the consonants, the new formation denoting something simulative or artificial. *Awãsis*, child; *awãsisë'kãn*, doll. *Pësim*, the sun; *pësimo'kãn*, a clock. *Manitoo*, God; *manito'kãn*, an idol. *Pã'kwãsekun*, flour; *pã'kwãsekunë'kãn*, wheat; in this derivative one would expect the word for flour to be derived from that which signifies wheat, according to rule, but this is the exception.

(f) If *wãn* is added to the name of an animal, a name is obtained for that animal's skin. *Wãpoos*, rabbit; *wãpooswãn* rabbitskin. *Mooswã*, moose; *mooswãn*, mooseskin.

By affixing *wãgin* to the same names of animals, a name for a part of the skin is supplied. *Moostoos*, a cattle beast; *moostooswãgin*, a piece of oxhide, or leather. *Mooswãgin*, a piece of mooseskin. These derived cognate nouns are much in use. The word for book is *musinëkun*; if *ãgin* is added, as in *musinëkunãgin*, the name for paper is obtained. *Papakëwãn*, shirt; *papakëwãnãgin*, shirting.

(g) Diminutives are formed by means of an affix "is," "oos," or an ending of like sound. *Sësep*, duck; *sësepis*, duckling. *Nãpão*, man; *nãpãsis*, boy. *Iskwão*, woman; *iskwãsis*, girl. *Mã'kã'k*, barrel; *mã'kã'koos*, keg. *Musinëkun*, book; *musinëkunis*, letter. *Musinëkunãgin*, paper; *musinëkunãginoos*, a bit of paper. *Sëpë*, river; *sëpësis*, creek. *Misëhão*, hen; *misëhãsis*, chicken.

(h) By affixing *ãpwë* to a noun or an adjective, the name of a liquid is obtained. *Iskootão*, fire; *iskootãwãpwë*, fire-liquid or whiskey. *Musinëkun*, book; *musinëkunãpwë*, ink. *Sëwow*, it is sour; *sëwöpwë*, vinegar. In this last word, by eliding a vowel and a consonant, a euphonious word is formed.

(i) If *ã'tik* is added to a noun, an appurtenance or part is designated. *Musinëkun*, book; *musinëkunã'tik*, pen. *Chëkëkun*, axe; *chëkëkunã'tik*, axe-handle. *Mëtisowin*, eating or food; *mëtisowinã'tik*, table.

(j) *Kumik* denotes abode, dwelling, or building, when affixed to a noun. *Mistãtim*, horse; *mistãtimokumik*, horse-stable. *Moostoos*, cattle-beast; *moostoosokumik*, cattle-stable. *Sooneow*, money, *sooneowokumik*, bank. *Asã'kão*, he gives rations; *asã'kãokumik*, ration-house.

(k) By prefixing an adjective or a verb to a noun, a composite noun is formed. *Pë'tukão*, he enters; *ãyamehowin*, prayer; *pë'tukãwëãyamehowin*, class-meeting. When *ãyamehão*, he prays, is prefixed to *ëyënew*, person, there results the long word *ãyamehãwëyënew*, preacher. *Ki'che* is great; *ökemow* is chief, ruler or king; *iskwão* is woman. Now, by joining these three in order, and remembering euphony, a significant noun is the result, which means queen. This word is *ki'cheökemãskwão*.

“RECENT VIEWS ON COLOUR.” BY ALBERT H. ABBOTT, B.A.

(Read January 29, 1898.)

The colour problem has three aspects :

I. The physical problem, which investigates that energy in nature which is especially connected with our sensation of light and colour.

II. The physiological problem, which investigates the processes in the eye and its accessories as the organ of vision.

III. The psychological problem, which investigates our sensations of colour, or colour as it is experienced. The question here is: What are the mental facts of light and colour, and on what conditions do they depend ?

The first “recent” view on colour discussed was the emphasis which has been laid upon this psychological colour problem with the rise of scientific or experimental psychology. Both of the other aspects, the physical and physiological, must refer continually to the facts of colour which scientific psychology discovers or establishes, as the final test of the adequacy of their theories. The facts of all sciences are *primarily* facts for psychology (*i.e.*, psychic or mental facts), and *secondarily*, facts for these sciences, and hence, the conclusions and theories of all sciences must be judged by their faithfulness to the facts of experience.

The second view on colour discussed was a modification to the ordinarily accepted physical theory of colour, suggested by Dr. Kirschmann. The ordinary theory contends that colour is an explicit function of the wave length. There is a difficulty, however, in this view which is raised from the fact that *no one has ever seen light or a colour of only one wave length*, and, therefore, that, could we get light of one wave length, there is no guarantee at all that we should see it coloured. *Colour of one wave length is a purely hypothetical conception*; at every point on a spectrum there is always a superposition or interaction of wave lengths. A slit *infinitely* small would, so far as mathematics are concerned, give the *pure* spectral colours which advocates of this theory demand: but, on the other hand, a plate bearing a slit which is *infinitely narrow* would be for us an *opaque* object. Colour as seen in the spectrum must actually be projected by use of a slit of finite width, and, therefore, it must always be produced by the superposition or interaction of wave lengths.

This contention is based directly on psychical considerations, *viz.*, whether we *see* colour or not. To contend that that alone would be a *pure* colour which is to be produced under circumstances which would prevent us seeing either light or colour seems to overlook the fact that it is our sensations of colour which make any science of optics possible, and surely they must be the deciding factor in such a matter to the last.

A second line of objection to the theory that colour is an explicit function of the wave length arises in connection with the discussion regarding purple, *i.e.*, the colour which would form the transition from violet to red. This colour is not present in the ordinary spectrum, and from this it has been concluded that purple is not a *pure* but a *mixed* colour, and as such it is not a constituent of white light at all.

An experiment was shown which seems to have some bearing on the question. By very simple means two spectra were thrown upon a screen together, parallel and in close juxtaposition to each other. The one was the ordinary spectrum, consisting of red, orange, yellow, green, blue, violet, and the second was an “inverted” spectrum, consisting of blue, violet, purple, red, orange, yellow. (Note.—Purple is absent from the first, *green is absent from the second.*)* This “inverted” spectrum

*The “inverted” spectrum was first shown in this connection in a lecture given by Dr. Kirschmann before the Mathematical and Physical Society of the University of Toronto. The objection may be raised that the colours in the inverted spectrum are not as “pure” as those in the ordinary spectrum, but this is met by the fact that, as sensations, the colours are quite as pure and brilliant as the ordinary spectral colours. The right of these colours to rank physically the same as the latter colours was further demonstrated in the above-mentioned lecture by the fact that both spectra show interference bands equally well.

is produced by the superposition of two spectra, so that the red and violet rays act together, and so give purple. *The presence of purple, therefore, proves nothing* which could reflect on the ordinary theory, but *the absence of green* is of more significance. If green is a constituent of white light, why is it absent? Where is the green? If we answer, Just where the purple is in the ordinary spectrum, we must undertake a thorough discussion as to the basis of the contention that green is a constituent of white light while purple is not. The fact is, if we prevent the rays of the ends of the spectrum interacting we lose purple, and if we prevent the rays of the middle of the spectrum interacting we lose green. The absence of both of these colours from the spectra seems to be rather a property of the means used in each case than of white light. In white light every wave acts at the same point, while in the longitudinal arrangement of the colours, as in a spectrum, we prevent this; but while allowing the neighbouring waves to act together we deprive the waves of ends of the spectrum altogether of this possibility. Hence, Dr. Kirschmann contends, the absence of these colours in each case. He suggests, therefore, that the theory be modified and stated as follows: "*Colour-quality is a function of the superposition of wave-lengths*, so that to every qualitative difference in spectral colours corresponds a difference in the mode of superposition.*

This position goes back to the psychology of the question. If purple were found to play an exceptional role in our colour sensations there might be grounds for rejecting these conclusions. But if, as is the case, purple be found to obey the same laws which all other colour sensations follow, there is no reason whatever for regarding it in any peculiar light. It is a colour quite as much as any other. There is, therefore, no *a priori* reason for rejecting it from the list of *pure* colours. If, however, it must be rejected in the case of the ordinary spectrum, surely green must be rejected in the case of the inverted spectrum from the list of the constituents of white light, and both for the same reason.

The third question discussed was along the line of the general psychology of colour.

Experiments were made, showing that colour sensation could occur when physically there was no light of the specific colour present, *e.g.*, as in contrast phenomena.

The manifoldness of our colour sensations was also illustrated by a geometrical construction known as "the colour cone," and by means of rotating discs, showing transitions in shades, tints and saturations of colour.

The fact that, from the psychological standpoint, there is no reason to speak of fundamental colours was discussed, and the significance of the colour theory of Prof. Wundt was pointed out. Owing to modifications made in connection with this theory recently by Dr. Kirschmann, and in consideration of the modifications suggested to the physical colour theory by the same scientist, it seems proper to give the theory the name of the Wundt-Kirschmann Colour Theory.

*"Colour saturation and its quantitative relations."—*American Journal of Psychology*, Vol. VII., No. 3.

SEISMOLOGICAL OBSERVATIONS AT TORONTO. BY R. F. STUPART, ESQ.,
DIRECTOR METEOROLOGICAL SERVICE OF CANADA.

(Read February 5, 1898.)

At the Ipswich meeting of the British Association it was resolved that the two committees which were studying vibrations of the earth's crust, viz., "The Committee for Investigating the Earthquake and Volcanic Phenomena of Japan" and "The Committee on Earth Tremors" should not be reappointed individually, but that the whole subject should be referred to a new committee, consisting largely of the members of the old committees, which should be called, "The Committee on Seismological Observations." The new committee at Liverpool reported as follows: "This Committee, however, think that it would be well in this, its first report, to state definitely what it hopes to accomplish, and how far it thinks that the British Association should go. It has long been an unwritten rule that the Association should initiate work, but should not charge itself with its maintenance. This is precisely what your Committee desires. Now that it has been proved that any important earthquake is felt all over the globe, the Committee considers that arrangements should be made for the record and study of these movements. Your Committee considers that such records may prove as important as those of *e.g.*, terrestrial magnetism, and, just as we have magnetic observatories in various parts of the world, so, in its opinion, should there be seismological ones. But, before advocating their erection, it is essential that a decision be arrived at as to the form and degree of sensitiveness of the instrument to be recommended.

This, and correspondence connected with the organization of the system, is the work which the Committee desires to complete. Previous reports and the appendices to the present one, show how much has been done in this direction, but the Committee desires to do much more. It wished to place side by side four good patterns of instruments, and to compare and study their records. When this is done it hopes to receive the support of the Association in approaching the Government with the view to the establishment of a limited number of instruments, identical in sensitiveness, in this country, in India, and in the colonies, and of a small central office at Kew or elsewhere for co-ordinating and publishing the results. As far as the Committee can at present judge, the equipment of each station, with complete apparatus for continuous photographic record, would not exceed £100. For the experimental work of the coming year the Committee have one instrument, and can have the use of another (constructed under a grant to Professor Milne by the Royal Society); it wishes to purchase two others, and will have to build piers, etc., and pay for photographic necessaries and an assistant to run the instruments, which, altogether, would probably cost over £200. Your Committee thinks it desirable that to meet unforeseen items it should have £250, but without £200 the work cannot go on."

Early in 1897 a letter was received from the chairman of this Committee inviting the co-operation of the Canadian Meteorological Service in a seismological survey of the world. The Honourable the Minister having been pleased to authorize the expenditure of the necessary funds, a seismograph was ordered, and the instrument arrived in Toronto on the morning of the day that Professor Milne gave his most interesting lecture on "Earthquakes" at Massey Hall, and he was able to have it on the table for the inspection of those of his audience who wished to examine its construction. The instrument consists of a horizontal pendulum with a boom two feet six inches long; at the end of this boom is a plate in which is a narrow slit,

parallel to the length of the boom. The position of this, beneath a slit at right angles to it, is shown by a speck of light from a small lamp, reflected down, which photographs continuously on a bromide film two inches wide, which passes at the rate of five-feet each day. Every hour the light is eclipsed by a screen attached to the long hand of a watch, and thus a time scale is supplied.

After the departure of the members of the British Association we lost no time in getting the instrument in position, but unfortunately were unable to begin operations immediately, as the maker had failed to send us the necessary paper, and it was not until the 20th September that the clock was set in motion. I say unfortunately, because there was great disturbance on at the very instant the record began, and we have a clear record of the maximum and last vibrations caused by an earthquake which Professor Milne informs us occurred in Borneo.

There are difficulties to contend with in the management of the seismograph, and the greatest of all is vibration of the pendulum, caused, we believe, by some movement of the air. Professor Milne has been unable to altogether get rid of the movement in his instrument in the Isle of Wight; he is inclined to think it is caused by air currents. He has studied the vibrations under various atmospheric conditions, and apparently finds, as we do, that the disturbance is most pronounced on clear, calm nights when radiation is great. It is a subject for investigation, whether we are not registering on our seismograph the very atmospheric tremors or waves which cause telegraph wires to hum on clear, calm nights, and that, Mr. Percival Lowell asserts, are the cause of bad seeing on certain nights which, to all appearance, ought to be good for astronomical observations.

Since the starting of the instrument we have recorded eleven very decided quakes and nine small earth tremors; many others have perhaps been lost in the air current disturbances. The most marked of the eleven was the first one, the origin of which Professor Milne places in Borneo; the next in order of importance occurred on December 19th, when earthquakes were reported both from Bermuda and Italy; this was not recorded in Great Britain. Next came one on December 28th, and was followed by a larger one on the 29th; and both were also recorded by Milne in the Isle of Wight.

The preliminary tremors on the 28th (Fig. 1) began at Toronto at 8h. 24m. 37s., Greenwich mean time, and in the Isle of Wight at 8h. 54m. 51s., or over half an hour later. At present we have no knowledge of the origin of this disturbance. The disturbance of the 29th at Toronto (Fig. 2) was marked by the absence of preliminary tremors, and vibrations of large amplitude began at 11h. 32m. 29s. In the Isle of Wight preliminary tremors began at 11h. 40m. 48s., and the larger waves at 12h. 0m. 37s., or 28m. 8s. later than Toronto. The origin of this disturbance was obviously near the north coast of San Domingo. Two cables were broken by it, and, according to newspaper reports, the town of Santiago was greatly damaged at about 11h. 29m.; which time, however, Professor Milne thinks is an error, and is inclined to place six minutes earlier. The distance from San Domingo to Toronto is 1,510 nautical miles, and to the Isle of Wight 3,823 miles. We are endeavouring to obtain further particulars from San Domingo regarding the time of the shake, and if successful the comparison will be particularly interesting. The last important shock was on January 24th, the preliminary tremors beginning in Toronto (Fig. 3) at 12h. 18m. 28s., or 32m. 39s. later than in England; this would seem to indicate a very different origin from those of December, perhaps in Asia Minor. At the Toronto meeting of the British Association last year Professor Milne obtained a grant for the construction of a few seismographs, and I promised to place one of them in charge of the meteorological observer at Victoria, B.C. The instrument is nearly ready for shipment, and will probably be placed in position about the 1st of June. This will be another link in the chain of seismological stations, and it is pleasant to know that Canada is taking a very active part in this most interesting and important seismic survey.

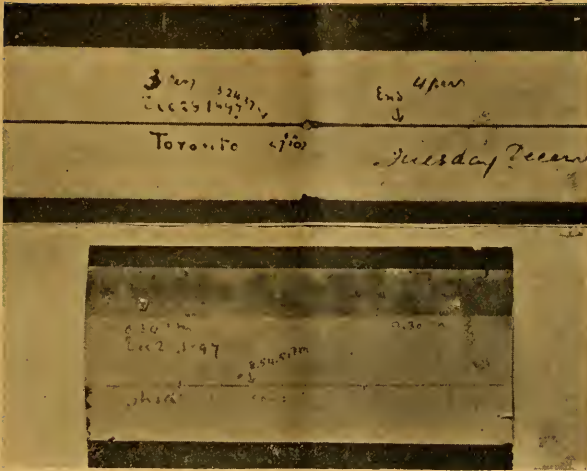


FIGURE 1.

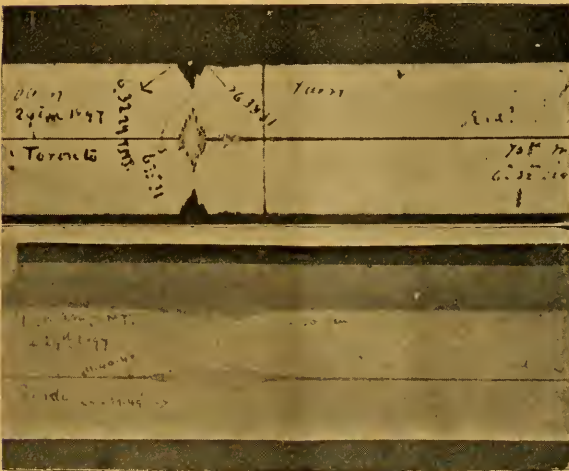


FIGURE 2.

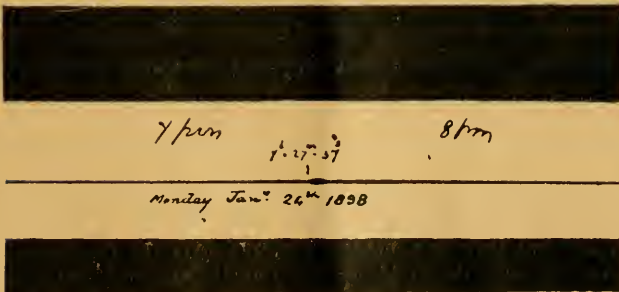


FIGURE 3.

THE GENERAL HISTORY OF THE CELTS. BY REV. NEIL MACNISH, LL.D.

(Read February 19, 1898.)

In the topographical names of the British Isles, in the names of streams and rivers and hills and mountains and lochs and headlands, an argument plausible and strong can be found in favour of the theory, that the Gaelic portion of the Celtic race preceded the Cymri, or Welsh, in the occupation of Britain; and that the Scottish Gaels of to-day speak the same language which our remote ancestors spoke, who, of the Celtic race at least, were the first to enter and inhabit the British Isles. Those whose hearts are warmed with Celtic blood have at least the satisfaction of knowing that they are the descendants of perhaps the oldest race in Europe; and that, although the early appearance of the *Keltoi* in that Continent is enveloped in hopeless obscurity, it is true beyond contradiction that their Celtic forefathers were both numerous and powerful long before the English, or German, or French, or Italian peoples had any distinctive existence. The Celtic dialects were strong and well developed and cultivated before any of the important languages of modern Europe were born. Pride of extraction and veneration for genealogies that reach back into the distant past, seem to have an irresistible attraction for the human heart. In the social life of modern days, there is a tacit admission that he is entitled to more than ordinary respect who can establish his contention, that the blood of many respectable generations is coursing in his veins. In addition to the acknowledged antiquity of their presence in Europe, the Celts have the additional satisfaction, that the stream of their particular blood has flowed down with comparative purity during many centuries; and that in the Celts of our day, there is a large absence of that admixture of blood and nationality which is so marked in the Anglo-Saxon race. Mommsen asserts "that the Greek and Italian are brothers, and that the Celts, the German and Slavonian are their cousins." Max Müller thus writes: "The fourth branch of our family is the Celtic. The Celts seem to have been the first of the Aryans to arrive in Europe, but the pressure of subsequent migrations, particularly of Teutonic tribes, had driven them towards the westernmost parts, and latterly from Ireland across the Atlantic. At present the only remaining dialects are the Kymric and the Gadhelic. In former times the Celts not only enjoyed political autonomy, but asserted it successfully against the Germans and Romans. Gaul, Belgium and Britain were Celtic dominions, and the north of Italy was chiefly inhabited by them. In the time of Herodotus we find Celts in Spain and Switzerland. The Tyrol and the country south of the Danube have once been the seats of Celtic tribes; but after repeated inroads into the regions of civilization, familiarizing Latin and Greek writers with the names of their kings, they disappear from the east of Europe." This is the opinion of Latham regarding the *Keltoi*: "This stock was indigenous to the water systems of the Loire, the Seine, the Rhone; in other words, to the whole of France north of the Garonne, to the south of which river lay the Iberians. From Gaul it spread to Great Britain. Its present representatives are the Bretons of Brittany, the Welsh, the Gaels of Ireland and Scotland, and the Manxmen of the Isle of Man."

The early annals of Rome record a victory which the Gauls, under their leader, *Brennus*, obtained over the Romans. At Allia, in the neighbourhood of Rome, the Romans sustained so severe a defeat in 391 B.C. that the Gauls were allowed to occupy the city without much or any molestation. Though the inventive genius of Roman historians has thrown a halo of romance over the departure of *Brennus* and his Gauls from the city, the stubborn fact remains that the Gauls were at that time brave and numerous and powerful. Further, we learn from classic story that

Gauls under the leadership of another Brennus invaded Greece in 279 B.C., and were prevented by some miraculous interposition from gaining possession of the treasures at Delphi. The Gauls were defeated and their leader was killed. After their departure from Greece they crossed into Asia Minor, and finally settled in the province which was known as Galatia—a name which doubtless owed its origin to the Gauls who planted their homes in that portion of Asia Minor. Max Müller and others are of opinion that *Brennus* is akin to the Welsh *Brennin*; and that the meaning of the word in question is *king*. The conjecture may be advanced that, as the two leaders of the Gauls bore the same name, *Brennus* may be regarded as a distinction of office, or as an appellation which every Gaul who occupied the highest position bore in virtue of his office. I am disposed to believe that *Brennus* is a Gaelic word; and that in it we have a faithful if not an unmistakable reproduction of *Breitheanas*, or *Judgment*, or better still, *Breith a nuas*, *Judgment from above*. The presence in Gaelic annals of *Vergobretus*, or *Fear' gu breith*, or *Man of Judgment*, or judicial officer, strengthens the conjecture that Brennus is a reproduction of our Gaelic word *Breitheanas*.

Various opinions have been advanced as to what the true meaning of the term *Celt* is. In his introduction to the "Beauties of Gaelic Poetry" Mackenzie writes: "The appropriate name which this remarkable people gave themselves was *Celtae*, but the terms *Calatae*, *Galatae* or *Gallatians*, and *Galli* or *Gaul*, were adopted by the Greeks and Romans, and were the appellations by which in later ages they were usually distinguished. A more probable derivation is from the fair complexion by which the ancients characterized this race. This is the *Etymon* given by Greek scholars, as if the body were *Galactoi*, milky-coloured. And as G and C are commutable letters, it must be confessed that the Gaelic *Gaelta* or *Celta* has the closest possible resemblance to *Celta*." Zeuss, the erudite author of the *Grammatica Celtica*, suggests that *Gael* has its origin in a word meaning *wind*; and that it, therefore, signifies a violent, stormy people. Latham contends that *Kelt* means *Mountaineer*. In the description which Virgil has given of the various scenes that were represented on the shield of Aeneas, reference is made to the Gauls who captured Rome, "*Aurea Caesaris ollis et aurea vestis*." Two allusions are found in Herodotus to the Celts. His words, literally rendered, are these: "For the River Danube, beginning from the Kelts, and the City of Pyrene, flows, dividing the middle of Europe. But the Celts, or *Keltoi*, are outside the pillars of Hercules, and border on the *Cynesii*, who are the last that dwell toward the west of those who reside in Europe. The *Ister*, or Danube, beginning from the Celts, *i.e.*, having its source at the country of the Celts, flows through the whole of Europe. The Celts are the last of the Europeans after the *Cynesii*, who live in the direction of the setting of the sun." Pausanias thus writes in reference to the Celts of his own time: "The custom of calling them *Galatae* or *Gauls* has only prevailed of late. They were formerly named *Celtae*, both by themselves and others." We may conclude with at least a large measure of reason, that the words *Keltoi*, *Galatai*, *Gaul* and *Gael* have very much in common, and that their signification is to a large extent the same. *Kelt* is a more ancient, and doubtless a more comprehensive term than *Gaidheal*. So strong and palpable is the relation which *Gael* bears to *geal* (white) that there is valid ground for believing, in consideration of the argument which Mackenzie adduces, as well as of the reference which is found in Virgil to the yellow or golden hair of the *Gaul*, that the origin of the appellation, *Celt* or *Gael*, is to be traced to the fair complexion of the ancient members of the Celtic race.

The earliest settlers of a country are wont to leave behind them indelible reminiscences in the names of mountains, streams and lochs. There can be no doubt whatever that the word *Alp* is Celtic; and that we have in the very name of one of the largest mountain ranges of Europe, an enduring proof that the *Keltoi*, at some time in the remote past, inhabited that portion of Europe which is embraced by the region of the Alps. There is an old Gaelic word *Alp*, which signifies a height or

mountain, and hence we perceive that Alp is a very expressive designation. In the word *Apennines* the root *ben* or *beann*, a hill or mountain, occurs; nor can there be any difficulty in detecting a strong likeness, if not an identity, between the name of the mountain range in Italy and *Apuinn*, the name of a hilly district in the north of *Argyllshire*. *Pyrenees* (*bryn*, a hill), the name of the range of mountains whereby Spain is separated from France, is a compound of *bior*, sharp, and *beinn*, Biorbheinn, sharp-pointed hills. When it is remembered that the letters *b* and *p* are convertible in Gaelic, the similarity of the Gaelic word, *Bior-bheinn*, *piorbheinn*, and *Pyrenees* will become apparent. The Gaelic word *Tabh* (water) is to be found in Loch Tay and the River Tay in Perthshire, Scotland. There can be no doubt that the same root, *Tabh* (Irish *Tab*), is traceable in the word *Tiber*, *Tagus*, *Thames*. It is said that when the Roman soldiers beheld the Tay in Perthshire they exclaimed, *Ecce Tiberim*. I find that Tacitus in his "Agricola" renders *Tay* by *Taus*; and, such being the case, it is evident that *Taus* and *Tagus* are largely identical, and that in the name of the latter river we have a Gaelic word which signifies water or ocean. In the word *Italy* the presence of a Gaelic word is traceable. *Eudailt*, the Gaelic name of that country, involving, as it does, *Eudail*, cattle, does not bear a very far-fetched resemblance to *Italy*, and indicates that the fertility of that country has always been very great. Very few suspect that *Portugal* is a genuine Gaelic word—*Port nan Gaidheal*, the port or harbour of the Gaels. In *Oporto*, the presence of the same word *port* is to be found. The very fact that the harbour which *Columba* entered when he first visited *Iona* bears to this day the designation of *Port va Curraich*, is sufficient to show that *port* is a genuine Gaelic word; and that its presence in *Portugal* justifies us in sending our thoughts back to a time when Gaelic was spoken in that country.

The names of some of the rivers of France are Gaelic. *Rhine* is compounded of *reidh*, smooth, and *amhainn*, river. *Rhone* is compounded of *ruadh* and *amhainn*, the Red river. *Garonne* is compounded of *garbh*, rough, and *amhainn*, river, the rough river. *Seine* is compounded of *seimh*, smooth, and *amhainn*, river, the smooth river. In *Calais* we have almost an exact reproduction of *Caolas*, a Gaelic word, which signifies Firth or Strait. The narrowest part of the English Channel is at *Calais*. In *Baile Chaolais*, a little village at the mouth of the famous Pass of *Glencoe*, in the north of *Argyllshire*, a word which in its English form, *Balachulish*, baffles the skill of the English tourist so far as pronouncing it correctly is concerned, we have the word *Caolas*, the farm or village of the strait. Thousands who are in the habit of admiring the sublime scenery of the Kyles of *Bute* in the Frith of *Clyde*, are not aware that *Kyles* is exactly the Gaelic word *Caoil* in its plural form, and, therefore, signifying straits or narrows. In *Colintraive*, or *Caol un t-snaimh*, the strait of swimming, we have another word into which the root of *Calais* enters as a component part. *Dover*, which stands opposite *Calais* on the other side of the English Channel, is the Gaelic *Dobhar*, a word which means the border of a country. The examples which have now been given of names of mountains and countries and rivers wherein Gaelic roots are manifestly present, may suffice to indicate that the Celts inhabited the south and south-west of Europe in the far-off past, and that they left monuments behind them in the names of mountains, streams and rivers—monuments which no power of victorious armies can ever demolish—monuments which will continue to endure and to tell in their own mute language that the Celts once owned and occupied that portion of the world.

Many questions may be asked in connection with the Gaelic words, *Calais* and *Dover*. Is it not clear that the Celts in those far-off days were well aware that the narrowest channel is between *Calais* and *Dover*? Is not the surmise reasonable, that they availed themselves of that particular part of the channel for going to Britain and for returning from it? Is there not ground for the conjecture that the largest stream of population must have entered Britain through the straits between *Calais* and *Dover*? The names *Calais* and *Dover* will always indicate that if the Celts

were not the earliest settlers in the neighbourhood of those places, they were at least powerful and important enough to leave behind them a memorial which time cannot obliterate. Aristotle is the first writer who mentions the British Isles by name. His words are: "Beyond the pillars of Hercules the ocean flows round the earth, and in it are two very large islands called British *Βρετανίκα λεγόμενα* Albion and Ierne lying beyond the Keltai." While the term British is employed by Aristotle, he applies the name Albion to what is now known as England and Scotland. It is evident, therefore, that so far as the knowledge of the famous Greek extended, the portions of British Isles which are now embraced by the kingdoms of England and Scotland were regarded, it may be, as one kingdom, and bore one designation. Pliny's language is very similar to that of Aristotle: "Albion ipsi nomen fuit, cum Britanniae vocarentur omnes insulae." Stephanus of Byzantium thus writes: "Albion insula est hodie Britannia dicta ab albis rupibus quas mare abluit." Julius Caesar came much in contact with the ancient inhabitants of Britain. His description of their habits and their country is, therefore, full of interest. In his "De Bello Gallico" he informs us that "the interior of Britain is inhabited by a race said to be aboriginal—the coast by invaders from Belgium, who, having come over for the sake of spoil, have settled in the country. For money they use either copper or pieces of iron of a certain weight. Tin is found in the interior of the country, iron on the coasts, but the quantity is small. Copper is imported; the timber is of the same kind as in Gaul, except the beech and the fir. The climate is more temperate than in Gaul, the cold being less severe. By far the most civilized are the inhabitants of Cantium (or Kent). They do not differ much in their customs from the Gauls. The inhabitants of the interior do not, for the most part, sow corn, but live on milk and flesh, and clothe themselves with skins. All the Britons stain themselves with woad, which produces a blue colour, and gives them a more formidable appearance in battle. They wear their hair long, and shave every part of the body except the head and the upper lips. The Druids are engaged in matters of religion, and have the care of public and private sacrifices. They are the arbiters in almost all disputes, public and private, and assign rewards and punishments. Whoever refuses to abide by their decision is excluded from the sacrifices, and thereby put outside the pale of the law. The Druids are exempt from military service and from the payment of taxes. Their chief doctrine is that souls do not perish with their bodies, but are transferred after death to other bodies."

In his life of Agricola, Tacitus details the fortunes of the Romans in Britain. He particularly describes the exploits of his father-in-law in Caledonia and against the Gaels whom Galgacus led. The speech which, following the example of classic historians, he puts into the mouth of Galgacus, is remarkable for the patriotic spirit that pervades it, as well as for the ingenious argument which the brave Gael adduces to stir up the hearts and stimulate the heroism of his soldiers. It was at the Grampians that the battle was fought between Agricola and Galgacus. The army of the Gaelic warrior was defeated, and found instant refuge in the rocky portions of Caledonia. May we not discern something akin to the division into clans which subsequently prevailed in the Highlands of Scotland in these expressive words of the Roman historian: "Nec aliud adversus validissimas gentes pro nobis utilius quam quod in Commune non consulunt." The name Galgacus is evidently Gaelic. It is virtually Gaidheal gagach, a stammering Gael—a Gael with an impediment in his speech. Enthusiastic descendants of the heroes who fought under Galgacus are wont to reflect with pride that, while the Roman arms were powerful in every corner of the world, and while the bravest races were compelled at last to succumb to the forces of the city on the seven hills, the Caledonians were never fully vanquished. It defied the forces of Rome and her ablest generals to bring under her yoke the intrepid inhabitants of Caledonia. I am disposed to think that into the term Grampians there enters the adjective *gorm* or *garbh*, and *beinn*, *gorm bheinn*, or *garbh bheinn*, green mountains or rugged mountains.

Many ethnological questions suggest themselves—questions as to how Great Britain and Ireland were first settled; as to what course the stream or streams of population took; as to whether there had been two streams that entered Britain from the continent of Europe, or whether it is possible to maintain that the differences which have existed for many centuries between what Zeuss chooses to term the Irish and British branches of the Kelts in Great Britain and Ireland—arose after the Celts had fairly taken possession of the British Isles. Scholars who have examined the question very carefully are disposed to believe that the differences which now exist between the representatives of the ancient Celts began and were developed in the British Isles, and are necessarily to be regarded as the result of two independent streams of population from the continent of Europe. Latham avers that, "no matter how unlike the Scotch and the Welsh may be, they are more like than the English that lie between them." It is altogether probable, according to a reasonable conjecture, that the route of which the earliest Celts availed themselves was the straits between Calais and Dover. The earliest settlers would extend northwards and westwards, reaching Scotland, and advancing to that portion of it which was subsequently known as Caledonia. As to the manner in which Ireland was peopled, for poetical legends are fanciful, it is natural to suppose that when the western portion of Wales was reached adventurous Celts would cross to Ireland; and that, when the stream of population had fairly reached and taken possession of Scotland, so great and marked are the facilities which the south and west of that country offer for crossing to Ireland, that Celts could in a very simple manner plant homes in that island. Owing to the rude interference of the Romans, and to the prowess of their arms, as well as on account of continuous invasions in later centuries from the north and west of Europe, the Britons or the early occupants of Great Britain found shelter in the mountainous regions of the country. In this manner we can understand how Wales and the Highlands of Scotland came to be inhabited strictly by Celts, and to furnish a home even to our own time for the descendants of the early occupants of the British Isles.

It has already appeared, on the authority of Aristotle and others, that Albion was at one time the name of what is now known as Great Britain, or as England and Scotland. The term *Albion* is now entirely confined to Scotland. We are wont to say: I am a Scotchman, *Is Albainmach mise*. I am a Highland Scotchman, *Is Gaidheal Albainmach mise*. I was born in Scotland, *Rugadh mi ann an Albainn*. He is an Englishman, *Is e Sasunnach a tha ann*. He was born in England, *Rugadh e ann an Sasunn*. There is no Gaelic word to represent England or Englishmen directly. We are wont to speak of England as *Sasunn*, or the land of the Saxons, and of Englishmen as Saxons, *Sasunnaich*. It seems to me that as the word *Albion*, which at one time was an appellation for Great Britain, has for many centuries been restricted to Scotland, we may find an argument in favour of the supposition that the Highlanders or the Gaels of Scotland are the descendants of the earliest Celts who occupied Britain; that they, therefore, continue to speak of themselves as *Albainnaich*, a designation which must at one time have been general enough to include all the Celts of the British Isles, and that the Britons are a later stream of population than the Scottish Gaels.

Albion signifies the land or country of hills or mountains. *Alb* or *Alp* is the same root which is to be found in *Alps*. *Albion* is compounded of *Alb* or *Alp*, for *b* and *p* are convertible letters, and *fonn*, or with the aspirate *fhonn*, *Alb-fhonn*. The root *fonn* or *fhonn* occurs in *Eilean, eil fhonn*, another land. *Eilean* is the Gaelic name for island. The same word, *fonn* or *fhonn*, occurs in *Oban*, a term which strictly means the land of bays or creeks, an apt designation, as anyone will admit who has seen Oban in Argyllshire, and who has taken notice of the physical features of that bay and its neighbourhood. The same root, *fonn* or *fhonn*, is to be found in *Sasunn*, England, the land of the Saxons, and in *Eirinn*, Ireland. The derivation of *Albion* (*ab albis rupibus*) from the white rocks of Britain is not to be regarded with

any serious attention. The common derivation which is assigned to *Eirinn* (Ireland) is *I iar-fhonn*, the land of the western isle; or, the land of the island of the west. The letter I (island) occurs in Iona, Islay and many other topographical names. Max Müller gives in a footnote in his first series of lectures on the Science of Language, a very learned and elaborate disquisition by an eminent Irish scholar on the etymology of the word *Eirinn*. The most enthusiastic admirer of the Celtic race can scarcely maintain that the Celts of those far-off times had even an approximation to the philosophical ingenuity that is involved in the disquisition on the word *Eirinn*, to which allusion has just been made. I hold the opinion that the common explanation of *Eirinn* is correct, and that the disquisition to which Max Müller has given a place in his lectures is too learned to be of any practical value.

Various derivations of the word *Breatunn* have been advanced. *Is Breatunnach mise*, I am a Briton. *Rugadh mise ann am Breatunn*, I was born in Britain. *Breatunn* and *Breatunnach* are, therefore, Gaelic words, and are very commonly employed. Some one has contended that *Breatunn* is a compound of *braith*, extensive, and *in*, an island; and that, therefore, the signification accordingly is an extensive island. The presence of a fertile imagination is so unmistakably manifest in that interpretation of *Breatunn* that no importance can be attached to it. An ingenious explanation of *Breatunn* has been given by Mr. Clark in his "Caledonian Bards," where he contends that the components of the word in question are *Braigh*, top, and *tonn*, waves. The argument whereby it is sought to defend that interpretation is very ingenious: "That Britain was at first peopled from the opposite coast of Gaul is a rational hypothesis, and accordingly it has been adopted by the most eminent historians. As Britain was within sight of Gaul, the inhabitants would bestow on it some name before they crossed the channel, is a supposition not altogether improbable. Ingenuity could certainly suggest no term more significant of the appearance of Britain from France, viewing it over the convexity which the globe forms in the breadth of some part of the channel, than the *land on the top of the waves*." To overthrow the fanciful interpretation that Britain means the *land on the top of the waves*, it is sufficient to consider that there is no syllable to correspond with *land* in *Breatunn*; and that in the last syllable *unn* there is evidently present the same root which forms the termination of *Albion*, *Eirinn*, *Sasunn*. The word *Breatunn* has also been resolved into *Breac Imis*, the variegated island. I find that Prydain is the name of the first legendary King of Britain, and that from him the British Isles have taken the appellation, *Ymis Prydain*. To contend that *Breatunn* had its origin in Breton, the name of that portion of Gaul from which the Celts emigrated to Great Britain, is merely to thrust the difficulty aside, and not to explain it at all. Professor Rhys, of Oxford, has in recent years advanced another interpretation of *Breatunn*. He asserts that when the Romans came to Britain they learned the name Britannia or Brettann, which the Brythones gave themselves. He is of opinion that *Britanni* and *Brettani* are regarded as of the same origin as the Welsh *brith*, spotted, parti-coloured—feminine *braith*; and that there can be found in them a reference to the painting or tattooing the body, already alluded to more than once. "It would appear," he writes, "that the word *Brythan* and its congeners mean a clothed or cloth-clad people. There is no reason why the name should not be treated as exclusively belonging in Britain to the non-Goidelic branch of the Celts of the second invasion. But some time later, there arrived another Celtic people with another Celtic language, which was probably, to all intents and purposes, the same as that of the Gaul. These later invaders called themselves Brittones, and seized on the best portions of Britain, driving the Goidelic Celts before them to the west and north of the island." It seems, however, to be impossible to explain the term *Breatunn* in a manner that can be regarded as altogether satisfactory.

The Picts and Scots are by common consent admitted to have played a prominent and restless part in the early annals of Great Britain. In a paper which I prepared for the Canadian Institute last session, I entered somewhat fully into the

discussion of the question as to who the Picts and Scots were. In his dissertation on the poems of Ossian, MacPherson remarks that the Caledonians, who possessed the east coast of Scotland, applied themselves to the raising of corn or to agriculture. It was from that employment that the Gaelic name of Picts proceeded, for they are called *Cruithnich*, *i.e.*, the wheat or corn-eaters. I may add that the etymology of *Cruithnich* is identical with that of *Cruithneachd*, the Gaelic word for wheat; *cruth*, form, and *sneachd*, snow, the reference doubtless being to the white colour of the flour which is extracted from wheat.

With regard to the term *Caledonia*, it has to be observed that it was never applied by the Gaels of Scotland to their own country; and that it comprised that portion of country which lies to the north of the Forth. Dunkeld, in Perthshire, has been regarded as the capital of the Caledonian Gaels when the Romans first invaded that portion of Scotland. Dunkeld, or Duncalden, forms the substratum of Caledonia. Among the various explanations which have been given of Caledonia, the most plausible seems to be *Dun a' Chaltuim*, the hillock of the hazel, and not *Dun Caeldhaoinne*, the stronghold of the Gaelic people. St. Columba is said to have resided at Dunkeld for some time about 570 A.D. There rose then at Dunkeld a royal monastery, which subsequently attained to great eminence.

Zeuss prefers to divide the Celtic tribes and languages of Great Britain and Ireland into the Irish and British branches—the former including the Celts of Ireland, and of the Highlands of Scotland and of the Isle of Man, the latter including the Welsh and the Armoricans in Brittany. It is abundantly evident that those in whose veins the blood of Galgacus and his heroes, of Taliessin and Ossian, of Fingal and Arthur is now flowing, are honouring themselves by taking a warm interest in the language which, venerable with years and use, continues to be still spoken, and to have in many cases the vigour and persuasiveness of olden times. Max Müller affirms “that the language of England may be said to have been in succession Celtic, Saxon, Norman and English. The history of the Celtic language runs to the present day. It matters not whether it be spoken by all the inhabitants of the British Isles or by only a small minority in Wales, Ireland and Scotland. A language, so long as it is spoken by anybody, lives and has its substantive existence. The last old woman, Dorothy Pentreath, that spoke Cornish, and to whose memory it is now intended to raise a monument, represented by herself alone the ancient language of Cornwall.”

THE ANATOMY OF THE ORANG-OUTANG. BY A. PRIMROSE, M.B., EDIN.

(Read December 18, 1897.)

A good specimen of the animal was obtained in the Anatomical Department of the University of Toronto during the autumn of 1897. This animal, which is the chief representative of the Anthropoid Apes in Asia, is found in the islands of Borneo and Sumatra. A series of photographs were made of the creature, and by this means the external characteristics were readily studied. The shape of the cranium is very similar to the human type, but the facial region of the skull projects very prominently, so as to produce a markedly diminished facial angle. Thus the photograph taken in profile shows a projecting muzzle, which is far removed from anything of the kind found in the skull of man. The nose is short and depressed, so that the anterior nares look upwards and forwards. The forehead is high and fairly prominent, in this respect differing from the condition found in the Chimpanzee, in which the forehead is retreating; in the Orang, in fact, there are frontal eminences to some extent developed. The eyelids are wrinkled, so that a series of grooves parallel to the free margin exist in both the upper and the lower eyelid. The eyes are never widely open in the Orang. From the margin of the lid project well developed eyelashes. The lips are very wide, and possess a great degree of mobility: the degree of mobility may be appreciated even in the dead animal when one separates the lips and exposes the jaw arches. The dental formula is similar to that of man—in this specimen a noticeable feature was the width and flatness of the central incisors. There is no prominence in the region of the chin. There is a very gradual curve extending from the free margin of the lower lip and merging below into the outline of the neck. The ear of the Orang and the Chimpanzee is said to be curiously like man; this statement is borne out in the present instance. The ear stands out fairly prominently from the side of the head, but not more so than in many men. Along the edge of the infolded margin of the ear, near its upper part, there exists in man a blunt-pointed process, to which Darwin has called attention, and which is supposed to represent that part of the ear which exists in many monkeys as an upper pointed extremity without any infolding. We find that a well marked process representing Darwin's point is present in this Orang. There is no lobule; it is entirely absent. In man the lobule is very frequently absent also. The Orang possesses a short, thick neck, of great strength. Lastly, in connection with the head of this animal one must note the absence of any wrinkles in the forehead. In man the wrinkling of the forehead forms one of the most characteristic forms of expression, but we find no trace of such in this Orang. The fact that this form of expression is not possessed by the Orang has been noticed by various observers.

The long arms of the Orang, reaching below the knees, and the comparatively short lower extremities, are noticeable features of the animal. In this respect it differs from man, in whom the lower extremities exceed the upper extremities in length and are much more strongly developed, thus serving more efficiently as a basis of support in the erect attitude. It must be remarked, however, that this remarkable elongation of the upper extremities in apes is also reproduced in many negroes, and occasionally in Europeans.

In an address delivered at the recent meeting of the Anthropological Section of the British Association, in Toronto, Sir William Turner selected as his subject "Some Distinctive Characters of Human Structure." Among other things he

referred to the markings which are found in the integument in the palm of the hand and the sole of the foot. I have made photographs of the palm and the sole in the Orang, and these well illustrate the conditions found as described by Prof. Turner in the Anthropoid Apes. The two oblique lines which run from the base of the index finger to the inner side of the palm in the human hand indicate the lines along which the fingers are bent in towards the palm. The obliquity of these lines in man is in contrast to the transverse direction of the lines as shown in the photographs of the Orang. It is quite obvious that the oblique direction in man indicates that the fingers are more directly opposed to the thumb in man than is the case in the Ape. Thus, in the Orang, the fingers are folded more directly into the palm, as would be the case if the animal were grasping a cylindrical object, hence transverse lines result and the fingers are not to any appreciable extent opposed to the thumb, which, by the way, is a very rudimentary structure in the anthropoid apes as compared with the thumb of man. This rudimentary thumb in the Orang, is, however, capable of opposition, and therefore we find that the deep groove which is found separating the eminence at the root of the thumb in man is also found in the Orang. In the Orang we find, too, that there is a well marked groove marking off an eminence at the root of the little finger. When we come to examine the sole of the foot in the Orang we find here a very characteristic condition. A well-marked line is developed at the root of the great toe, indicating the line along which the great toe is opposed to the other toes. This is a characteristic not possessed by man, in whom the great toe is not capable of opposition and in whom this mark is entirely absent. Further, the lines at the roots of the toes are in reality more oblique in the foot of the Orang than in the hand of the same animal. This would indicate that the foot is better adapted for grasping objects than the hand, and that opposition of the smaller toes to the great toe is more perfect than is the similar movement of opposition in the hand. In the foot of the Orang, further is to be noted the great length of the toes, producing a marked resemblance to a hand. The great toe is very much shorter than the remaining digits, but it is strongly developed otherwise and is much more effective as a grasping agent than the corresponding digit in the hand. This foot of the Ape so much resembles a hand that it has been called a foot-hand; the term "pedimanous" has been used to describe the condition. When we come to examine the structure of the foot, however, and study the bones, muscles, ligaments, etc., we find that, morphologically, we are dealing with a foot, and from that standpoint it is in no sense a hand. Physiologically, however, it performs the functions of a hand as well as of a foot. Turner alludes to an interesting point regarding the development of the markings on the palm, namely, that they are found in the human embryo at a very early stage of development, long before they could be accounted for by movements occurring in the hand of the embryo. This would indicate that the markings themselves were hereditary and are not simply acquired after the various movements which they indicate are brought about.

The Orang possesses a highly developed brain. In the particular animal we are describing the brain was removed and examined. The antero-posterior diameter of the brain is less in proportion to the transverse diameter than it is in man. The brain of the Orang may be described as a round-oval. The characteristic fissures and convolutions of the human brain are readily distinguished in the Orang. The external occipital fissure is much longer than in man. This is so characteristic of the brain of apes that it is known as the "Simian Fissure." The Island of Reil is completely overlapped in the Orang by an operculum. The third frontal convolution—said to be characteristic of man—is certainly not well defined in the example before us. This convolution of the left side in man is the so-called "speech centre." The convolutions about the fissure of Rolando—the Motor Area—are well developed.

The abdominal viscera were examined and one noted the existence of a long, well developed vermiform appendix. This structure is present in the Orang and the Chimpanzee among Anthropoid Apes, but is generally absent in Monkeys and in the majority of Mammals. One noted also the entire absence of those reduplications of the mucous membrane of the small intestine which are described in man as the "Valvulae Conniventes."

The author of this paper proposes to make a complete dissection of the Orang, and hopes to make a further communication to the Institute when the work is complete.

THE TRANSPORTATION QUESTION. BY J. S. WILLISON, ESQ.

(Read April 16, 1898.)

I.

A discussion of the transportation problem in the language of hysterical Populism unfits the public mind for a sane judgment and drives Legislatures and Parliaments to attempt legislation so rash, extreme and impracticable that rational reform is embarrassed, disastrous reaction invited and the public authority discredited. Too often that class of vociferous patriots who move against the railway corporations with a fleet of froth and an army of adjectives accomplish no other result than to inflame the public temper, disturb legitimate private investments and hurt the national credit. Always in the field of economics the forces of order are "turning to scorn with lips divine the falsehood of extremes." Indiscriminate denunciation is the vice of the press and the pastime of democracies. We in Canada, in recent days, have had much hearty denunciation of railway monopoly, and corporation-baiting threatens to become the chief business of some of our influential journals and of an active and aggressive wing of our politicians. It is beyond doubt that we have made grave mistakes in railway policy. We have been cheated by the phantom of railway competition. We have unwisely duplicated pioneer lines. We have rashly vested great tracts of the public heritage in railway corporations. But we are a young community, at least in range of settlement and in measure of development, and we have had great problems to solve; and it was perhaps inevitable that just as we gave noble forests of timber to the fire in clearing the virgin lands of older Canada, so we should make a prodigal use of the resources of the west in laying the lines of rail communication across the continent. Now, as to these grave follies of statesmanship and grave errors of policy, we can perhaps do nothing better than to say with Bacon: "That which is past is gone and irrevocable, and wise men have enough to do with things present and to come; therefore they do but trifle with themselves that labor in past matters."

II.

We should remember, too, that railway transportation has not been a profitable business in Canada, that millions of English capital have been sunk irretrievably in the Grand Trunk, that with the slow growth of settlement in the west only exceptional resource and exceptional enterprise could have maintained the Canadian Pacific as a going concern, and that both of our great through roads have been heavily burdened with unprofitable branches. Canada's reputation in the money markets of the world depends upon a few of its great enterprises. For half a century the spectre of the Grand Trunk has stood at the elbow of the Canadian financier and promoter on the London money market, and all over this country there are idle mines, and untilled acres, and rich fields of natural wealth undeveloped that would have been opened and occupied by the strong arm of British capital if the melancholy story of the Grand Trunk had not been written in financial London. If the Canadian Pacific had met a like fate, a blow would have been dealt us from which we could not have recovered for a generation. We can imagine what a blow would be dealt at the private and public credit of the United States if half the railway system of the Republic were to be plunged into bankruptcy, and when we face the fact that the Canadian Pacific system embraces half the railway

mileage of Canada, it is manifest that the maintenance of its credit is of vital importance to the Canadian people. The improving credit of the Grand Trunk and the established credit of the Canadian Pacific are facts of great consequence to Canada among the nations who supply capital for the development and men for the settlement of new lands; and while we do right to be jealous for the authority of this free community over its carrying corporations, we should be slow to work ourselves into the passionate temper of western Populism, and thereby check the movement of capital from the uneasy centres of the United States into the undeveloped Canadian Provinces. Capital is mobile. It will not rest where it is constantly menaced by political agitation. It will not seek investment where political conditions are unstable, and established enterprises harassed by revolutionary political experiments. The best service we can do for Canada is to introduce into our public controversies and to incorporate into our code of laws the prudence, the sanity, the steadiness of the British political temper and the sober courage and inflexible justice of British legislation.

III.

One lesson that a democracy finds hard to learn is that legislation cannot be made omnipotent. In Great Britain, more than in any other country, the practical limitations of Parliamentary authority are understood and appreciated. There, after fruitful centuries of trial and experiment in all the fields of coercive legislation, from statutes fixing the wages of laborers and the prices of goods at wholesale and retail, to statutes declaring the value of money and restraining the freedom of trade, private employments are at length safe from the British legislator, while over public employments the authority of Parliament is absolute and unquestioned. Railways operate in the field of public employments, exercise rights of expropriation and hold public franchises, and therefore the inferiority of the carrying corporations to the sovereign authority of Parliament is established and the right of regulation and control freely asserted. In truth, the authority of the people over transportation agencies is well settled in all free countries, and argument upon that point may rest. Having settled that these powers are vested in Parliament, the question is, through what machinery they can best be exercised. The Railway Committee of the Privy Council at Ottawa has large powers, but these have been but feebly employed for the protection of the public interest, and the technical defences of skilled counsel and the active zeal of equally skilled lobbyists make its procedure tedious and complicate its judgments with political considerations. Then the dealer, who may be prejudiced by discriminatory favors to a competitor; the farmer, whose safety may be imperilled by a dangerous crossing; the town or village, whose progress may be checked by the concession of lower freight charges to a rival community; the carrier that may be refused reasonable interchange of traffic by a competitor—each and all of these have found the Railway Committee inadequate to give satisfactory redress. The individual citizen, aggrieved by railway greed or vindictive discrimination, cannot go to the capital and lay his grievance before the committee. The cost is too great, the undertaking too onerous. He requires the privilege of communicating his complaint to a public commissioner, and upon the commissioner should rest the responsibility of investigating the complaint and redressing the injustice. The commission must operate through methods of conciliation as well as through methods of compulsion. There is no doubt that in many cases the American advisory commissions, that is, the commissions with power only to report the facts and leave to public opinion, either acting directly on the railway corporations or through the Legislature, the remedy for the evils established, have been influential in redressing the more flagrant discriminations and injustices of railway managers, and in Massachusetts, for example, it has not been thought necessary to adopt more drastic legislation. But at most the power

of the advisory commissions is no greater than the force of public opinion and public opinion is likely to be inactive, except during seasons when the transportation question is a main issue in the press or in politics, or some very special grievance looms large in the public eye.

IV.

It is a common notion that in Great Britain the railways are effectually controlled by the Board of Commissioners created in 1873, and vested with the powers of jurisdiction exercised by the Court of Common Pleas under the old law (Act of 1854). Mr. Stickney, in his new book on State Control of Trade and Commerce, declares that this Act is "amply sufficient to redress any substantial injuries done by common carriers to the public," and that in the field of private employments the growth of the law "has been from a condition of minute and annoying restriction to one of complete freedom," while in the case of public carriers it "has been from a condition of comparative freedom to one of complete and adequate supervision and control." This conclusion will not bear investigation. It was the judgment that I had reached from a study of the American books dealing with the railway question, but even a perfunctory and inadequate study of the question on the ground made it plain that the laws regulating common carriers are not as well enforced in Great Britain as in the United States. The great British railway corporations have enormous political and commercial power. There are now 140 railway directors in the Imperial Parliament. The British railways support the Parliamentary bar, they control influential organs of financial opinion, they keep a strong hand upon the course of legislation, and they discriminate against the domestic in favor of the foreign shipper to a degree that is intolerable. It seems to be the fact that grain and other food products are carried from Calcutta or from New York to London for rates much lower than are charged on similar home products from mid-England into the metropolis. The British agriculturist suffers almost as seriously from railway discrimination as from hereditary landlordism, and German and Belgian and American competition with British manufacturers is greatly aggravated and materially promoted by the secret discriminations and lower rates made for foreign competitors with British industries.

V.

There is combination to maintain domestic rates and open or secret competition for the carriage of foreign goods. This, in fact, seems to be a feature of railway administration the world over. The policy of the railway managers everywhere is to enforce the maximum rate on home traffic, and to compete for foreign shipments at any rate that may be necessary to secure the business. The subsidized railways of Canada carry American goods at rates so much lower than the charges exacted upon native products that in many cases the discrimination more than offsets the advantages of the Canadian tariff. No doubt the result of this policy is to increase the bulk earnings of the Canadian roads, and, it may be argued, enables the companies to reduce the average of transportation charges. But the inevitable tendency is to build up foreign rather than Canadian ports and foreign rather than home industries, and to unduly burden local traffic in the interest of through business. As between Germany or Belgium and Great Britain the effect is peculiarly and particularly objectionable. The German and Belgian railroads are owned and operated by the State. There are, therefore, no secret rates or discriminations on the German and Belgian roads, and the embargo which British railways put upon British trade is unknown within Germany and Belgium, and the British manufacturer enjoys no such advantages in the German or Belgian market as the German or Belgian manufacturer and trader enjoy in the market of Great Britain.

But the British people are moving. Some of the younger British politicians have been making a close study of the State railways of the continent; there is unrest among the agricultural population, and manufacturers are awakening to the injustice of these intolerable discriminations in favor of their foreign competitors. And once the British people are thoroughly roused to the existence of an injustice, reform comes speedily and thoroughly. It may be that for the moment the British people would not consider State ownership, but we must remember that they have taken over the telegraph service, that that service is operated as efficiently as the postal service, and it is at least my conviction that before the world is much older we shall have in Great Britain a formidable movement for State ownership of the carrying corporations, and that public ownership rather than public regulation will be the future railway policy of England. More than half a century ago, as far back as 1844, Mr. Gladstone put through the British Parliament a measure, to take effect 21 years thereafter, declaring the right of the State to take over the railways at such time as the people might determine to be propitious and advantageous, and that the price should be 25 years' purchase of the "annual divisible profits estimated on the average of the three then next preceding years;" and it is a noteworthy fact that, notwithstanding this Act, some of the ablest advocates of State railways in Great Britain counsel delay on the ground that the railway corporations have such vast political power that they would force Parliament to pay for their roads a price far in excess of their actual value.

VI.

Mr. Clement Edwards, in his new work on Railway Nationalization, makes an interesting estimate of the possible financial results of State purchase of the British railways. The profits of the British roads are put at £38,046,065, or 4 per cent. on the capital invested. He believes that the State railway stock would be taken up at 2 1-2 per cent. as a maximum. This would leave a margin of nearly 1 1-2 per cent. on the transaction. He estimates saving by unity of management at £10,000,000. Thus he would increase the profits from £38,000,000 to £48,000,000, and after deducting 2 1-2 per cent., £23,775,000, to cover the interest on the Government railway stock, he would get a net profit to the State of over £24,000,000. He would thus be enabled to reduce freight rates by 20 per cent., absorbing £8,807,000, reduce passenger fares by 20 per cent., absorbing £7,472,000, and use £4,000,000 to reduce hours of labor and improve wages, and still have nearly £4,000,000 to provide for a sinking fund and exceptional contingencies. Mr. Edwards adds: "The recoupment from increased traffic could be used for still further reducing rates and fares, and augmenting the sinking fund to facilitate redemption of purchase, remembering always, however, that the lower the rates and fares are reduced to a certain point, the greater the traffic, and the better for the nation." This is an optimistic calculation, but in sober truth it seems to be warranted by the experience of State operation of railways on the continent.

VII.

A remarkable illustration of the effect of cheap fares on passenger traffic is afforded by the introduction of the zone system in Austria and Hungary. In these countries, under this system, one may travel first-class by fast express at a penny and a third a mile, and third-class at less than a half-penny a mile. In Hungary, for the four years from 1889 to 1892, the number of passengers carried increased from 5,684,845 to 38,325,151, and in Austria, for the six years from 1889 to 1894, the increase in the number of passengers ran up from 42,582,726 to 102,897,828, an increase of 600 per cent. in Hungary and of 140 per cent. in Austria, as compared with 11 per cent. increase in Great Britain. Then, while the Hungarian railways were

paying 3.48 per cent., when the zone system was adopted they paid 6 per cent. in 1892, and while in '89 the Austrian railways paid 4.01 per cent., in '94 they paid 4.08 per cent. It is quite likely that in Great Britain the zone system and cheap fares would yield as good results, and possibly in the United States and Canada the results would be hardly less satisfactory. The main fault to be found with passenger rates on this continent is that they are made to carry a great percentage of deadheads, and of the very class who are best able to travel at their own expense. If this mortuary department were abolished there is little doubt that the Canadian railways could give a two-cent rate without impairment of revenue, even if but a very moderate increase of passenger traffic were secured.

VIII.

The United States has a better railway literature, a greater body of railway legislation, and has made, at least in some of the States, a more determined attempt to regulate and control the carrying corporations than any other country. The results have not been wholly satisfactory. The operation of the laws has been embarrassed by a conflict of jurisdiction, the half-heartedness of Legislatures, and the hostility, or at least the unsympathetic attitude, of the courts. Only such traffic as originates and terminates within a State is subject to the State Commissions, while the authority of the Interstate Commission is limited to interstate traffic. This condition requires concurrent action between the State and Interstate Commissions, creates confusion, gives occasion for technical disputes, necessitates a divided sovereignty, and blocks and complicates the work of the commissions. Still much has been accomplished, particularly by the strong State Commissions, and the work of the Interstate Board has been by no means unfruitful or ineffective. In *The Atlantic Monthly* for April there is an admirable review of the work of the Federal Railway Commission since its creation in 1877. The writer, Mr. H. C. Adams, is the statistician of the Interstate Commerce Board, and ranks high among the authorities on the subject. He tells us that the idea of the commission was that "authoritative principles of railway transportation should be developed very much as legal principles attain their growth," that to this end it was necessary that a large variety of cases of discrimination and unjust rates should be considered, and that in some way this result must be realized if the control of railways through commissions is to prove a permanent part of the political organization, and he argues that "had the courts been willing to grant the commission the interpretation that Congress assured for it when it was passed, the railway problem would by this time have approached more nearly its final solution." Notwithstanding this, however, there has been a marked movement toward uniformity in administration, a useful service of statistics has been developed, and a far step has been taken toward a uniform system of railway accounts. He points out that "if there be but one system of accounts for all corporations subject to the jurisdiction of the commission, it is necessary only to master the principles, rules and classifications of one system in order to gain a mastery of all," and he declares that "out of the opinions expressed upon cases there has begun to develop a system of authoritative rules and established interpretations, which, sooner or later, will come to be recognized as a body of administrative law for inland transportation."

IX.

Mr. Adams gives this compact statement of the main conclusions that have been reached by the commission:

"It has been decided that a just schedule of rates will not tend to destroy the natural advantages for the production and sale of goods possessed by localities;

and when the same commodity is transported by two or more different modes of carriage the charge should be uniform for the unit of commodity.

“ ‘Group rates,’ by which a given commodity produced at different points within a prescribed territory is rated as though shipped from a single point, do not constitute a discrimination repugnant to the law; but this opinion is limited to the cases presented and is not set forth as a general principle.

“ A rate on one commodity in a class, or on one class of commodities, cannot be justly depressed so as to become a burden on the transportation of other commodities or classes of commodities.

“ The law does not impose upon the carrier the duty of providing such a rate that goods may be sold at a profit to their producers.

“ The car-load, and not the train-load, is the proper transportation unit, but higher charges may be made for goods in less than car-load lots; with this exception, the decisions of the commission have been consistently against the application of the ‘wholesale’ principle in the adjustment of railway charges.”

“ Not only must a just schedule of rates rest on a just base, but the relative rates on competitive articles must be such as not to disturb the natural order of competition.

“ A just schedule of rates will conform to the competitive equities that exist between goods shipped at different stages in the process of their manufacture.

“ All shippers should have at their disposal equal facilities of transportation; but in judging of local advantages, care must be taken not to confound those that are artificial with those that are natural.

X.

It has to be added that the experience of the United States has established beyond controversy that in order to the successful operation of railway commissions authority must be granted to compel witnesses to testify, that the investigations of a commission must be final on matters of fact, that an order of the commission must be enforced unless the courts shall find some material error in its proceeding and judgment, and that a commission must have the right to prescribe a reasonable rate, as well as to declare that a rate fixed by a carrier is unreasonable. The closing words of Mr. Adams’ sane and moderate paper are well worth quoting. He says: “The record of the Interstate Commerce Commission during the past ten years, as it bears upon the theory of public control over monopolistic industries through the agency of commissions, cannot be accepted as in any sense final. It may ultimately prove to be the case, as Ulrich declares, that there is no compromise between public ownership and management on the one hand and private ownership and management on the other; but one has no right to quote the ten years’ experience of the Interstate Commerce Commission in support of such a declaration. This is true, because the law itself scarcely proceeded beyond the limit of suggesting certain principles and indicating certain processes, and Congress has not, by the amendments passed since 1887, shown much solicitude respecting the efficiency of the Act. It is true, also, because the courts have thought it necessary to deny certain authorities claimed by the commission, and again, Congress has not shown itself jealous for the dignity of the administrative body which it created. And, finally, it is true because the duty of administering the Act was imposed upon the commission without adequate provision in the way of administrative machinery, and ten years is too short a time to create that machinery, when every step is to be contested by all the processes known to corporation lawyers. For the public the case stands where it stood ten years ago. Now, as then, it is necessary to decide on the basis of theory, and in the light of political, social and industrial considerations rather than on the basis of a satisfactory test, whether the railways shall be controlled by the Government without being owned

or controlled through Governmental ownership. The danger is that the country will drift into an answer of this question without an appreciation of its tremendous significance."

XI.

The public regulation of railway rates in Canada is not beset with some of the most formidable difficulties that have embarrassed and crippled the commissions in the United States. We have practically only two great through railways, in the main they operate under very similar territorial conditions, and by the Federal Acts declaring most of the Provincial branch railways to be roads for the general advantage of Canada the Federal Parliament would seem to have authority over the entire railway system of the country. We may be sure, however, that the validity of the laws which have authorized the summary seizure of the Provincial railways will be tested when we come to establish and attempt to operate a Federal railway commission. There are three possible courses open to the Canadian people: (1) The present system of spasmodic railway competition, and enduring and unregulated railway combination; (2) regulation and control by a strong Federal commission; (3) public ownership and operation. The third is no doubt the final solution, but it is probably remote in Canada. I do not believe that it would be sound policy to attempt to regulate great through systems by building patches of Government road in various parts of the Dominion. There is, however, much to be said in favor of natural extensions of the Intercolonial and the acquirement of natural and profitable branches of the Government railway. But in the main one must have either a system of public railways or a system of private railways. For the Government to go into the business of competition with private railways would be unwise, and would mean the adoption of a policy discredited by the experience of Germany and other countries. The result would be either the ruin of the private railways and enormous deficits at Ottawa, or the public roads would simply fetch and carry for the private corporations. In the end we would have to take over the private roads or hand our Government roads over to the private concerns, and in either case we would then find the country burdened with hundreds of miles of unnecessary railway. Our best and soundest policy for the time is to create a strong railway commission, vested with power to abolish discriminations as between particular individuals and rival communities, to force a fair interchange of traffic between rival lines, and to establish some reasonable relation between local and through charges. If we can regulate by commission we can regulate without Government railways. To adopt the double method would be costly and absurd. If we can make regulation effective over the Grand Trunk and the Canadian Pacific it would be folly to create a new great through line in order to divide the traffic and increase railway charges to the farmers and traders of the country. For every mile of new railway you construct an additional charge is laid on the people for railway support, and at least in a sparsely settled country it is only by increase of traffic that material reduction of rates can be secured.

XII.

There are grave objections to the policy of subsidizing railways out of the Federal Treasury. Most of us are convinced that the system of Provincial subsidies was a mistake, although if we look far enough we shall probably agree that upon no other condition could we have induced the eastern Provinces to come into the Confederation and surrender their control over customs revenue. But the subsidies to Provinces are arbitrarily determined by growth of population and the terms of union. While in the case of Federal subsidies to local railways there is no fixed basis of distribution, localities and Provinces are not unlikely to engage in a competition for Federal favors, and in too many cases party considerations rather than

the public interest determine the distribution of the public money. We are fond of saying that railways should be undertaken purely as commercial enterprises; but with an empire to colonize, vast spaces to open in the west and enormous natural obstacles to overcome, and settlement scattered over wide leagues of prairie, it is doubtful if any practical government could conclude that liberal aid to pioneer roads or the construction of pioneer roads by the State was not a wise and legitimate feature of any well-considered plan of colonization. Theory counts for a good deal more in print than in government. We owe something to remote and struggling settlements, and if we proceed wisely we reap a return in growth of markets, expansion of trade and increase of revenue. It does seem clear, however, that we should vote no more public money to our great through systems, and that, richly and prodigally endowed as they have been out of the public treasury, they should now construct their own branches, and even as in the case of street railways, where they enjoy a monopoly in any rich territory, they should be required by Parliament to push out new branches as increase and extension of settlement demand.

XIII.

It seems for the moment to be the policy of Parliament to reserve running rights over new roads for possible competitors. It may be that this policy involves the continuation of the system of subsidies. In cases where heavy public subsidies are voted to aid in the construction of railways that become the property of private companies, it is perhaps not unreasonable that the State should reserve the right to give future competitors the privilege of running over rails that have been laid with public money. But in the case of roads that are built wholly by private capital, it would seem to be an extreme exercise of the public authority to give competitors, seeking to share in a business they had done nothing to create, the right to use the roadbed and station accommodation of the pioneer corporations. This policy was tried in England, but was found to operate as a very serious check to railway building, and was abandoned as unprofitable and impracticable. Perhaps all that can be said on the point is that it is a policy that can be applied to existing railways only by mutual agreement, and to such railways hereafter to be constructed as may receive large grants of public money. It was well in the case of the Crow's Nest Railway, where a mountain pass was to be held for the people, that this right of running powers should be clearly and unequivocally reserved, and it is fair to point out that a subsidy granted with this material reservation is something very different from a grant of aid without conditions. It is, in fact, almost equivalent to public ownership, and will give a roadbed through the mountains to any railway, private or national, that may hereafter be constructed across the western prairies into British Columbia. Perhaps a more practicable policy would be to acquire the right of way and build the roadbed of new railways with the money of the State and lease the rails to private corporations. This would be to stop midway between public ownership and operation and would make the final stage easy, and as it is not at all difficult to fix the carload rate per mile for freight business, public regulation of charges under such conditions could be made very effective. It seems to me it would be well to consider this policy in developing a railway system in northern Ontario, where as yet the claims and franchises of private corporations have only a slight foothold, if we are not ready to accept the more heroic policy of public construction and operation.

XIV.

One hardly finds it necessary to prove the waste of competition, the fact of combination, the existence of discriminations in Canada. There is for the time a war of passenger rates between the two great Canadian railways, but this will be

of short duration, and the settlement that will shortly be reached will probably be followed by a more rigid enforcement of the maximum charges for passenger traffic all over the Grand Trunk and Canadian Pacific systems. As to freight rates, there is an inflexible combination between the two great Canadian roads. One road will not give a reduced rate to a community or to a class of shippers except through consultation and agreement with its competitor. If ever secret discriminations are made they are probably granted to some great trading corporation or some great business house whose shipments are of very material consequence to the railway, and just as there is secret surrender to these powerful concerns the position of the ordinary shipper is prejudiced and business monopoly established. Live stock is carried from Chicago to Montreal for as low rates as are charged from points in western Ontario to the commercial capital. Grain is carried from Winnipeg to Fort William, 500 miles, for 17 1-2 cents per hundred, and from Fort William to Montreal, 1,500 miles, for 20 cents per hundred. On the main line of the Canadian Pacific the passenger rate between stations is five cents a mile all through British Columbia, while the through rate from older Canada to Vancouver is less than half a cent a mile. On freight shipped to Kamloops, Ashcroft and other points along the main line of the road in the interior of British Columbia the charge is the same as if the goods were shipped through to Vancouver and brought back two, three or four hundred miles to the point of destination. It has been established that a carload of self-binders is carried from Toronto to Australia for less than the through charge to the Northwest. A reduction of rates from Edmonton and points on the Calgary and Edmonton road gave new life to the Alberta district, and made all the difference between comparative comfort and a bare, hard living to hundreds of western settlers, and probably increased the traffic earnings of the railway. Great for adversity or for prosperity are the powers of railway corporations.

XV.

At the Union Station every day we have eloquent evidence of the waste of so-called competition. At the same hour each morning and night two great express trains start for the east, both perhaps half loaded, each carrying passengers at the same rate, making about the same time, and traversing very much the same territory. How much better it would be if we had one well-equipped, well-balanced, fast express service, and a well-ordered system of branch roads. What a waste of railway mileage we shall have on hand if we ever take over the private railways, and how important it is that we should not repeat the blunders of Ontario and Quebec in western Canada. But if we deny the people competition we must give efficient regulation, and even with satisfactory regulation we should keep always in view the probable final acquisition of the railways by the State, and strive so to distribute our new roads that the State shall not be required to take over thousands of miles of unnecessary and unproductive railways. It is estimated that in the United States there are 37,000 railway stations, that not more than eight per cent. of these are junction points, and therefore at nine-tenths of the shipping points of the country the shippers and buyers of goods must always be dependent on the facilities and rates offered by a single line of railway. In Great Britain there are about 6,000 railway stations and about 1,500 junction points. In Canada the ratio of possible competing points to the number of stations is certainly much less than in the United Kingdom, and probably lower even than in the United States. Our country, at least our developed country, is of unhappy geographical formation, and transportation over such enormous distances is very costly, and to create another through road to compete with the Grand Trunk and Canadian Pacific for Canadian traffic would be very like the enactment of a statute to impose a tax of 20 or 25 per cent. on all interprovincial trade. However effective we may be able to make a law for the regulation of common carriers, it is at

least beyond controversy that in competition there can be found no satisfactory solution of the railway problem, and we must look for the present to regulation by commission, and finally to public ownership and operation.

XVI.

A question of perhaps greater importance to the west than even the regulation of railways is the taxation of corporation lands. As the Minister of the Interior told Parliament the other day, we have 67,000,000 acres of land in Manitoba and the Northwest Territories reserved from settlement. "On that 67,000,000 of acres," said Mr. Stton, "I, as the Minister of the Interior to-day, cannot give a man a homestead entry. Nor can I sell a single acre of it, although there are millions of acres of that land that never have been and never will be nor can be earned by any railway company. But they are reserved by order in Council, the good faith of the Dominion is pledged to that for ever, and no Government can interfere with that reserve until the bond is literally fulfilled to the last letter." Much of this land is held by the Canadian Pacific Railway Company, but there are also several millions of acres held by other railway corporations, and these lands, while not exempt from taxation by deliberate enactment, are not immediately taxable, because patents are not issued until the land is paid for by the purchaser from the railway. The clause in the Canadian Pacific charter under which its lands are exempt from Dominion, Provincial and municipal taxation, reads:—"The lands of the company in the North-West Territories, until they are either sold or occupied, shall also be free from such taxation for twenty years after the grant thereof from the Crown." The charter is dated February, 1881, and makes provision also for the granting of alternate sections of land on each side of the railway. Whether this exemption extends from the time the surveys are made and the lands become the property of the company, or from the issuing of the patents by the Government, is a point of first-rate importance. If the twenty-year exemption extends from the time the lands become the property of the company, the bulk of the railway reserve will soon become subject to taxation. If the exemption extends from the issue of the patents, it is, under existing conditions, perpetual. The company has its land secured and will take out the patents only as the land is bought by the settler. Under this interpretation the clause has the same effect as if it had simply declared the land free from taxation until sold or occupied. It is perhaps not too much to say that when the charter was granted to the syndicate the popular impression was that the exemption from taxation was to run for only twenty years, but a popular impression and the technical meaning of a railway statute are likely to bear a very different significance in the final analysis. One would think that it would be wise policy for the western railways to put their rates down to the very lowest figures that would yield a living revenue and thereby increase the value of their great landed estates. There is no doubt that low freight charges would do more than any other conceivable influence to promote settlement, and as settlement grows, as roads are made, schools opened, villages and towns established, the alternate blocks held by the railways rise in value, and the corporation grows steadily richer and richer through the sweat and toil of the settlers. The farmer who may have the ambition to acquire an adjoining railway section will feel that for every dollar of additional value his improvements give to his own property he adds to the value of the adjoining land which he aims to acquire, while he and his neighbors are refused even the privilege of imposing legitimate Provincial and municipal taxation upon these vacant spaces.

XVII.

This means practically a railway sovereignty and a subject population in the west, and there is no escape for the people from this unhappy condition except

through the exercise of the power of taxation. It is, therefore, of the very first consequence that the Government of Canada shall give early and close attention to the Land Question in the West, seek an authoritative decision from the courts as to when these lands become subject to taxation, if there be any doubt, and use to the full the power of Parliament to force the early issue of patents and to re-establish the authority of the people over the wide-stretching areas that we have rashly surrendered to railway corporations. We have here a question of tremendous import to the future of Canada, and we may be sure that as the seeds of irritation germinating at the roots of this problem spring into life and vigor, only by wise and patriotic handling of the situation will we be able to secure justice for the people without doing injustice to corporations that were deliberately created by the Parliament of Canada and deliberately endowed with these vast estates. But, even in the face of a problem like this, we may hope that this British community will move toward reform and readjustment in the spirit of justice and fair dealing, and not in the temper of confiscation and destruction. As yet there is no very serious indictment to lay against our railway corporations. The Grand Trunk, with all its mistakes and all its misfortunes, has done splendid service for the Canadian people, and we can afford to regard with kindly eye and sympathetic mind the labors of the Grand Trunk management to redeem the fortunes and restore the credit of that great pioneer in the carrying business in Canada. And as one passes over the great length of the Canadian Pacific road, with its thin fringe of population stretching for thousands of miles through wastes of rock, and wide reaches of sparsely-settled prairie, and great overhanging mountains and pioneer villages and scattered homesteads, he must conclude, despite all the clamor of the press and all the vehement eloquence of the politicians, that it is one of the marvels of this time, even when we take account of its great public subventions, that the road has been established in the financial centres of the world as a revenue-earning and dividend-paying property.

The Book tells us that there is "a time to get and a time to lose, a time to keep and a time to cast away," and it seems to me that now is the time for Canadians to get new inspiration and new courage, to cast away old prejudices, to rise superior to old quarrels and to seek a new and a common dedication to the work of building up in this new land a civilization that will have all the freedom without the license of the earlier western democracies, and that will have the stability of the old British constitutional system without the pomp and circumstance of privileged and governing classes. To my mind, the test of civilization is not in flags, or in fleets, or in armies, is not in dominion over leagues of land or over leagues of sea, but in the average material comfort and moral safety of the masses of the people. The hungry mouth is the great problem of modern civilization, and that country that can feed the multitude and have even twelve basketsful to spare will take the primacy among the nations. We should so direct our policy and so fashion our legislation that great fortunes will be hard of accumulation, that our corporations will be the servants rather than the masters of the people, and that equality of opportunity shall be preserved to all elements of the population. The danger to democracy comes from unequal social conditions, from the bare foot and the empty hand; and we, with all our rich natural heritage and all our wide, unoccupied lands, may still escape many of the evils of the old world and many of the follies of the new; may still make the remnant of the natural wealth of the country the possession of the whole people, reserve some fair percentage of the revenue from natural resources and natural opportunities for public uses and for the public treasury, and establish here in our own rich and spacious domains a freer and a better civilization than any the world has known. Many of us could, perhaps, do more than we are doing to maintain a sane public opinion in the country. There is nothing easier than to shriek the shibboleth of a mob. It is vastly easier to make an unjust attack on

a corporation than to make a just defence of a corporation. It takes courage to turn in the teeth of a mob or a wave of sectarian or national prejudice and strike a man's blows for one's own opinions. But, after all, the citizen who speaks his own mind, rests on his own judgment even in the face of press or caucus or pulpit, is the only free man and the only man worthy of representative institutions. A needless war against corporations is a menace to credit and a drag upon progress, but we are far more likely to surrender unduly to the corporation lobbyist and the concession hunter than to be over-vigilant for the rights of the people in public franchises and natural resources. We cannot hold for the people too much of what is left; we cannot too soon establish the right of control and of taxation over what has been surrendered. But, after all, the outlook is hopeful. We are neither oppressed nor in peril of war or famine. We live in a land of plenty and a time of peace. Within the past year or two there has been a wonderful upgrowth of Canadian feeling. Here at home we feel a new impulse to progress, a splendid confidence in ourselves, and across the old world the name of Canada is ringing as it never rang before. It is not a time to bicker and snarl as to what man or what party is responsible for these happy and hopeful circumstances and conditions. It is not a time to revive the memories of old quarrels and deliver judgment on the mistakes and follies of earlier days. Are we sure that we would have done better if we had had to bear the responsibilities of the fathers? Let us rather unite to honor all men who give us faithful public service, to recognize the good intent of all men who labor for the public betterment, and to make the splendid promise of to-day the more splendid achievement of to-morrow.

The golden fleece is at our feet,
Our hills are girt in sheen of gold,
Our golden-flower fields are sweet
With honey hives. A thousandfold
More fair our fruit on laden stem
Than Jordan's tow'rd Jerusalem.

THE ORIGIN OF OCEAN TIDAL SECONDARY UNDULATIONS. BY F. NAPIER
DENISON, TORONTO OBSERVATORY.

(Read April 23, 1898.)

Last year the writer had the honor of reading before the members of this Institute a short paper, entitled "A Probable Solution of the Secondary Undulations Found Upon Ocean Tidal Records." As the information then obtainable was extremely limited, the important points were set forth as suggestions for criticism. Since the publication and widespread distribution of your valuable "Proceedings" containing this paper, the writer has received numerous encouraging letters bearing upon this subject from various quarters of the globe.

In order to still further pursue this most engrossing and what is to be hoped valuable investigation, arrangements were made by Mr. Stupart, Director of our Service with the Marine Department at Ottawa, whereby the writer was granted free access to all the Canadian Tidal records now under Mr. M. W. Bell Dawson, Engineer in charge of the Tidal Survey, who also assisted me in every way possible. Tracings were made from over 1,000 daily tidal records, showing different types of undulations, from the following stations:—Halifax, Anticosti, St. Paul Island, Forteau Bay, St. John, N.B., Father Point, and Point Levis; also the original records were obtained from the temporary tidal stations at Carleton, P.Q., Pictou, N.S., Souris, P.E.I., St. Peter's Bay, P.E.I., and the Grindstone Island Barograph records from 1893-1894 to study with the corresponding Anticosti tidal traces, also tracings from several St. John, N.B., barograms. Upon returning to Toronto these records were carefully studied in conjunction with the corresponding synoptic weather charts at the Observatory. The result of this investigation clearly demonstrated that these undulations are due to the direct action of atmospheric waves or billows, as they pass over the harbours or bays, which tend to form minute undulations upon the surface of the water, and as these small water undulations advance farther into semi-enclosed basins become magnified as they reach narrower and shallower portions where the tide gauges are situated. Permit me briefly to summarize what has already been observed by others bearing upon this interesting subject.

In 1838 this phenomenon was observed at Swansea, England, where a regular time interval of from fifteen to twenty minutes was noted. Some of these records were sent to Sir George Airy, who was then unable to account for them. Admiral Smythe referred to this phenomenon at Malta, where it had long been termed "Mirobia," and supposed to be due to distant storms. In 1878 Sir George Airy read a paper before the Royal Society upon the tides of Malta, in which he speaks of these undulations as simple harmonic curves, whose heads are sometimes notched as by the intermixture of small waves. That they had a marked time interval of twenty-one minutes and a range of twelve inches amplitude, much exceeding that of the lunar tides. He believed they were "seiches" similar to those discovered by Forel upon the Swiss lakes, and supposed them due to a reflexive action from the shores of Sicily and the African coast. Major Baird, of the Indian Tidal Survey, referred to this phenomenon in 1868 as being most pronounced at the ends of bays, but offered no explanation. In 1896 Professor Duff, of Purdue University, studied these undulations at St. John, N.B., and Indiantown, and later presented a paper before the Royal Society of Canada, in which he also classes them as "seiches," due to some form of oscillation between the two sides of the Bay of Fundy. He does not attempt any explanation for the abnormal movements often observed during fine settled weather. Mr. H. C. Russell, of New South Wales,

states that at Sydney what have been previously termed earthquake waves are in most cases due to atmospheric disturbances in some yet ill-defined manner, and have a marked twenty-six minute time interval from crest to crest.

Finally, these undulations are universal to a greater or less extent, as has been proved by a personal study of tidal records obtained from all parts of the world.

CHIEF POINTS DEDUCED.

1. That the undulations are due to the direct action of atmospheric waves upon the surface of the water at stations, and not to ground swells due to distant storms or "seiche" movements, as found upon lakes during atmospheric disturbances.

2. There is a marked relative correspondence in amplitude between the barometric and water undulations.

3. That they often appear during fine settled weather, when the barometer is high over the station but decidedly low to the south-west, frequently when over 1,000 miles distant.

4. That they increase in amplitude as the storm advances, the maximum usually occurring shortly before and at the time of the shift of wind, which also corresponds with the time of heaviest precipitation. This tends to prove that the axis of rotation of important storms is inclined towards the direction of its future course.

5. That after the storm has passed the station, these undulations rapidly diminish, although a heavy westerly gale may still be blowing, provided the temperature to the westward is fairly uniform; should a cold or warm wave be approaching marked undulations appear.

6. Should a south-west storm move with diminishing energy towards the station the undulations correspondingly decrease as it approaches.

7. That the tidal records are most disturbed during winter and least in summer, due to the velocity of the primary poleward current being almost double in winter what it is during the summer months.

8. The disturbed traces during the summer months chiefly occur shortly before or at the time of showers or thunderstorms, and usually precede warm and cool waves.

9. Whereas many of our storms are whirling eddies, developing from above downwards, it is hoped a further study of these undulations may throw much light upon their future growth and course, even before the ordinary barometer begins to fall.

10. Meteorologists throughout the scientific world now realize that for the further advancement of weather forecasting a better knowledge of the upper atmosphere must be obtained. Rapid strides are now being made in this direction by means of kites, balloons and cloud observations. May we not add the study of atmospheric and water waves at the bottom of this aerial ocean, which can be carried on during all conditions of weather by means of sensitive self-recording instruments?*

The various traces, termed "hydro-aerographs," obtained from such instruments, when more fully understood, will indicate to us certain wonderful forces at work far above, not visually discernible either through the dense lower clouds of an approaching storm or the clear blue sky of a fine winter's day. Also we trust that in the near future the installation of such instruments will become universal, and that Canada will lead in such an undertaking.

*Fully described in a paper read before the Toronto meeting of the British Association in August, 1897.

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