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ON

DEMODEX PHYLLOIDES, (*CSOKOR,*)

IN THE SKIN OF CANADIAN SWINE.

BY R. RAMSAY WRIGHT, M.A., B.Sc.,
Professor in University College, Toronto.

In the *American Naturalist* for December, 1882, I announced the discovery of this Demodex in pieces of pork-skin submitted to me by Mr. R. Awde, Inspector of Food for the City of Toronto. The portion of skin was thickly studded with white tubercles, varying in size from a pin's head to a pea; these did not project much above the surface of the epidermis, but on reflecting the skin the larger ones were seen to extend into the subcutaneous tissue. The tubercles are enlarged sebaceous glands filled with hundreds of mites in various stages of development. The parts of the body chiefly affected are the mouth, cheeks, flanks, belly, and inner surfaces of the legs.

Mr. Awde asserts that one in twenty of the pigs sent in to market in Toronto during the pork season, are affected to a greater or less extent with this cutaneous parasite. In view of such frequency it is somewhat singular that its occurrence has not hitherto[1] been recorded elsewhere, except by Dr. J. Csokor, of the Veterinary Institute at Vienna, Austria, who found in 1879, a herd of swine from Galicia affected in this manner, and described the Demodex causing the disease as a new variety, *D. phylloides.*

The skin in these swine was, however, much more seriously affected, the collections of mites in the glands having caused the formation of subcutaneous abscesses frequently as large as a hazel-nut, which in one or two cases had become confluent on the inner surfaces of the legs. Mr. Awde has never observed any such cutane-

[1] After publishing the note in the *American Naturalist*, I learned that Dr. A. J. Johnson, of this city, to whom Mr. Awde had submitted specimens of affected skin, had sometime ago recognized the parasite as a Demodex, and mentioned the fact of its occurrence at the meeting of the American Microscopical Society, 1881.

ous abscesses. As the parasite is confined to the skin, and does not appear to affect the general health of the animal, he has merely ordered the removal of the skin from the parts involved, a precaution which is entirely sufficient to render the flesh useful for food.

My observations have served to establish the complete agreement of my specimens with those of Csokor. I have accordingly concluded that a synopsis of his paper, which is probably accessible only to a few of those who may be interested in the matter, with a copy of his excellent figures, may stimulate enquiry into the distribution of this parasite in America, and perhaps into the means best adapted to hinder its attacks becoming so formidable as represented by Dr. Csokor.

Dr. Csokor's paper considers:

1. The history of hair-sac mites in general.
2. Their systematic position.
3. The natural history of *D. phylloides* in particular.
4. Its occurrence and mode of life.

1.—SPECIES OF DEMODEX occur in the sebaceous glands and hair follicles beside the nose in man, occasion forms of mange in dogs and cats, and have been recorded (but merely in isolated cases) from the sheep, horse, ox, and Surinam bat. The best known forms have been distinguished by Megnin as three varieties:

D. folliculorum hominis.
D. folliculorum canis.
D. folliculorum cati.

A good many experiments have been made with a view to ascertain whether the Demodex of the dog is capable of being transferred to man, and *vice versa*, and although some results appear to render likely the possibility of both methods of transference taking place, yet the weight of evidence unquestionably points the other way.

The mode of occurrence of the Demodex of the dog is so totally unlike that of the Demodex of man, that apart from difference in form and size, we would be inclined to suspect a difference of at any rate varietal value. In man the Demodex is found on the hairless parts of the face and is perfectly harmless, in the dog it is found in the hairiest parts and brings about a troublesome and often fatal cutaneous disease. Experiments, however, as to transference can hardly be depended upon, for although it is quite certain that the

Demodex may be conveyed from dog to dog, yet experimental attempts to prove this have failed, and very often one dog in a kennel may be affected, and, although mingling freely with the others, may be powerless to infect these.

2.—Systematic Position.

After discussing the results of previous observers as to the anatomy of Demodex, he concludes under his second heading that five well marked varieties may be distinguished, all referable to that genus, viz.:

D. folliculorum hominis.
D. folliculorum canis.
D. folliculorum cati.
D. phyllostomatis (*Leydig*).
D. phylloides (*Csokor*).

The genus he regards with Koch as forming an independent Family of the Acarina the *Dermatophili*.

3.—Natural History of D. Phylloides.

The form of the body and its division into three regions, head, thorax and abdomen (the last distinguished by the absence of appendages and of the chitinous framework present in the thorax), may be studied in Figs. 7 and 8.

The result of a series of comparative measurements shows:

1. That D. phylloides (length, male 0.22 mm., female 0.24—0.26 mm.) reaches the minimum length of D. canis, but never that of D. hominis.
2. Head and thorax are together equal in length to the abdomen, while in D. canis they only form a third of the whole length of the body, and in D. hominis only a fourth.
3. D. phylloides is comparatively almost twice as broad as D. canis or hominis.
4. The head in D. phylloides is absolutely both longer and broader than that of either D. canis or hominis, a circumstance which renders the analysis of the appendages of the head easier in this species.
5. The egg is more oval than spindle-shaped, and both it and the larval stages are longer and broader than the similar stages in D. canis and hominis.
6. There is more difference between D. phylloides on the one hand, and D. canis and hominis on the other, than there is between these two last-mentioned varieties.

The Skin.

In the abdominal region the cuticle is transversely striated, an appearance which Csokor attributes to segmentation. In the head the cuticle is not so closely applied to the underlying parts as in the rest of the body—a clear margin resulting, to which Megnin has applied the term epistome. In the thoracic region the cuticle is locally thickened along certain ridges which thus form a chitinous framework. The mesial element of this is the sternum, which gives off laterally four pairs of epimera, and projects also beyond the origin of the last pair of epimera almost as far as the anus. The first pair of epimera run obliquely forwards and form the boundary between the head and thorax. The basal joints of the four pairs of appendages are movably articulated to the outer thirds of the corresponding epimera.

The appendages of the head are three pairs, viz. : 1 pair of mandibles, 1 pair of maxillae, 1 pair of pedipalpi, and an impair stylet-like structure between the maxillae (*lg*, Fig. 11), which, together with these, forms a piercing apparatus, while the mandibles and pedipalpi move chiefly from side to side, and are therefore masticatory. All of these appendages are attached to the cephalic segment. (*cp*, Fig. 11). On the cephalic segment are also to be noticed two punctiform ocelli (*oc*, Fig. 11), and close beside the contour of the pharynx (*ph*, Fig. 11) are two openings (*dc*, Fig. 11) apparently belonging to glands in connection with the pharynx.

The development of the cephalic segment and its appendages is illustrated in Fig. 1–5. First a retraction of the granular contents is noticeable (Fig 1), then a demarcation of the hyaline region as head (Fig. 2), in which an anterior notch containing a pyramidal outgrowth is bounded by two lateral curved processes; these are the future pedipalpi, while the pyramids by a division in the middle line (Fig. 3), and the subsequent longitudinal division of each half gives rise laterally to the mandibles, medially to the maxillae (Fig. 4–5).

The maxillae are curved rods 0.01 mm. in length. (*mx*, Fig. 11). Although chiefly piercing organs, they can also be moved from side to side.

The pedipalpi are three-jointed, the middle joint being soft, while the basal and terminal joints are provided with a chitinous framework, which projects on the terminal joints into three inwardly-directed hooks.

The mandibles are 0.04 mm. in length, and in form resemble a pair of shears with rounded points. (*md*, Fig. 11).

The oesophagus is short, leading directly into the stomach, which occupies the whole of the thoracic cavity, and is possessed of rudimentary caeca answering in position to the appendages, which give the stomach a wavy contour when seen from the side. (Fig. 9). The anus is close behind the sternum.

In accordance with the views of Leydig, the refractive corpuscles, which are to be seen towards the posterior end of the body in the adults as well as in all stages of development, are regarded as urinary concretions.

A rudimentary tracheal system is present, which is represented in Fig. 10. No stigmata have been made out. Between the longitudinal tracheae are two reniform bodies which Csokor is inclined to regard as central organs of circulation.

Csokor studied the locomotion of the Demodex in oil on a hot stage. He found that the movements of the mites became very lively with increased temperature, and is inclined to attribute non-success in experiments as to transference to the absence of a suitable temperature for encouraging locomotion. Pedipalpi, head and legs are all active in locomotion; the head is capable of lateral as well as vertical movement; at a high temperature, also the abdomen may move upon the thorax so as to form an angle with it. The legs are 3-jointed, (Coxa, Tibia and Tarsus; see Fig. 11), but only the two latter take part in locomotion, the tarsus being capable of invagination into the cavity of the tibia. Each tarsus terminates in five equally long claws.

One of the most important of Csokor's results is the establishment of three ecdyses or moults which take place (1) between the egg and the six-footed larva (Fig. 2); (2) between the six and eight-footed larva; and (3) between the latter and the adult.

4.—Occurrence and Mode of Life.

Under this heading Csokor mentions that in the smallest tubercles 50—60 mites may be reckoned, in the larger 500—1,000. The cast-off cuticles are found towards the centre of the tubercle, the younger stages towards the duct of the gland, and the adults towards the base and periphery of the gland, head downwards. That the mites are air-breathers is apparent from the little bubbles constantly forming under the cover-glass from specimens recently pressed out of a gland.

As the whole of the herd observed by Csokor (22 animals) were attacked by the Demodex, he considers that its transference from pig to pig is evidently more easily effected than is the case with D. canis. The explanation of this is to be sought for in the dirty habits of the pig and uncleanly condition in which they are kept.

EXPLANATION OF THE PLATE.

FIG. 1.—Ripe egg of D. phylloides.

FIG. 2.—First ecdysis: head with rudiments of jaws and ocelli; crenate outline of thorax due to the developing extremities; granules posteriorly may be urinary concretions.

FIG. 3.—First 6-footed larva; appendages of head already well advanced; 6 short feet.

FIG. 4.—Second ecdysis: the jaws in the form of four rods, larval case striped posteriorly.

FIG. 5.—Eight-footed nymph ecdysis beginning posteriorly.

FIG. 6.—Last ecdysis, within the larval skin is the fully developed mite.

FIG. 7.—D. phylloides: male, ventral aspect—the small fissure near the front of the ventral surface of the abdomen is the anus, *in front* of this two folds represent the penis.

FIG. 8.—Female, ventral aspect—the abdomen contains an egg undergoing segmentation; genital and anal fissure behind the sternum.

FIG. 9.—Female, lateral aspect—the crenate outline towards the dorzal surface of the thorax is the contour of the stomach; the egg inclines towards the genital fissure; the transverse striping of the abdomen is seen to stop abruptly at the thorax.

FIG. 10.—Female, dorsal aspect—the branched tubes are tracheal; the median reniform bodies hearts.

FIG. 11.—Appendages and skeleton of head:

md = mandibles;
mxl = maxillae;
pl = pedipalpi;
oc = ocelli;
lg = ligula;
ph = pharynx;
dc = openings of glands;
st = sternum;
ep = epimera;
cx = coxa;
tib = tibia;
tar = tarsus.

FIG. 12.—Section of skin of pig, with sebaceous gland filled with mites; incipient inflammation.

Figs. 1, 2, 3, 4, 5, 6, were drawn with Hart oc. 2, obj. 8.
Figs. 7, 8, 9, 10 with oc. 2, obj. 7.
Fig. 11, oc. 6, obj. 11.
Fig. 12, oc. 3, obj. 4.

SOME

LAWS OF PHONETIC CHANGE

IN THE KHITAN LANGUAGES.

BY JOHN CAMPBELL, M.A.
Professor in the Presbyterian College, Montreal.

In several published articles, some of which were read before the Canadian Institute, I have given comparative vocabularies illustrating the connection of the American languages with those of the Old World. Among ethnologists there is a strong prejudice against this mode of procedure, a prejudice arising partly from an unwillingness to undertake the labour necessary for an appreciation of the results obtained; partly, it may be, from a suspicion that the vocabulist has been too anxious to prove his point to be scrupulous about the means; and, in particular, from the possibility or probability that the resemblances exhibited are nothing more than such chance coincidences as will appear more or less in comparing any two languages in the world. A similar prejudice might have opposed, and in many minds probably did for a time oppose, the reception of the Indo-European family of languages, for the resemblances presented in their vocabularies as compared among themselves are not a whit more striking than those which characterize a comparison of the languages of north-eastern Asia with those of the principal native races of North and South America. This, however, distinguishes the two linguistic fields; the Indo-European is infinitely better known. Now, speaking of that field, Professor Max Müller tells us that, as far as etymological science is concerned, identity or similarity of sound or meaning is of no importance whatever. This, of course, is true when we are dealing with individual words, but to apply such a rule in the case of a general comparison of vocabularies would be to remove the foundation on which the classification of languages has been laid and from which comparative etymology has sprung. As well go to the extreme at once, and, with Schleicher, assert that grammatical construction is the only test of linguistic affinity, as if no great changes had taken place in such construction, soul of language though it be, even within the period of modern history. Putting aside such extreme views, or perhaps, as it would be more just to term them, extreme statements, and asking the philologist to suggest some valid criterion of relationship among languages which we deem to be connected and whose grammatical systems are, to say the least, not discordant, he will probably invite us to discover among them such a process of phonetic change as has been illustrated in the case of the Indo-European languages by the well-known Grimm's law. Now it is precisely such a law, or a portion of such a law, that I profess to have found, after a somewhat laborious and careful examination of those New and Old World languages which may constitute provisionally the Khitan family.

The name requires explanation. About the middle of the tenth century, a foreign horde, whom the Chinese annals know as the Khitan, descending from the north, took possession of Mantchuria, and extended their sway over the whole of Northern China. For two centuries they maintained themselves as the rulers of that empire, being recognized in Chinese history as the Liao Dynasty, and were then expelled to the north-east by the Nyuche, a supposed Mantchu tribe, who ruled in their place as the Dynasty of Kin. It was these Khitas or Khitan, for the final *n* is the Khita mark of the plural, who gave to the Celestial Empire its mediæval name Cathay. Some of the Chinese historians derive the Khitan from the desert of Kobi, but, farther to the north about the sources of the Yenisei, and throughout Southern Siberia according to Tartar tradition, their remains are found. These are tumuli, similar to the mounds of this continent, containing arms and ornaments, and sculptured inscriptions upon adjoining rocks in an unknown hieroglyphic character. The Tartars call the tumuli Li Katei, or the tombs of the Cathayans. Tumuli of the same character as those of Siberia, accompanied in many cases by cup shaped and other rude sculptures agreeing in outline with those found in many parts of this continent, appear in India, where they are regarded as the work of a Turanian people, the Indo-Scyths of history. These must have been none other than the Kathaei of Arrian and Strabo, whom Alexander the Great encountered at Sangala in the Punjaub. The very name Sangala is Khitan, for from the Songari River the Khitan are said to have descended upon China; to the country of Saghalien they retired; and their presence farther east in Japan is marked by the straits of Sangar. Sangura again or Sagura was the name of a river in the country of the Khita or Hittites, according to the Assyrian inscriptions, and its ethnical character is apparent in its use as the proper name of one of the greatest Hittite monarchs, Sangara of Carchemish. Several native references to the Indian Sangala, as well as that of Isidorus Characenus, make it plain that its population was not Aryan, but Turanian or Indo-Scythic. In the third century, A.D., these Indo-Scyths were expelled or subdued, and at that point the migration northwards through Tartary to Southern Siberia must have commenced. It is natural to suppose, in the want of definite information, that the Kathaei or Khitan reached the Punjaub from the west by skirting the northern boundary of the Persian empire, arriving in their Indian home at or before the fourth century, B.C., when Alexander found them there. The Persian chronicles class among the northern peoples of Touran the Khatai, and link them with Shankul, Prince of Hindustan, another Sagala or Sangala. The original cause of their movement eastward was the capture of the Hittite capital Carchemish on the Euphrates by Sargon, King of Assyria, in 717 B.C., and the consequent dispersion of a brave and restless people unwilling to live under a foreign yoke. Many tribes, as has been shown by Professor Sayce, Dr. Hyde Clarke, and others, found their way into Asia Minor, where Hittite dynasties reigned down into the days of Rome's supremacy. Others, long ages before, when the Kheti invaded the land of the ancient Pharaohs, leaving their Syrian domain, planted colonies in northern Africa, and even penetrated into Europe. But the great bulk of the Hittite population took refuge in the Caucasus, and from thence by dint of pressure, internal and external, forced its eastward way along the route that has been traced in retrograde order, from the Caucasus to the Punjaub, from the Punjaub to the Yenisei, from the Yenisei to the Songari, and thence to Corea, Japan, the Kurile Islands, Kamtchatka, and, finally, as far as the Old World is concerned, to the Aleutian chain. They carried with them their practice of mound building, their peculiar hieroglyphic character, and their own geographical and tribal nomenclature. The mounds begin with the Tells of Syria, are followed on the west by the Lydian and other similar tombs of Asia Minor, on the east by the tumuli of the Caucasus, India, Tartary, Siberia and Japan, and on this continent give name to their otherwise unknown architects, the Mound Builders. At Carchemish and Hamath, in Phrygia and Lydia, the Hittite hieroglyphics strange and distinctive remain as monuments of Khitan empire and journeyings. The Cypriote syllabic notation has borrowed largely from them; the Libyan and Kelt-Iberian alphabets are their descendants. Some of the more characteristic symbols appear on rudely sculptured rocks in India; the alphabet of Corea preserves many forms identical with those of Hamath; and, in this western world, the few surviving inscriptions of the Mound Builders are unmistakably Hittite, while the Aztec paleography is but an adaptation of the ancient symbolism of Syria to the productions and necessities of a new land. The Hittites of the Hebrew Scriptures are the Kheti of the Egyptian, and the Khita of the Assyrian records, the Ketei of Homer, who left their name to the Keteus river in Mysia, the Kathaei of the Punjaub, the Katei of Siberia, and the Khitan of Chinese history. When, in the 12th century, the Acullua Tepanecs, traversing the length of the North American continent, arrived in Mexico within the borders of the Chichimec kingdom, they sought to conciliate its monarch Nopaltzin by the tidings that they belonged to the same ancient stock from which he was descended, that namely of the Citin, a race illustrious by its nobility and heroic deeds. Hamath, a Hittite word, yields its meaning only when we discover it in the native name of Japan which is Yama-to, the mountain door; and this again explains the Bible expression, "the entering in of Hamath." Hittite colonists, or Greeks who had dwelt with Hittites in Asia Minor, carried the word into Europe as Haemus and Hymettus. The Kathaei carried it with them to India, where it became on Aryan lips Himavat, afterwards to change to Himalaya. Among the survivals of the ancient name on this continent I may mention Yuma, that of a tribe in south-western California to which, with the other members of the family so designated, I shall have occasion to refer more than once, and Yemez, the name of a Pueblo people of New Mexico. The languages of these two peoples are undoubtedly Khitan. Another group of Khitan names to which I can only briefly refer, as I have already directed attention to them in my paper on "Hittites in America," has been linked with the Kathaei by writers on Indian antiquities. These have supposed that the Kathaei and the Kshatriyas are one and the same. The Kshatriyas also were Asuras, and of the Asuras were the Pisachas. With these three names, *Asura*, *Kshatriya*, *Pisacha*, may be compared the Basque *Euskara*, *Haitor*, *Basque* and *Guipuzcoa*, the Caucasian *Iskuria* or *Dioscurias*, the Dioscurian *Castor*, who found his way into classical mythology, *Abasech* and *Schapsuch*, the Khita (of Syria) *Sangara*, *Ashteroth* and *Khupuskia*, the Huron-Iroquois *Tawiscara*, *Ahatsistari* and *Jouskeha* and the Peruvian *Huascar*, *Ayatarco* and *Pasco*, together with the Kheti *Ashtar*, the Dacotah *Seepohskah*, the Muyscan *Bochica*, and many other isolated members of the triad in other tribes and families.

The original physical features of the Khitan must be found on this continent in regions more or less remote from European influences, for in Spain and the Caucasus, in India, and even in Japan, foreign intermixture has so changed the type that little but language and tradition remain to point out a Khitan origin. The measure of Khitan culture was probably never in excess or greatly in excess of that which anciently prevailed in Mexico and Peru. The savage independence of Khitan character appears equally among the tribes of the Caucasus and the Koriaks of Siberia, on the one hand, and among the Dacotahs and Iroquois of this continent, on the other. It is language, however, that determines the relationship of the various members of this once central and historical but now widely scattered family.

Of the African and Indian members of the dispersion, I prefer for the present to say nothing. In Europe the Basques, with their polysynthetic language are the most westerly of the Khitan. In the Caucasus, under modified grammatical forms, the same language survives among the Lesghians, Mizjeji, Circassians, and Georgians. In Central Siberia the Yeniseians are the remnant of the Katei, whose inscriptions are as unintelligible to them as those of the Mound Builders to our Indians. Of the same family are the whole of Dr. Latham's Peninsular Mongolidae, namely, the Koriaks (including the Tchuktchis) of Siberia, the Kamchatdales, the Ainos, Coreans and Japanese, together with the Yukahiri within the Koriak area. The leading American divisions of the Khitan are: in the northern continent the Dacotahs, Huron-Iroquois, Choctaws, Cherokees, Natchez, Adahis, Shoshonese, the Pujunis and Yumas of California, Pueblos Indians of New Mexico and Arizona, the Sonora tribes, the

Aztecs and the Lencas; and in the south, the Muyscas of New Granada, the Quichas, Aymaras, Atacamenos, Sapibocones and Cayubabas of Peru, and the Chileno family, embracing the Chilians, Pampas Indians, Patagonians and Fuegians. The Dacotah, Huron-Iroquois, Choctaw, Shoshonese, Pujuni, Yuma, Pueblos, Sonora and Lenca divisions comprise many dialects, and, as I propose to treat the Chileno division as one under the name Araucanian, the same will be true concerning it. The dialectic differences of the Basque are few, as are those of the Circassian and Mizjeji, but the Georgian has four dialects, and the Lesghian at least ten. The Yeniseian, Koriak, Kamchatdale, and Aino divisions each present tribal and dialectic differences, and the language of the Loo Choo Islands provides a complement to that of Japan. These dialectic differences are valuable as furnishing the laws of phonetic change within the bounds of a single language, and as aiding in the application of similar laws to forms of speech widely separated geographically.

Instead of setting forth in this paper the whole of my comparative vocabulary of over 150 words in the various languages and dialects of the Khitan family, which would be more likely to confuse than to convince, I prefer for the present to restrict myself to an exhibition of some of the relations of one such language to its connected forms of speech. The language selected is the Huron-Iroquois in its various dialects, the Huron, Tuscarora, Nottoway, Mohawk, Oneida, Onondaga, Cayuga, Seneca, &c. This is one of the most peculiar and difficult members of the family, differing from all the others known to me in this particular, that no one of its dialects possesses the labials *b, p, v, f,* or the liquid and labial *m.* The nearest approach they can make to a labial sound is *w,* and where *m* cannot be similarly represented it must be replaced by another liquid, *n.* With the Huron-Iroquois language I compare first of all that member of the family which, following the line of Khitan migration backwards, is the most remote from it, namely the Basque of northern Spain and south-western France. Grammatically the two languages agree, for it has been rightly said that the Basque is the most American of the Old World tongues known to philology. A better acquaintance than is at present possessed of the languages of north-eastern Asia would doubtless modify such a statement. Still it is well to be on a right footing with the grammarians, although one of them, M. Vinson, a distinguished Basque scholar, who, some time ago, published an article comparing the Basque with the Iroquois, failed to find the grammatical accordance of the languages borne out by the lexicon. This, however, arose from the fact that M. Vinson had not made a special study of the Iroquois, and that he had neglected the geographically intermediate languages which, in some respects, furnish the key to the common origin of the Iroquois and the Basque.

I.—In a large number of instances, although there are many exceptions, the Iroquois replaces the Basque liquids *l* and *r* by another liquid, *n*.

Take, for example, the Iroquois word for tooth, *honozzia*, *onotchia*. It is easy to perceive the relationship between these forms and the *innotay*, *noti*, of the Choctaw, the *ente* of the Natchez, the *noto* of the Shoshonese, and even the *'neas*, *naygha*, of the Lenca. But where, it may be asked, is the similarity between these names for tooth and that of the Yuma, which is *aredoche?* The Basque displays the relation. Its word for tooth is *hortz*, *ortz*, or, in the plural, *hortzac*, *ortzac*. The unaspirated *ortz*, somewhat drawn out as is generally the case in the pronunciation of uncivilized man who has abundance of time for his conversation, becomes, without any consonantal change worth noting, the Yuma *aredoche*. If, however, we apply the rule which transforms the Basque *r* into the Iroquois *n*, then *ortz* becomes *ontz*, and *hortz*, the aspirated Labourdin and Bas-Navarrais form of the word, *hontz*, thus furnishing us with abbreviated but distinctly recognizable equivalents of the Iroquois *onotchia* and *honozzia*. In the Kasi Kumuk dialect of the Lesghian the Basque aspirate is strengthened into *k*, *kertshi* being its rendering of *hortz*. Indeed it may almost be said to be a rule that the Basque aspirate, as an initial letter at least, becomes the Lesghian guttural. The Quichua of Peru follows the same rule, and surpasses the Lesghian in its attenuation of the vowel, by changing *kertshi* to *kiru*. Thus the two forms *onotchia* and *kiru*, which appear to present no feature in common, are found to have the same origin.

A similar instance is that of the Iroquois *kelanquaw*, which denotes the moon, but also the sun. The Pueblo word for sun is *hoolenwah*; with which the Yukahiri name for the same orb, *yelonsha*, invites comparison. But in the Basque the equivalent for *kelanquaw*, the moon, is *hilargia;* and, just as the Yuma *aredoche* corresponded with the Basque *ortz*, so does the Yuma *hullyar* almost perfectly reproduce the Basque *hilargia*. Let the Iroquois *n* become *r*, and *kelarquaw* is the Basque *hilargia* and the Yuma *hullyar*. The Quichua, still retaining its original guttural, changes *hilargia* and *hullyar* to *coyllor*, but employs the word to designate not the moon but a star. It is worthy of note that the Yukahiri of Siberia, which renders the sun as *yelonsha*, calls the moon *kininsha*, thus replacing the *l* as well as the *r* of *hilargia* by *n*, and preparing the way for the Aino *kunezu* and another Iroquois form, *kanaughquaw*.

An Iroquois word for an axe or hatchet is *ahdokenh*, and this is the Koriak *adaganu*. Turning once more to the Yuma, the phenomenon presented in *aredoche* and *hullyar* is repeated, for the Yuma word for an axe is *atacarte*. Here again we meet with the Basque, for *atacarte* is to *aizkora* as *aredoche* is to *ortz*. In Aino and Japanese the Basque word takes a prefix *m*, and *aizkora* becomes *masakari*.

The Yuma gives us *kooruk* for the adjective old. and the Iroquois, *akaion*; here also the Yuma and the Basque agree, for in the latter language old is *agurea*. But in the Lesghian both forms appear, for, while the Avar and three other dialects accord with the Basque and Yuma in *herau*, two, the Akush and Kubetsh, are in harmony with the Iroquois, *ukna* and *okna* being their respective renderings. In North America the Dacotah also gives two forms, that of the Sioux or Dacotah proper being *kon*, and that of the Upsarokas or Crows, *karrahairea*. The double form *karrahairea* is itself far from singular. The Lesghian tribe of the Avars, besides *herau*, uses *mirvara*, which becomes *noorkoor* in Corean, *porugur* in Aino, and *furuberu* in Japanese.

A remarkable word for egg is the Basque *arraultzia*. The application of the rule to *r* and *l* reduces *arraultzia* to *annauntzia*, which is almost the sound of the Iroquois word *onhonchia*. The Quichua agrees with the Iroquois in changing the *l* to *n*, but retains the *r*, and removes the initial vowel; thus *arraultzia* becomes *runto*. A similar elision of the initial vowel takes place in Kamtschatdale, which furnishes the two forms—*lilchatsh* corresponding with the Basque, and *nyhatch* according with the Iroquois.

In all the Khitan languages there is no radical distinction of adjective and verb. Indeed almost any word may become a verb. Taking the word *dead*, therefore, we find it represented by the

Basque substantive so called, *erio, heriotce,* and the Iroquois adjective *kenha.* But *kenha* is the same word as *heriotce,* for, while the Lesghian tribes, Tshar and Kabutsh, render it by *chana* like the Iroquois, the other Lesghian tribes, Dido and Unso, agree with the Basques in calling it *haratz.* The Dacotah sides with the Basque in *karrasha,* and the Peruvian Aymara with the Iroquois in *hinata.*

A road or street in Basque is *kharrika,* but in Iroquois *chanheyens.* The Dacotah, which the late Lewis Morgan proved to be of the same stock as the Iroquois, furnishes the more appropriate form *kanga,* while the Lesghian reconciles the Basque and it by its duplicate renderings *chuldu* and *chuni.* The Corean rejects the termination which appears in *kharrika* and *chuldu* and calls a road *kir.*

The Koriak *ennen, innaen,* a fish is the Basque *arran, arrain,* and the same with the prefix of a guttural is the Iroquois *kunjoon.* So the Iroquois *enia* a finger is the Basque *erhia,* and the Basque *oscola,* the bark of a tree, is the Iroquois *askoonta.* Again, the Quichua rejects the initial vowel and calls bark *kara.* The *t* of *askoonta* which is not found in *oscola* is probably a euphonic addition merely, since it frequently appears, as in *ourata,* a leaf, the Basque *orri,* in *ashuchta,* a hand, the Basque *escua,* and Dacotah *sake,* and in *kihade,* a river, the Kamtchatdale *kiha.*

II.—THE IROQUOIS REPLACES THE BASQUE *m* BY *an, en, on;* AND THE BASQUE *b* FOLLOWS THE SAME RULE AS *m* WHEN IT IS THE EQUIVALENT OF THAT LETTER IN THE CAUCASIAN LANGUAGES.

One of the best known Iroquois words is *onontes,* a mountain, figuratively employed to denote a governor or great personage, as *onontio,* the beautiful mountain. This form *onontio* probably explains the Hittite word *mati* in the Hamath inscriptions, which I have translated "king." However, the Iroquois *onontes* is the Basque *mendia.* In South America the Basque form is almost given back in the Araucanian *mahnida,* but the Cayubabas of north-eastern Bolivia, a people allied to the Quichuas, are *Vasconibus Vasconiores* and turn the Iroquois *onontes* into *iruretui.*

The word tongue in Basque is *mia, mihia,* the Lesghian *mitz* and *mas.* The application of the rule transforms *mas* to *ennas,* which is just *ennasa,* the Iroquois tongue. The Georgian form is *ena.*

The Caucasian *m* is frequently represented in Basque by *b.* Thus the Lesghian *mussur, muzul,* the beard, is the Basque *bizarra.*

There is little doubt that the Lesghian form is the more ancient and radical. In the Atacameno, a Peruvian language of the Quichua family, *musur* survives, not indeed as denoting the beard but the hair. The Iroquois therefore instead of rendering the Basque *b* by *w* recognizes the original in *m* and calls a beard *onwskera*.

A similar word, *burua*, the head in Basque is the Lesghian *mier*, *maar*, the Corean *mari*, the Dacotah *marshaa*, the Sonora *moola*, the Cayubaba *abara-cama* and *nahuara-cama*. Accordingly in Iroquois its form is not *wara* but *anuwara*.

The radical part of the Iroquois *eniorhene*, to-morrow, is *enior*, and this is the Basque *bihar*, *biar*, *bigar*. While the Iroquois agrees with the Guipuzcoan and Biscayan dialects of the Basque in suppressing the medial aspirate or guttural, it refuses to recognize the initial *b*, and thus claims affinity with the Georgian *michar* and the Corean *myongir*. The Yuma gives back the Georgian form in *mayyokal*; while the Dacotah and Cherokee, preserving the Iroquois form, prefix a sibilant, *shinnakshare* and *sunahla* being their respective terms.

No unscientific collector of verbal coincidences would dream of associating the Basque *bizkhar*, the back, with the Iroquois *ohnaken*. But when we learn that the Basque *bizkhar* is the Lesghian *machol*, it is easily perceived that by the application of the first law *machol* becomes *machen*, and, by that of the second, *machen* is transformed into *onachen*.

III.—When the Basque *b* is represented by the same letter, or a corresponding labial in the Caucasian languages its Iroquois equivalent is *w*.

A Basque adjective meaning great and wide is *zabala*. In Lesghian it appears as *chvallal*, *chvallase*, and similar forms are furnished by the Shoshonese, Aztec, and Atacameno, namely, *oboloo*, *yzachipul* and *capur*. The first rule changes the Basque and Lesghian *l* into the Iroquois *n*, and, by this third rule, the *b* and *v* of these two languages become *w*. Hence we have *kowanea*, the Iroquois word. It is to be remarked that in certain Lesghian and Iroquois dialects the labial disappears altogether, the Lesghian *kunosa* being the counterpart of the Iroquois *hons*.

The Basque word for grass is *belharra*. Here the Caucasian and Basque agree, for *belharra* is the Georgian *baluchi*. Accordingly the

Iroquois form is *wennokera*, a term illustrating the first law as well as the third.

The Basque dialects furnish us with two words for hair, *ileac* and *biloac*. In Iroquois also we find *arochia* and *werochia* or *ahwerochia*. The first form corresponds with the Lesghian *ras*, the Aino *ruh*, and the Dacotah *arra*. In the second we meet with the Circassian *abra*. The final *ac* of *ileac* and *biloac* is the Basque mark of the plural, and is the same in origin and in function as the Iroquois *ke*.

Although not entitled to rank as a law of phonetic change, it is worthy of note, as tending to simplify the exhibition of the common origin of Basque and Iroquois, that *the Iroquois frequently differs from the Basque by inserting a dental between the letters n and r, for purposes of euphony.*

Thus the Iroquois *kanadra*, bread, is the Basque *janhari, janari*, food ; for the initial *j*, as we learn from M. Lecluse, though pronounced as in French in the canton of Soule, and as in German in that of Labourt, assumes the power of the Spanish letter in Guipuzcoa, and may be represented by *kh*.

The verb to love in Basque is *onerechi, oniritzi*, in which it is easy to recognize the Yukahiri *anoorak*, and the Japanese *noroke*. In Yuma the word is *awvonoorch*. Three Iroquois forms are *endooroohquah, aindooroolcwa* and *enorongwa*.

A large number of words in Basque and in Iroquois coincide in sound and in signification, and for such coincidence I have so far been able to discover no law. Among these may be mentioned the Iroquois *garioha*, bird, which is the Basque *choria*, the Lesghian *zur*, the Aymara *chiroti*. The final *ti* of the Aymara has also appeared in *hinata*, dead, as compared with the Iroquois *kenha* and the Lesghian *chana*. The Iroquois white, which English missionaries write *kearugea* and the French *kenraken*, is the Basque *churia*, the Japanese *kiroi*, the Loo Choo *shirusa*, the Lesghian *tchalasa*, and the Quichua *yurac*. An Iroquois word for dog is *tschierha*, the Shoshonese *schari*, the Mizjeji (Caucasian) *tkari*, the Georgian *djogori*, and the Basque *zacurra*. So the Basque *hezurra*, bone, is the Iroquois *ohskereh*, and the Cherokee *ookolah* ; and the Basque *aztala*, leg, is the Iroquois *okotara*, and the Lesghian *uttur*. While *geree*, an Iroquois word for tree, agrees with the Basque *chara* and the Quichua *kullu*, meaning wood, another Iroquois form, *kaeet*, is the Lesghian *hueta, guet*, the Basque *zuaitz, zuhaitz*, and the Aztec *quahuit*, *quauitl*. The Khitan terms for thunder are like the Semitic *gidgad*. The Lesghian seems to furnish the type in *gurgur*, which is approached by the Basque *curciria*, *ihurzuria*, and aggravated in the Koriak *urgirgerkin*. The Georgian modifies the harsh sound by dropping one of the *r's*, as in *gurgin* and *kuchili*, the latter of which corresponds with other Koriak forms, *kyhal*, *kyigala*, and with the Kamtchatdale *Kychichlizen*. The Choctaw has the two forms *jyrajaa* and *hiloha*; the Yuma stops short at *aker*; but the Iroquois furnishes a word *kawseras* that agrees more perfectly with the Old World forms.

I have already referred to the Yuma dialects (the Yuma or Cuchan, Maricopa, Mojeve, Dieguno), as valuable members of the Khitan family for comparative purposes. Two Yuma words for cold are *xetchur* and *hutseelo*. The former accords with the Dacotah *hootsheere* and the Iroquois *otsorai*, which the Basque changes to *otsbero*, while in *hutseelo* we find the Lesghian *chuatzala*. The connection of the Iroquois *onyare*, neck, with the Basque *cinzurra* might seem doubtful, as the Basque sibilant and guttural prefixes are generally more conspicuous by their absence than by their presence. But the Yuma form *henneeil* shows that it is the Iroquois which errs by default in this respect. The Yukahiri *jomuel* restores that original form which would naturally have been looked for in the Basque, and leads the way to the Lenca *ampshala*. The Lesghian word *gabur*, which could never be evolved out of *cinzurra*, naturally rises out of *jomuel*.

The Iroquois *onuste*, maize, and the Basque *arto*, *artho*, have little in common. The Yuma *tarrichte*, however, dropping the initial *t* and applying the first rule as if it were a Basque word, becomes *annichte*. Another Yuma form is *terditch*, with which may be compared the Lesghian *zoroto* and the Circassian *narturh*, and with these the relation of the Basque *arto*, *artho* is easily perceived.

Still another Yuma word meaning to speak is *atchahquerck*. This is undeniably the Aino *itakguru*. But another Aino dialect gives *idakuwa*, and this prepares us for the Iroquois *atakia* and the Basque *itzegin*. The nearest word to the Yuma *haweel*, meaning a river, is the Aymara *hahuiri* or *hawiri*, and this is plainly the Lesghian *uor*, *chyare*, and the Basque *uharre*, *uharka*. In *chyare*, by the application of the first rule, we detect the Iroquois *kahionha*.

In some cases the Basque word, while agreeing with the Iroquois, differs from the Lesghian, so that both Iroquois and Basque must be brought under the first rule, in which Lesghian must take the place of Basque. Thus the word for name is in Iroquois *chinna* and in Basque *icena*, while the Lesghian form is *zar*.

Certain roots also which I have not found in Basque unite the Lesghian and the Iroquois. Such is the Lesghian *surdo*, night, which is the Iroquois *asunto*. Another Lesghian form *chur* agrees with the Aino *asiru*. The Lesghian *ras*, a feather, is the Iroquois *onasa*. The Iroquois word for rain, *iokennores*, is not very like the Lesghian Kasi-Kumuk form *kural*, but is at once recognisable in that of the Akush dialect, which is *kanili*. In fact the phonetic changes which I have pointed out as existing between the Basque and the Iroquois are really found operating in greater or less measure within the bounds of individual Khitan languages both in the Old World and on this continent. Even the Kamtchatdale, which generally accords with the Iroquois, gives occasionally a Basque form, as in *kchailta*, the belly, as compared with the Iroquois *kchonta*.

Before concluding the list of examples, which, however tiresome to enumerate, I feel are due from me to those who would themselves judge the validity of the laws which I have enunciated, I wish to set forth the relations of two connected Iroquois words the derivation of which has long been sought in vain. The first is the word for house *onushag*, *kanuchsa*, *anonchia*, *kanonsa*. Beginning near home, the Shoshonese *niki* and Sonora *nihki* should not be foreign to the Iroquois forms, especially as another Shoshonese form *kanuke* almost reproduces the Iroquois *kanuchsa*, and as the Sonora *kaliki* is the same word. The Shoshonese has still another form *liki*, which is the Araucanian *ruka*, and the Lesghian *ruk*. If, however, we ask how the Iroquois forms *anonchia* and *kanonsa* obtained their double *n*, we must be referred to the Koriak, which renders the Lesghian *ruk* by *oranga*, and this the Iroquois changes to *onanga*, *anonchia*. The Aztec *calli*, different as it may appear, is the same word, for the Sonora which gave us *kaliki* abbreviates this in certain dialects into *kari*, from which *calli* is derived by the simplest of all phonetic changes. The other word is that which gives name to our Dominion. *kanada*, *kanata*, a village. Nobody would dream of associating it with the Natchez word *walt*, and yet their derivation is one. The language of the Yenisei furnishes the original term, *kelet*, *koleda*, unless we are disposed to admit the prior claims of the Circassian *sheelday* or the Georgian *kalaki*.

Nothing can prove more convincingly the wonderful vitality of words even among peoples devoid of literature than the comparison just instituted between the Basque and the Iroquois. If it be allowed that the separation of the two stocks only took place at the time when the Hittite empire was overthrown by the Assyrian Sargon, for certainly it can be placed at no later period, then it follows that 2,600 years have passed since the ancestors of the Vascones and those of our Hurons and Iroquois mingled their voices on the banks of the Euphrates. But if, as is far more probable, the Basques reached their Spanish home by way of Northern Africa, this journey must have been undertaken long centuries before, when that Shepherd tide of conquest, in which the Kheti formed a mighty wave, was driven back upon the desert sands and the Mediterranean shore by the great Egyptian Pharaohs of the 18th dynasty. When Moses was still a child, and the ancient Hebrew language had not yet assumed a literary form, the Khitan wanderers carried their imperishable speech across the Libyan sands to plant it at last in the remotest bound of the European continent.

Even now we hear much of the Atlantis theory, of the population of America from Western Europe and Africa by means of a submerged continent, or by such brave sea daring as brought Columbus to the New World, and the very connection of the Basque and Iroquois languages tempts the question: May there not be truth in such a theory? But language, which has established the relationship of the peoples, refutes the theory. Our Huron-Iroquois came not to the east first but to the west, not to the south but to the north. Their features, their religion, their character and customs are distinctively Koriak, and their appearance upon the stage of American history began at a time when, had Biscay or Morocco been their starting point, they must have brought with them some traces at least of mediæval culture. Euskara and Basque, names of a people only in Spain, are to the Iroquois Tawiscara and Jouskeha, gods or divine ancestors of the race, whose memory has vanished long years ago from Guipuzcoa and Navarre. The Basque is a seaman, but some other race than his own, that of his mother, it may be, who gave the European tint to his dusky complexion, must have taught him to hold the sail and brave the dangers of the ocean, for the

Khitan, fierce, warlike, indomitable, as many of their tribes have proved themselves on mountain and plain, have never taken rank among the masters of the sea. Their very passage to this Western World has been the stepping stones of the Kurile and Aleutian Isles, with land in sight for almost all the way.

To return to language; we look in vain in our Basque lexicons for the compound words of the Iroquois tongue, but in Koriak, in Kamtchatdale, and in Japanese, we discover, not indeed the precise words, for a few centuries may suffice to alter these, but some of the elements of which they are composed. Take, for instance, the Iroquois word for silver. It is *hwichtan-oron.* I am not sufficiently versed in ancient Iroquois to know the meaning of its component parts, but there can be no doubt that the first of these, *hwichtan*, is the same as *wychtin* in the Koriak word *elnipel-wychtin*, denoting the same metal. An Iroquois word for the colour yellow is *cheena-guarle*, and *guarle* is apparently the same word as *karallo* in the Kamtchatdale *duchl-karallo*, which means not yellow indeed but green, colours not always distinguishable by savages, for the Koriak uses the same term, *nigil-tshachain*, for both. Another Iroquois word for yellow is *hotgikkwa-rogon*, of which the latter member, *rogon*, corresponds with *grachen* in the distinctive Koriak term for yellow, *nuutel-grachen.* We are on a surer foundation in regard to the Iroquois words for red, two of which are *otquech taroku* and *quwen-tarogon.* The first part of each word is a variation of the terms *otweacha*, *hotkwensa*, blood. The Koriak red is *nitshel-rachen*, although *nitshel* is sometimes used alone. The latter Koriak word does not seem to denote blood. Still the *rachen* of *nitshel-rachen*, red, and the *grachen* of *nuntel-grachen*, yellow, are doubtless variations of the Iroquois *rogon* of *hotgikkwa-rogon*, yellow, and the *tarogon* of *quwen-tarogon*, red. The explanation of these terms is found in the Japanese. One of its words for red is *chi-darake-no*, literally, "smeared with blood," for *chi* denotes "blood," and *darake*, or with the particle *darake-no*, means "smeared with." Hence the Iroquois words for red, in which we have already found the equivalents of the Japanese *chi*, blood, plainly exhibit their Northern Asiatic origin, for *taroku* and *tarogon* are the Japanese *darake* and *darakeno*, as well as the *rachen* and *grachen* of the Koriak. Taking the Japanese also as the more correct form of the language, it follows that the Iroquois have been more careful of their speech than the Koriaks. The Atlantis theory gains no support from philology.

If in this paper I have not exhibited the relation of the Iroquois dialects to those of all the divisions of the Khitan family, it is not from lack of material or in order to avoid any difficulty. I have purposely chosen for comparison languages the most remote in place and in time of separation from the original tongue, languages of peoples most unlike in present feature and character, whose sole connecting link has been supposed to be the common possession of a complicated grammatical system marked by polysynthesis. That I have succeeded in showing the relation of these languages to one another and at least to some of the intermediate members of the Khitan family, will be granted, I doubt not, by all true philologists who do not shut their eyes at antecedent improbability.

RULE I.

THE IROQUOIS REPLACES THE BASQUE *l* AND *r* BY *n*.

	BASQUE.	RULE APPLIED.	IROQUOIS.	ENGLISH.
1.	ortz, hortz	ontz, hontz	onotchia, honozzia	tooth
2.	hilargia	hilangia	kelanquaw	moon
3.	aizkora	aizkona	ahdokenh	axe
4.	agurea	agunea	akaion	old
5.	arraultzia	annauntzia	onhonchia	egg
6.	herio	henio	kenha	dead
7.	kharrika	khannika	chanheyens (*Dacotah*, canga)	road
8.	arrain	annain	kunjoon	fish
9.	erhia	enhia	enia	finger
10.	oscola	oscona	askoonta	bark

Note.—ILLUSTRATIONS OF THE RULE IN OTHER LANGUAGES.

BASQUE FORMS.	IROQUOIS FORMS.
1. ortz = rytti, *Koriak*; aredoche, *Yuma* hortz = kertshi, *Lesghian*; kiru, *Quichua*	onotchia = innotay, noti, *Choctaw*; ente, int, *Natchez*; neto, *Shoshonese*; neas, nigh, nagha, *Lenca*
2. hilargia = hullyar, *Yuma*; coyllor, *Quichua*	kelanquaw = gailgen, *Koriak*; yelonsha, *Yukahiri*; hoolenwah, *Pueblos.*
3. aizkora = masakari, *Japanese, Aino*; atacarte, *Yuma*	ahdokenh = adaganu, *Koriak*; tlateconi, *Aztec.*
4. agurea = herau, *Lesghian*; kooruk, *Yuma*; karrahairea, *Dacotah*	akaion = ukna, okna, *Lesghian*; kon, *Dacotah*
5. arraultzia = lilchatsh, *Kamtchatdale*; runto, *Quichua*	onhonchia, = nyhatch, *Kamtchatdale*; nanki, *Shoshonese*
6. herio, heriotce, = haratz, *Lesghian*; carrasha, *Dacotah*	kenha = chana, *Lesghian*; hinata, *Aymara*
7. kharrika = shara, *Georgian*: chuldu, *Lesghian*; kir, *Corean*	chanheyens = chuni, huni, *Lesghian*; canga, *Dacotah*; hinah, *Choctaw*
8. arrain atlan, *Aztec*	kunjoon = ennen, innaen, *Koriak*; henn, *Natchez*; kanu, *Aymara*
9 erhia = kilish, *Lesghian*; gelyhat, *Koriak*; hal, *Yenisei*	enia = onkahah, *Dacotah*
10. oscola = kerki, *Georgian*; ichalgyn, *Koriak*; kara, *Quichua*	askoonta = kani, *Georgian* (skin); cangha, chanha, *Dacotah*

RULE II.

THE IROQUOIS REPLACES THE BASQUE *m* BY *an*, *en*, *on*, AND THE BASQUE *b* BY THE SAME WHEN *b* IS THE EQUIVALENT OF THE CAUCASIAN *m*.

	BASQUE.	CAUCASIAN.	IROQUOIS.	ENGLISH.
1.	mendi	mta, *Georgian* suntu, *Lesghian*	onontes	mountain
2.	mia, mihia	mitz, mas, *Lesghian* ena, *Georgian*	ennasa	tongue
3.	bizarra	mussur, muzul, *Lesghian*	onwskera	beard
4.	burua	mier, maar, *Lesghian*	onuwara	head
5.	biar, bihar, bigar	michar, *Georgian*	enior-hene	to-morrow
6.	bizkhar	machol, *Lesghian*	ohnaken	back

Note.—ILLUSTRATIONS OF THE RULE IN OTHER LANGUAGES.

	BASQUE AND CAUCASIAN FORMS.	IROQUOIS FORMS.
1.	mendia = mahuida, *Araucanian*; pinujudtsh, *Kamtchatdale*	onontes = suntu, *Lesghian*; neit, *Koriak* nenichaha, *Choctaw*
2.	mia, mas = mutt, motte, *Mizjeji*	ennasa = ena, *Georgian*; onnor, *Yukahiri*; neeighjee, *Dacotah*; yahnohgah, *Cherokee*; honinee, *Pueblos*; anongin, *Shoshonese*; nenetl, *Aztec*; ine, *Cayubaba*
3.	bizarra, mussur = musur, *Atacameno*; muzul, (hair)	onwskera = hannockqueit, *Shoshonese* (chin); huntur, *Atacameno*
4.	burua, mier, maar = mari, *Corean*; marshaa, *Dacotah*: moola, *Sonora*; abara-cama, *Cayubaba*	ánuwara = nahuar-acama, *Cayubaba*
5.	biar, michar = myongir, *Corean*; mayyokal, *Yuma*; miecar, *Yuma* (morning); emukulas, *Kamtchatdale* (morning)	enior-hone = unhaiel, *Yukahiri* (morning); onnihile, *Choctaw* (morning); sunahla, *Cherokee* (to-morrow and morning); shiunakshare, *Dacotah* (to-morrow and morning); yaurne, *Shoshonese* (morning)
6.	bizkhar, machol = ushiro, *Japanese*	ohnaken = senaka, *Japanese*

RULE III.

THE IROQUOIS REPLACES THE BASQUE *b* BY *w* WHEN *b* IS THE EQUIVALENT OF A LABIAL IN THE CAUCASIAN LANGUAGES.

	BASQUE.	CAUCASIAN.	IROQUOIS.	ENGLISH.
1.	zabala	chvallal, chvallase, *Lesghian*	kowanea	great
2.	belharra	balachi, *Georgian*	wennokera	grass
3.	biloac	abra, *Circassian*	ahwerochia	hair

RULE IV.

THE IROQUOIS INSERTS A DENTAL BETWEEN THE BASQUE *n* AND *r*.

	BASQUE.	IROQUOIS.	OTHER LANGUAGES.	ENGLISH.
1.	janari, janhari	kanadra	kendowan, *Koriak*	bread, food
2.	onerechi, oniritzi	endooroohquah aindoorookwa	anurak, *Yukahiri* noroke, *Japanese* awvonoorch, *Yuma*	to love

ROOTS COINCIDING IN BASQUE AND IROQUOIS.

	BASQUE.	IROQUOIS.	OTHER LANGUAGES.	ENGLISH.
1.	choria	garioha	zur, *Lesghian*; chiroti, *Aymara*	bird
2.	churia	kearagea	kiroi, *Japanese*; shirusa, *Loo Choo* tchalasa, *Lesghian*; yurac, *Quichua*	white
3.	zacurra	tschuerha	djogori, *Georgian*; tkari, *Mizjeji* schari, *Shoshonese*	dog
4.	hezurra	ohskereh	ookolah, *Cherokee*	bone
5.	aztala	okotara	uttur, *Lesghian*	leg
6.	chara zuaitz, zuhaitz	geree kaeet	kullu, *Quichua* hueta, guet, *Lesghian* quahuit, quauitl, *Aztec*	wood, tree
7.	curciria	kawseras	gurgur, *Lesghian* urgirgerkin, kyhal, kyigala, *Koriak* kychuchlizen, *Kamtchatdale* gurgin, kuchili, *Georgian* jyrajaa, hiloha, *Choctaw*; aker, *Yuma*	thunder

The Yuma dialects as aids to comparison.

Iroquois.	Yuma.	Basque.	Other Languages.	English.
1. otsorai	xetchur hutseelo	otsbero	chuatzala, *Lesghian*	cold
2. onyare	henneeil	cinzurra	jomuel, *Yukahiri* ampshala, *Lenca* gabur, *Lesghian*	neck, throat
3. onuste	tarrichte terditch	arto, artho	zoroto, *Lesghian* nartuch, *Circassian*	maize
4. atakia	atchahquerck	itzegin	itakguru, idakuwa, *Aino*	to speak
5. kahiouha	haweel	uharre	uor, chyare, *Lesghian* hahuiri, *Aymara*	river

(See also under Illustrations of Rule I.)

Miscellaneous Examples of Affinity.

Iroquois.	Caucasian.	Other Languages.	English.
1. chinna	zar, *Lesghian*	icena, *Basque*	name
2. asunto	surdo, chur, *Lesghian*	asiru, *Aino*	night
3. onasa	ras, *Lesghian* kamesh, *Mizjeji*	hanni, *Loo Choo*	feather (wing)
4. iokennores	kanili, kural, *Lesghian*	chenar, *Shoshonese*	rain (hail)
5. kchonta	siarad, *Lesghian*	kchailta, *Kamtchatdale* xillantli, *Aztec*	belly
6. onushag, kanonsa	nuk, *Lesghian*	ruka, *Auracanian* kanuke, liki, niki, *Shoshonese* kaliki, cari, nihki, *Sonora* calli, *Aztec*; oranga, *Koriak*	house
7. kanada, kanata	sheelday, *Circassian* kalaki, *Georgian*	kelet, koleda, *Yenisei* walt, *Natchez*	village

The relation of compound words in Iroquois.

Iroquois.	Japanese-Koriak.	English.
1. hwichtan-*oron*	*elnipel*-wychtin, *Koriak*	silver
2. *cheena*-gnarle	*duchl*-karallo, *Kamtchatdale*	yellow
3. *hotgikkwa*-rogon	*nuutel*-grachen, *Koriak*	yellow
4. *otquech*-taroku *quwen*-tarogon	*nitshel*-rachen, *Koriak* *chi*-darake, *chi*-darakeno, *Japanese*	red

NOTES ON
SOME CANADIAN INFUSORIA.

BY J. PLAYFAIR McMURRICH, M.A.,

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For some weeks past I have been occupied in identifying some Infusoria found in water from a pool in the neighbourhood of the Ontario Agricultural College, Guelph. This was obtained during the past summer, and has been standing in a moderately warm spot since. Even during the time I have been engaged in investigating it, its fauna has varied considerably, depending, to a certain extent at least, on the temperature, which has been allowed to vacillate within somewhat wide limits. A lowering of temperature will no doubt cause the disappearance of certain forms, whereby other more hardy ones, in the struggle for existence, will, by obtaining more abundant food be able to propagate themselves, and hence appear more abundantly, and also no doubt it will act indirectly upon certain other forms by destroying their usual food, and thus eventually causing these forms to disappear also, although they may of themselves be able to withstand the increased cold.

The only reference I have been able to find to any researches on the influence of low temperature on Infusoria is contained in Semper's work on the Natural Conditions of Existence as they affect Animal Life. He there alludes to Rossbach's investigations as to the influence of temperature on the pulsation of the contractile vesicle, which show that at 5° c. the contractions follow each other at long intervals, and at 3° c. a condition supervenes, which Rossbach has termed "chillcoma," from which the animal can be roused by increasing the temperature, but if it be long continued at that degree, death supervenes. These observations were conducted only with *Chilodon cucullus*, *Euplotes charon* and *Stylonychia pustulata*, and even in these forms considerable variation was observed.

Many data, however, are yet required to elucidate the action of external conditions on these low forms, and my professional duties have not allowed of a sufficient inquiry into the subject to permit of any generalizations or instances being given here.

In the following notes I do not pretend to give a complete list of all the forms observed, but shall merely deal with certain forms which seem to merit description. In the first place, however, it will be well to record the general zoological and botanical characters of the water.

As to the vegetable life observed, there was in the first place always a large quantity of a small species of *Nostoc*, apparently *N. lichenoides*, var. *vesicarium*, usually mucous or hollow in the interior, the threads traversing the cavity being surrounded each with its own gelatinous envelope. *Oscillatoriæ*, *Spirogyra*, *Protococcus* and various forms of *Chroococcaceæ* were also present in considerable abundance, although towards the last the *Spirogyra* threads disappeared. Diatoms—principally *Navicula* sp.? and Desmids belonging to the genera *Cosmarium*, *Closterium*, *Scenedesmus* and *Ankistrodesmus* were exceedingly numerous, and like the *Nostoc* were apparently not at all affected by cold. Latterly many *Bacteria*, *Bacilli* and *Spirilla* were present, and in regard to the latter I noticed, that when only a small portion of the slide was kept illuminated for a length of time, by the use of a diaphragm with a small aperture, they invariably congregated in large numbers at that spot, apparently showing that these low forms have appreciation of light. Engelmann, however, shows [1] that these forms only approach the light for the purpose of obtaining oxygen, which, under its influence, is given off from green algae, etc., only two bacterial forms being observed by him, which are attracted to the light for the light's sake—*Bacterium chlorinum*, which is of a green colour, and *B. photometricum*, slightly reddish in colour.

As to the animal life, in addition to Infusoria, many lower and higher forms were present. When first procured the water contained numbers of specimens of *Daphnia pulex*, De Geer, in company with which were an undetermined *Ostracode*, and *Cyclops quadricornis*. Of these the two former soon disappeared completely, the *Cyclops* disappearing when the water was exposed to a moderately low tem-

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[1] Revue Internat. Sci. Biol. ix., 1882. Cf. Journ. Roy. Micr. Soc. ii., 1882.

perature, reappearing when the temperature increased, the ova apparently not being affected at a temperature which destroys the adult animal. This is a well-known phenomenon, and is exemplified by many of our Insects, which perish in the Fall, but whose eggs are able to withstand the intense cold of Winter. These same remarks apply to the Rotifer *Philodina citrina*, which was also present in considerable numbers. A single Nematode worm, which I did not identify, and several examples of a Planarian were seen, the latter possessing a distinctly vacuolar parenchyma. Of the lower forms of life many examples were observed: *Arcellæ*, especially *A. dentata*, *Amœbæ*, *Actinophrys sol*, and many *Flagellata*. Of these the *Arcellæ* persisted through all the changes, the *Amœbæ* perished in low temperatures, and *Actinophrys*, having only appeared lately, has not been exposed to cold.

With these preliminaries I shall now pass on to my observations on certain Infusoria, which I regret are somewhat incomplete, owing both to lack of sufficient time to perfect them, and more especially to the want of the necessary literature, which, for efficient work, shoud be continually at hand.

METOPUS, *nov. spec.*

The genus *Metopus* was originated by Claparède and Lachmann for the reception of a species formerly described by O. F. Müller as *Trichoda sigmoides*, and by Perty as an unknown form. It presents many peculiarities, and has hitherto been frequently mistaken for other forms; Balbiani, for instance, mistaking it for the young form of *Spirostomum ambiguum*. It has been described from several localities in Europe, Claparède and Lachmann having found it at Berlin, Englemann at Leipzig, Stein at Tharand and Niegmegk (very numerous among *Lemna polyorrhiza* and *trisulca*), and Balbiani at Paris, but as far as I can ascertain it has not yet been described from America.

The characters of the genus are thus given by Kent[1]: "Free-swimming, highly elastic and changeable in shape, normally elongate, oval, or fusiform, rounded at both extremities, cylindrical or only slightly flattened; the anterior portion usually twisted obliquely towards, and overlapping the left side of the ventral surface, sharply

[1] Manual of the Infusoria. London. 1882.

separated from the posterior portion; peristome field furrow-like, commencing on left side a little distance from the anterior extremity, produced obliquely downwards towards the right in a groove formed by the oblique curvature of the body, and terminating in a short pharynx at or shortly past the middle line; on the contraction or shortening of the body, the peristome with the pharynx for the time describes a complete spiral circuit, the animalcule presenting in this condition a totally different aspect; anal aperture postero-terminal; contractile vesicle single, posteriorly located. Inhabiting salt and fresh water."

With this definition of the genus my observations, although identical in most particulars, do not exactly correspond. The points on which I differ are mainly the position of the anal aperture, and the number of contractile vesicles. On reference to the figure (Pl. fig. 1), it will be seen that I have represented the anus (*a*) as being *postero-lateral*, and I have done so only after having witnessed the emission of unconsumed food from that point. Claparède and Lachmann[1] did not observe the anus, but merely suppose it to be situated posteriorly. Stein,[2] however, distinctly states that it is postero-terminal, and on his authority it is so described above. As to the contractile vesicles, I have observed two, one situated in front of the pharynx (*a. c. v.*) and the other (*p. c. v.*) near the posterior extremity but not quite central. On first observing the form I did not see the anterior vesicle, probably on account of the constant rotation about their long axis which the animals performed, and which, as the vesicle is situated slightly in front of the junction of the overlapping anterior portion with the posterior one, would render it liable to be overlooked. I, however, lately observed it in one form, but having lost it, and having not as yet discovered another, I am unable to confirm the observation. I would then alter these points of the generic definition so as to read, "anal aperture posterior; contractile vesicle single or double."

The only species belonging to this genus that I have been able to find reference to is *M. sigmoides*, and for it the genus was formed. The descriptions of this form vary somewhat, but in no particular sufficiently important to establish a new species. The characters of

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[1] Etudes sur les Infusoires et Rhizopodes. 1858–1860.
[2] Der Organismus der Infusionthiere.

the form which I observed differ so very considerably from those of *M. sigmoides*, that I think it necessary to regard it, however, as a new species. *M. sigmoides* is described by Claparède and Lachmann as having the buccal fossa bounded by cilia much more vigorous than those of the rest of the body. In the digestive cavity anteriorly are constantly found a number of granules, highly refractive, whose signification is still problematic, and which recall very strongly those found frequently in *Paramecium Aurelia*, and in certain *Nassulæ*. The contractile vesicle is spacious, and lodged in the posterior half of the body, which is S-shaped. In the figure they represent the nucleus as a morula-like structure. Engelmann[1] describes it thus: "It reaches a size of only 0.15 mm., posteriorly is bent towards the right not quite S-shaped, possesses at the posterior extremity some long bristles and at the centre of the body a usually curved reniform nucleus. *Metopus* possesses an adoral row of cilia of short bristles, which are however in a strange manner fastened not on the upper but on the lower side of the long peristome field. The upper border of the peristome bears the usual cilia, as well as the whole anterior half of the body." Engelmann's form accordingly differs from that of Claparède and Lachmann in the possession of terminal setæ, which are neither mentioned by the latter authors in the text, nor represented in their figure; also in the absence of the highly refractive bodies, and in the shape and appearance of the nucleus. Stein, again, describes this same form as occurring in three distinct shapes—the normal, described above, the shortened, and the rolled up; and also describes a bunch of terminal setæ and a terminal anus. He criticises Claparède and Lachmann's figure somewhat harshly, pointing out the non-pourtrayal of the proper curvature of the posterior portion of the body, and the incorrectness of the structure of the peristome and the nucleus, and the absence of the terminal bristles. He evidently does not recognize the possibility of the form observed by the Swiss authors being different from that he describes.

The form I observed differs from these descriptions in many respects, and the various differences may be discussed serially.

(1) The twisting does not appear to be as extensive as described for *M. sigmoides*. On examining the figures of C. and L. it appears that the plane of the anterior half of the body is parallel with that

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[1] Zeit. für Wiss. Zool. XI. 1861.

of the posterior half; whereas in my form they are almost at right angles, and are more like Engelmann's description, "not quite S-shaped."

(2) The situation of the anal aperture.

(3) The presence of two contractile vesicles.

(4) The presence of terminal setae distinguish it from C. and L's form, but in this particular it resembles those of Engelmann and Stein.

(5) The granules of the external portion of the protoplasm are arranged in rows so as to give the borders of the body a striated appearance, one stria apparently corresponding with each cilium. This appearance is particularly noticeable, and is not represented in any of the descriptions above referred to, and it may certainly be concluded that it was not present.

(6) The nucleus (n) is situated near the pharynx, and is ovoidal, with an endoplastule. In this it resembles Stein, but differs from the other observers.

(7) The peristome field does not bend round the body as represented by Stein and C. and L., but merely runs obliquely downward, being expanded at the top. This is dependent on the lesser extent of the twisting in my form.

As regards the size of my form, it ranges from 0.17–0.19 mm., while Engelmann's measured 0.15 mm., and, according to Kent, Stein's (?) measures $\frac{1}{300}$ $\frac{1}{80}$ of an inch, equivalent to 0.08–0.3 mm., a sufficiently large range to include almost anything, but which may be explained by the existence, according to Stein, of three distinct forms. Of the pharyngeal cilia, I can say nothing, not having sufficiently studied them.

Taking into consideration these various points, I think the form under observation was sufficiently characterized to be denoted a new species, but so much variation occurs in the descriptions of *M. sigmoides*, as given by different observers, that I do not feel justified in giving my form a name, until by renewed research I have fully satisfied myself of its specific distinctness.

SCYPHIDIA INCLINANS, D'UDK.

The genus *Scyphidia* belongs to the solitary, sessile *Vorticellidæ*, and attaches itself to foreign objects by means of an acetabuliform organ. Considerable doubt prevails as to the true position of many forms described as belonging to the genus. It was originated by Dujardin for the reception of *S. rugosa*, and Perty described another form as *S. patula*. Lachmann,[1] however, disputes both these identifications, regarding the forms as being merely recently attached immature *Vorticellæ*, and admits to the genus only two forms discovered by himself, viz.: *S. limacina* attached to small *Planorbis*, and *S. physarum* attached to *Physa fontinalis*. Kent, in his Manual of Infusoria, refers two other forms to this genus. Fromentel described a form as *S. rugosa*, from which, however, it differed in possessing three contractile vesicles, and a very short footstalk; this Kent terms *S. Fromentelli*. D' Udekem's *Gerda inclinans* he also places in this genus, the discoverer being somewhat undecided where it belonged, having described it as belonging to the closely allied genus *Gerda*, while expressing a doubt whether it might not be referred to Dujardin's *Scyphidia*, or to an immature form of his own *Epistylis tubificis*. The form I had under observation (Pl. Fig. 2.) presented a very close resemblance to this, differing, however, in some points from Kent's description. Unfortunately, I only met with a single example. This measured 0.075 mm., and was over three times as long as broad. The adherent disc I was unable to see, as the extremity of the foot was constantly concealed among confervæ. It tapers considerably posteriorly, and the body presents a fine transverse striation. The ciliary disc is elevated somewhat above the peristome, is inserted somewhat obliquely, and is capable of retraction. The mouth occupies the other half of the peristome, which is furnished with a few bristle-like cilia. The ciliated pharynx leads down from the mouth towards the centre of the body. Immediately beneath the edge of the peristome and below the ciliary dise is the single contractile vesicle (*c. v.*), while below it was a granular ovoid body (*n.*), corresponding with which was a similar structure on the other side of the pharynx. I was not able to distinguish any connection between these two bodies, but imagine them to be portions of the nucleus. According to Kent's description, D' Udekem's form differs from mine in the comparative length and breadth, in the smoothness of the cuticle, and in the snout-like projection of the anterior margin when contracted. He also describes the animalcule as being bent to one side when in the contracted state, and trans-

[1] Ueber der Organisation der Infusiorien, insbesondere der Vorticellinen Muller's Archiv. 1856.

versely wrinkled on the concave border. These points, however, do not appear to be of sufficient moment to authorize the establishment of a new species.

A peculiar feature in the ingestion of food was noticeable, which I have observed in no other form. Below the termination of the pharynx was a clear spot (*v*), which appeared to be ciliated on first looking at it, but the ciliation on further examination was seen to belong to certain structures contained therein. On watching it, it was seen to detach itself after a time from the pharynx and pass down the left side of the body close underneath the cuticle, the cilia continuing to work until it reached that point where the body commences to taper off into the foot, where it stopped and gradually disappeared. In the meantime a new spot has appeared at the termination of the pharynx, and it in its turn passes through the same changes. I believe the explanation of this phenomenon is to be found in the manner of feeding. The clear spot is merely an enormous food vacuole, the animal not absorbing its food into the protoplasm of the body, until a considerable quantity of it has been collected, and the apparent ciliation of the vacuole, as stated above, is due to the presence of ciliated forms in its interior. The appearance and disappearance of the vacuole is apparently rhythmical, but this was due to the animalcule being in a situation to obtain a large and constant supply of nutrition, but even then the intervals between the swallowing of the vacuoles varied considerably.

Cyclidium glaucoma, Eherh and margaritaceum.

These two forms occurred in considerable abundance, particularly the former, which, however, seemed to be rather susceptible to cold, while the latter was not affected. *C. glaucoma* (fig. 3) measures about 0.019 mm., and is covered throughout with bristle-like cilia, which, however, are capable of very powerful action. At the posterior extremity of the body (and not the anterior as has been stated) is the contractile vesicle (*c. v.*), and behind it an extremely long seta. The mouth is situated on the under surface of the body, and is provided with an exceedingly large hood-shaped retractile structure (*h*). These forms collect in large numbers wherever the light shines most strongly. Their motion is exceedingly rapid and jerky; usually remaining at rest, when disturbed one after the other will give a quick sudden jump, settling to repose again almost immediately.

C. margaritaceum (fig. 4) differs from the preceding in many respects. It presents the same hood-shaped structure *(h)* at the mouth, which is in the same position, but the hood is not nearly as large as that of *C. glaucoma*. It is somewhat large, measuring 0.024 mm., presents a somewhat pearly appearance, and is covered with minute tubercles. The arrangement of the cilia is also very different, the anterior three-fourths being covered with ordinary small cilia, while at the posterior extremity are a few setae. It is constantly in motion, seldom resting, and never moving in the quick jerky manner characteristic of the other form.

The two following forms I observed in water from the University creek, Toronto, which had been allowed to stand for some time, and was almost destitute of green matter.

VORTICELLA MICROSTOMA, EHERH.

The striations in this form (fig. 5) are not easily seen, but may be observed most readily under oblique illumination. My object in mentioning it is to confirm, or rather partially confirm, a phenomenon observed by Kent. While watching one of these animalcules, I observed it suddenly leave the stalk, which immediately contracted, and swim away by means of the cilia of the disc, not developing a posterior circle as is usual in such cases. The consequences of this action I was unable to follow, as by the next morning the animal was dead. Kent, however, has been able to follow it farther, and states that it encysts, the cyst having a characteristic appearance.

EUGLENA ACUS, EHERH.

This form (fig. 6) occurred in considerable abundance. It was 0.126 mm. in length, and is mentioned on account of the entire absence of the green colouring matter which usually characterizes all members of this genus. The red eye-spot *(e)* was however plainly visible. This was probably owing to their not being able to procure their accustomed food. Kent, in 1880, received specimens from near Birmingham, averaging 0.169 mm. in length, which presented the same peculiarity, which he attributes to the above mentioned cause. His forms were all exceedingly attenuate and stiff in their motions. Certain of the forms I observed were capable of considerable movement, bending the body into a circle, or even twisting it to form a spiral, but still the movements were stiff and ungraceful.

The so-called amylaceous corpuscles, *(c)* on account of the absence of pigment, were remarkably distinct and almost filled the body. They were much elongated. Dujardin imagined these structures to be carbonate of lime, but the occurrence of no effervescence on the addition of strong sulphuric acid at once disproves that supposition. As regards their amylaceous nature, some doubt exists in my mind. The constant association of starch with chlorophyll in the vegetable kingdom, and the similarity between the green colouring of *Euglena* and that of plants, has no doubt to a certain extent led to the supposition. But, as far as I know, no direct experiments as to the decomposition of carbonic acid gas by *Euglena* have proved the colouring matter to be chlorophyll, and further, we have here an individual containing no green colouring matter, and yet possessing large numbers of the corpuscles. Iodine or Iodine and sulphuric acid stain amylaceous substances of a dark brownish-purple colour, and these bodies when subjected to both these substances presented no such reaction, a fact, which, of course, militates rather forcibly against the amylaceous theory.

Guelph, January 25th, 1883.

PLATE.

n. = nucleus. c. v. = contractile vesicle. v. = food vacuole. ph. = pharynx. h. = hood. a. = anal aperture.

Fig. 1.—Metopus n. s. a. c. v. = anterior contractile vesicle. p. c. v. = posterior contractile vesicle. Zeiss obj. D., oc. 4.

Fig. 2.—Schyphidia inclinans, D' Udk. v^1 = food vacuole undergoing absorption. Zeiss obj. J., oc. 2.

Fig. 3.—Cyclidium glaucoma, Ehrh. Zeiss obj. J., oc. 2.

Fig. 4.—C. margaritaceum. Zeiss obj. J., oc. 2.

Fig. 5.—Vorticella microstoma, Ehrh. Hartnack obj. 9, oc. 2.

Fig. 6.—Euglena acus, Ehrh. C. amylaceous (?) corpuscles, e. = eye spot, *m.* = mouth. Hartnack obj. 9, oc. 2.

A TOPOGRAPHICAL ARGUMENT

IN FAVOUR OF

THE EARLY SETTLEMENT OF THE BRITISH ISLES BY CELTS, WHOSE LANGUAGE WAS GAELIC.

BY NEIL MACNISH, B.D.. LL.D.

I am of opinion that a topographical argument, so far as such an argument can be regarded as valid and satisfactory, can easily be framed out of the names of the rivers, and mountains, and valleys of England, Scotland and Ireland, in favour of the theory that the branch of the Celtic family whose representatives now are the Gaels of Scotland and Ireland was the first to enter the British Isles; and that those early Celts, after crossing into England from the Continent of Europe at what is now known as the Straits of Dover, extended northward and westward until they reached the extreme portions of Scotland and Ireland. In his edition of Pritchard's "*Eastern Origin of the Celtic Nations*," (p. 57), Latham thus expands the views which Adelung advanced in his "*Mithridates.*" "The Belgae, the author, *i. e.*, Adelung, makes Kelto-Germans; and connects them with the Cimbri, the doctrine running thus: That part of Northern Gaul which Cæsar gave to the Belgae, though orginally Keltic, came to be invaded by certain tribes from Germany. These styled themselves *Kimri*, or, as the Romans wrote the word, *Cimbri* . . . Belgae was the name by which the Gauls designated the Cimbri. Some time, perhaps not very long before the time of Cæsar, these Belgic-Cimbri, German in some points, Kelt in others, invaded Britain, *until then an Erse or Gaelic country*, and occupied certain portions thereof until, themselves invaded by the Romans, they retired to Wales and thence to Brittanny. If so, the whole of the British Isles was originally Gaelic. If so, the language of Southern and Central Gaul was more or less Gaelic also. If so, the so-called British branch of the Keltic stock had no existence as a separate substantive form of speech, being merely a mixture." According to the reasoning of Adelung, therefore, the earliest settlers of the British Isles were those Celts who spoke Gaelic and whose descendants are the Gaels of Scotland and Ireland; and the Cimbri, whose descendants the Welsh are, entered Britain at a later date.

Nicholas, in his preface to *The Pedigree of the English People*, (p. 7), thus writes respecting the argument which he pursues in his book: "It is first shown that the numerous tribes found by the Romans in possession of the British Isles were all presumably of what is called the Celtic race, and presented only such dissimilarities as would arise from separation into independent Clans or States. . . . Although among these numerous tribes, the Cymry may rightfully claim pre-eminence, as that branch of the family which both sustained the heaviest shock from the Teutonic invasion and tinged most deeply the new race with Celtic blood—the Gaels having from remote ages pushed their way northward and into Ireland—the term *ancient Britons* cannot be confined to them, but must be made to comprehend in short all the early Celtic inhabitants of Britain and Ireland."

It is important to notice that in the judgment of Nicholas, the Gaels pushed their way in the far-off past and before the arrival of the Cymry, northward and into Ireland: in other words, that the Gaels arrived before the Cymry in the British Isles, and that entering these Isles in the south of England, they gradually extended to Scotland and Ireland. According to Nicholas (p. 34), Meyer assigns two principal routes to the Celtic tribes in their westward progress from Asia: "One route he traces through Syria and Egypt, along the northern coast of Africa, across the Straits of Gibraltar, and through Spain to Gaul, where it separates into three branches, one terminating in the British Isles, the other in Italy, and the third near the Black Sea. The other great stream of migration ran less circuitously and more northwards through Scythia in Europe, the shores of the Black Sea, Scandinavia, or Jutland, Prussia, through Northern Germany, the plains of the Elbe, and to Britain across the German Ocean. It is conjectured that the stream which came by Africa and Spain was the earliest to reach Britain. They may have been the Gaels."

As to who the Cimbri were, and as to where their home on the Continent of Europe was, Nicholas thus writes (p. 31): "Local names in Jutland, and words in the vernacular of Schleswig and Holstein, are found to be Cymric. It is difficult to know why the Chersonese should be called Cimbrica at all, except for the reason that the Cimbri abode therein; and it is impossible to account for the belief of ancient historians that this peninsula was inhabited by Cimbri, unless such was the case. Equally difficult is it to account for the adoption of the name Cymry or Cymri by the people now represented by the inhabitants of Wales, unless we allow as the reason their relationship to the ancient Cimbri. The plain account of the name Cymro or Cymru is that it is a modification of Cimbri, just as Cimbri again, according to the testimony of Diodorus, is a slight modification of Cimmerii." Whatever other value the opinions which have been cited respecting the order in which the two divisions of the Celts entered the British Isles may have, a strong expectation will thus be formed that when the topography of these Isles has been closely examined, it will corroborate the theory that the Gaels came at an earlier time than the Cymri from Europe, and that those Celts who still speak the Gaelic language are the descendants or representatives of the earliest Celtic occupants of Great Britain and Ireland. Nor, so far as the value of such a topographical argument is concerned, is it material to determine the question, as to whether there were races in Britain before the Celts made their appearance, the desire being simply to ascertain what the Celtic names of streams, and rivers, and headlands, and mountains, and hillocks have to teach respecting the manner in which the Celts must have spread over the British Isles. In his *Celtic Scotland* (vol. 1, pp. 164, 226), Skene says: "Archæology enables us to trace the previous existence of a people of a different race, indications of which are to be found to a limited extent in the earlier notices of Britain and its topography. . . . The Celtic race in Britain and Ireland was preceded by a people of an Iberian type, small, dark-skinned and curly-headed." It will be generally admitted that the names of rivers, and lochs, and hillocks, and mountains, and headlands, and bays which are to be found in any country, furnish a very useful guide for determining who the earliest settlers of the country were, and who were the earliest races that had sufficient strength and importance, and continuance to leave indelible traces of their presence in the topography of the country. Such names as Ottawa, Ontario, Toronto, Niagara, Caughnawaga, Manitoba, &c., will always proclaim that the Indians were at least the earliest occupants of any permanence or strength in Canada, and that whatever alterations may occur in our population owing to the unrest of modern times, the very names of our lakes and rivers will continue to remind us of a time when the Indians had supreme, if not undisputed, sway in our Dominion.

It will frequently be found that the leading names of rivers and mountains are very expressive, enabling us to perceive how very observant those early and untutored tribes were, and how remarkable their success was in framing names whereby the characteristics of stream, and hill, and loch, and headland are pourtrayed with faithful accuracy.

In his article on Gaelic Language and Literature in the *Encyclopædia Britannica*, Dr. MacLauchlan remarks that "Topography is a remarkable source of evidence and one that will be made to serve purposes it has never served as yet." Skene asserts [1]that "the oldest names in a country are those which mark its salient physical features—large rivers and mountains—islands and promontories jutting out into the sea. The names of rivers and islands are usually root-words, and sometimes so archaic that it is difficult to affix a meaning to them. In countries where the Topography obviously belongs to the same language with that spoken by the people who still possess it, though perhaps in an older stage of the language, it presents little difficulty. It is only necessary to ascertain the correct orthography of the names and apply the key furnished by the language itself in that stage of its form to which the words belong. This is the case with the greater part of Ireland and with the Highlands of Scotland, where the local names obviously belong to the same Gaelic language which is still the vernacular speech of its population."

The conjecture is at least pardonable that in the earliest migration of the human race, when the knowledge and ingenuity of men were in the rudest form, and when in the tiny craft that then obtained, even adventuorous races would not care to face the storms of an open sea, the Celts who had their home in Gaul would naturally select the narrowest portion of the strait that divides England from Europe for the purpose of entering the British Isles. *Calais* is a faithful reproduction of *Caolas*—a Gaelic word which signifies

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[1] Celtic Scotland, vol I., pp. 212, 213.

a strait, and which in its simplest root *Caol* is of frequent occurrence in Scotland. In such words as Na *Caoil Bhoideach*, the *Kyles* or *Straits* of Bute; *Caol ant-snaimh Colintraive*; *Caol Mhuile*, the *Sound* of Mull; *Caol Ile*, the *Sound* of Islay; *Caol Dhiura*, the *Sound* of Jura, the first syllable *Caol* of *Calais* occurs. In *Baile-Chaolais*, *Ballachulish*, at the mouth of Glencoe in the north of Argyleshire, there is an exact reproduction of *Calais* or *Caolas*. *Baile-Chaolais*, which may be regarded as the Shibboleth of English tourists, means "*the village or hamlet of the strait.*" It is remarkable that there should be so striking a correspondence between the word *Calais* and many words in Scotland which signify *strait* or narrow arm of the sea. In *Colne*, the name of a river in Essex and of another river in Gloucester, compounded as it is of *Caol* and *Amhainn*, *an*, a river, and signifying, therefore, the *narrow* river, we have another example not far from *Calais* itself, of the root which enters into it. There is nothing unreasonable in the conjecture, that the Celts who gave its name to *Calais* and their names to the *Kyles* of Bute, and to many of the straits of Scotland, spoke the same language and were one and the same people.

Dobhar is an old Gaelic word which signifies *water* or the *border of a country*: it has the same meaning in Irish Gaelic. *Dobhar* is found in Scotland in such words as *Aberarder*, the ancient spelling of which was Aberardour, i.e. the *confluence of the water of the height*. Dobhar is also present in the word *Aberdour*, the ancient spelling of which was *Aberdovair*, i.e. the confluence of the water or stream: it is also present in *Aberchirder*, *Aber chiar dur*, the confluence of dark-brown water; and in Calder, which was formerly spelled *Kaledover* and *Kaledour*, i.e. *Coille dur*, the wooded stream. It is quite evident that the word *Dobhar* is of common occurrence in the Topography of Scotland. If we choose to assign to it the interpretation of *the border of a country*, we can discern a fitness in such a designation so far as the Celts of Gaul were concerned, Dover being to them the nearest portion of Britain. In any case, the words *Calais* and *Dover* are purely Gaelic, and have many kindred names in the topography of Scotland. *Cam*, the classical stream of Cambridge, is the Gaelic *Cam*, *crooked*. *Isis*, the classical stream of Oxford, is likewise a Gaelic word. In his *Words and Places*, Taylor maintains that *Isis* is a reduplicated form of *is*, one of the contractions which the Gaelic word *uisge* assumes. "The Isis," he says, "contains the root in a reduplicated form, and the *Thamesis* or Thames is the *broad Isis*." Whether the interpretation which Taylor gives of *Isis* be correct or not, or whether we may find in that word the root *eas a cascade*, *an eas*, or a *sios* downwards, there can be little doubt that Isis is a Gaelic word. It is better to regard *Tamh*, the first syllable in *Tamesis*, as meaning *quiet* or *silent*, or as the root *Tabh*, *water*, which occurs in Tay and Tagus.

The rivers Anne, in Devonshire, and Ehen, in Cumberland, come from *amhainn*, the Gaelic word for *river*. Esk, in Yorkshire, and Eskle, in Hereford, faithfully reproduce *uisge*, the Gaelic word for *water*. Devon is a contraction of *da*, two, and *amhainn*, *an*, *river*, and therefore means *two rivers*. The *Exe* in Devonshire, the *Ouse* in Yorkshire, the *Ouse* in Norfolk, and the *Axe* in Somersetshire, are derived from the same root *uisge*, water. Leven, in Yorkshire, is compounded of *liath*, hoary or grey, and *amhainn* or *an*, a river, and means the *grey* river. Don, in the same county, is a compound of *dubb*, black, and *an*, i.e., the black river, or it may simply be from *domhainn*, *deep*. Don is the name of a river in Aberdeenshire, and Doon, in Ayrshire, is the same as Don. Dee, in Cheshire, is compounded of *da*, two, and *abh*, water, *Daabh*, *Deva*, *Dee*, and means *the two waters*. Aire, in Yorkshire, the river on which Leeds is situated, is compounded of *a*, water, and *reidh*, smooth, i.e., the smooth water. It is the same as the river Ayr in Ayrshire, the river Aray in Argyleshire, and the river Arra in Tipperary.

Tyne, in Northumberland, and also in Haddington, is from *teth*, warm, and *an*, a river, the warm river.

Aldie, in Suffolk, is from *allt*, a stream, and *dubh*, black or dark, the black stream.

Lee, in Cheshire, is from *liath*, hoary.

Leen, in Nottingham, is from *liath*, hoary, and *an*, the hoary river.

Stour is the name of six different rivers, and comes from *sturr*, rough, uneven.

Cover, in Yorkshire, is the Gaelic word *cobhair*, froth, and means the frothy river.

Avon, which is the Gaelic word *amhainn*, occurs in many parts of England.

Severn is from *seimh*, smooth or calm, and *burn*, water.

The names of English streams and rivers which have now been adduced, may suffice to show, because they are undoubtedly Gaelic words, that tribes or people who spoke Gaelic must have preceded the Cymri or Welsh in England; and that one and the same people gave, in the *unrecorded* beginnings of human settlement in Britain, names to the rivers and streams of England and Scotland. Alterations in the topographical names of England must have been made to a much larger extent than in Scotland or Ireland, in consequence of the successive and powerful waves of invasion that swept over it from the time of the Romans until the Norman conquest.

The Gaelic word *Dun* (*hillock* or *fort*), which is of very common occurrence in Scotland, still survives in many parts of England. In Doncaster, with its Latin termination; in London, whose second syllable is supposed to be *dun*, the hill or fort on which St. Paul's Cathedral now stands; in Dunstable, Dunmore and Dundry in Somerset, the word *dun* is to be found. *Linn* the Gaelic word for *pool* occurs in Lincoln and in Linn, as it does in Loch Linne, in Argyllshire, in Dublin and Roslin. *Beinn* (ben), the well-known Gaelic word for a hill, may be discovered in P·nard or Beinnard, *high hill*, in Somerset, (the letters *b* and *p* being convertible), and in Penn in Buckinghamshire. *Ceann*, the Gaelic word for *head*, which occurs frequently in the Topography of Scotland and Ireland, appears in England in Kenne, in Somerset; in Kennedon, (i.e., *ceann an duin*, the head of the hillock), in Devonshire; Kenton, (*ceann duin*, head of the hillock), in Middlesex; Kencet, in Oxfordshire, and Kencomb (*ceann cam*, the crooked head), in Dorsetshire. There is a striking similarity between Cheviot (in Cheviot Hills) and *tinghad*, the Gaelic word for *thickness*. With regard to England, Taylor remarks that "over the whole land almost every river-name is Celtic: most of the shire names contain Celtic roots, and a fair sprinkling of names of hills, and valleys, and fortresses bear witness that the Celts were the aboriginal possessors of the soil."

When we turn our attention to Scotland, we find that over the entire extent of that country,—in the names of mountain and glen, of strath and corry, of pass and headland, of stream, and loch, and river, in sequestered islands, as well as in the heart of large cities and centres of population and industry, words of the purest Gaelic are to be found,—words which serve to connect the present time with the far-off centuries, and to testify that in the Gaelic as the Scottish Highlanders have it and speak it, there is perpetuated the language of those early Gaels, who, before they could leave an indelible record behind them in the names of streams, and hills, and valleys, must of necessity have held for a long time undisputed possession of the country.

It is noteworthy that, though for more than 1,300 years Gaelic has not been spoken in the South of Scotland, Gaelic words continually occur in the Topography of that part of the Kingdom. A brief reference must here be made to a theory which has as its advocates such scholars as Chalmers in his *Caledonia*, Dr. MacLauchlan and Taylor—the theory that at one time the Cymri occupied the region which was known as Strathclyde; and that the topographical names of that portion of Scotland are Cymric and not Gaelic. Taylor, in his *Words and Places*, thus writes (pp. 257, 258, 259): "The Cymry held the Lowlands of Scotland as far as the Perthshire hills. The names in the valleys of the Clyde and the Forth are Cymric not Gaelic. . . . To establish the point that the Picts, or the nation whatever was its name, that held central Scotland was Cymric not Gaelic, we may refer to the distinction between *ben* and *pen*. *Ben* is confined to the west and north, and *pen* to the east and south. *Inver* and *Aber* are also useful text-words in discriminating between the two branches of the Celts. The difference between the two words is dialectic only, the etymology and the meaning are the same—a confluence of waters either of two rivers, or of a river with the sea. . . . In Scotland the *invers* and *abers* are distributed in a curious and instructive manner. If we draw a line across the map from a point a little south of Inverary to one a little north of Aberdeen, we shall find that (with very few exceptions) the *invers* lie to the north of the line, and the *abers* to the south of it. This line nearly coincides with the present southern limit of the Gaelic tongue, and probably also with the ancient division between the Picts and Scots. The evidence of these names makes it impossible to deny that the Celts of the Scottish Lowlands must have belonged to the Cymric branch of the Celtic stock." By way of refuting the theory which Taylor has thus expounded, in reference to the prevalence of Cymric and not of Gaelic names in the region which was known as Strathclyde, it will be sufficient for my present purpose to cite the conclusions at which Robertson and Skene have arrived after able and mature consideration of the theory in question.

In his *Historical Proofs of the Highlanders*, Robertson thus writes: "The great number of genuine Gaelic names of places that exist in parts which we know were inhabited in the south-west of Scotland by Britons, undoubtedly prove that the Gael had there preceded them, and even lead to the conclusion that the British or Welsh occupation had only begun therein with the invasion of the Romans and under their protection." In his valuable and ingenious work on the Gaelic Topography of Scotland, the same author, after an exhaustive examination of the theory in question, in the discussion of which his Celtic temperament sometimes assumes unnecessary warmth, concludes (p. 99): "that instead of *aber* being, as Dr. MacLauchlan contends, in Scottish topography always joined to pure Welsh words, the truth is that in all Scotland there is not a single *aber* which has Welsh words joined to it. As to Dr. MacLauchlan's second statement that *aber* is never associated with a a Gaelic word, the truth is that in the whole of Scotland every instance where words are joined to *aber* they are Gaelic. The *abers* are as invariably joined to Gaelic words as are the *invers*; and both *aber* and *inver* were used to signify a confluence by the Gaelic-speaking race who originally gave all the Gaelic designations in Scotland, namely, the Caledonian Gael." Skene (*Celtic Scotland*, vol. I., p. 221), effectually disposes of Taylor's theory so far as the dividing line which the latter draws between the region of *invers* and *abers* is concerned. Skene thus writes: "This would be a plausible view, if true, but unfortunately there is no such line of demarcation between the two words. South of Mr. Taylor's line there are in Aberdeenshire 13 *abers* and 26 *invers*; in Forfarshire, 8 *abers* and 8 *invers*; in Perthshire, 9 *abers* and 8 *invers*; and in Fifeshire, 4 *abers* and 19 *invers*. . . . If these words afford a test between British and Gaedhelic, we might naturally expect to find as many *abers* in what was the Strathclyde kingdom as in Wales, but there are no *abers* in the counties of Selkirk, Peebles, Ayr, Renfrew, Lanark, Stirling and Dumbarton, 4 *abers* in Dumfriesshire, 6 in Lothian, and none in Galloway; and when we proceed further south, we find nothing but *abers* in Wales, and no appearance of them in Cornwall." There can be no doubt that the Topography of what was known as Strathclyde is Gaelic and not Cymric, and that Robertson and Skene have successfully refuted the theory of Dr. MacLauchlan and Mr. Taylor. And, even were it granted that Cymric names occur in the Topography of Strathclyde, it would still be true that the names of streams, and hills, and valleys in that part of Scotland are purely Gaelic.

Taylor correctly observes in his *Words and Places* (p. 203): "That the river-names, more especially the names of important rivers are everywhere the memorials of the very earliest races. These river-names survive where all other names have changed: they seem to possess an almost indestructible vitality." The names of the streams and rivers that occur in the southern counties of Scotland are so manifestly of Gaelic origin, that they refute the theory to which allusion has already been made, *e. g.*

In Wigtonshire are Tarff (*tarbh*, a bull), the wild river. Cree, *criadh*, clay, perhaps owing to the colour of the water.

In Ayrshire are the rivers Ayr, *a*, water, *reidh*, smooth. Doon = Don, *dubh an*, the black or dark river. Girvan, town and river, *garbh*, rough, *an*, river, *rough river*. Irvine, town and river, *Iar*, west, *an*, the west river.

In Kirkcubright are Dee = *da*, two, *abh*, water, double water. Ken, *ceann*, a head. Urr, *oir*, a margin, from the direction in which it flows.

In Dumfries (Dunphreas, *the fort of the copsewood*), Esk, *uisge*, water. Annan, *an*, quiet, and *an*, the quiet river.

In Lanarkshire, Avon, *amhainn*, river, which flows into the Clyde. Douglas, *dubh* and *glas*, grey, the black, grey stream. Kelvin, *coille an*, the wooded river. Clyde = Cliid = Cli, strong.

In Peebles, Esk, *uisge*, water. Lyne, *Linnhe*, pool, as in Dublin, Loch Linnhe. Leithen, *liath*, hoary, and *an*, the hoary river. Earn, *Ear*, east, and *an*, the east river.

In the counties of Roxborough and Selkirk are some of the rivers that have been celebrated by Sir Walter Scott, *e. g.*, Teviot *taobh*, a side, and *aite*, a place, from the course which the Teviot pursues. Ted, *teud*, a string, owing to the straight channel of the river. Gala, *geal*, white, and *a*, water, the white water. Tweed, *tuath*, north, and *aite*, a place, from the direction in which it flows. Yarrow, *garbh*, *gharbh*, rough. Enrich, *an*, river, *riabhach*, greyish, the greyish river.

Those rivers in Strathclyde, whose names have now been given, are purely Gaelic and not Cymric, and therefore invalidate the theory that the Topography of Strathclyde is Cymric.

In the Mull of Galloway, the word *mull* or *maol*, bald, is the same word that occurs in the Mull of Kintyre, and in Malin Head (Maolan), in the north of Ireland. Galloway is Galway in Ireland, and is a compound of *gall*, a stranger, *taobh* or *thaobh*, a side or direction. *Tairbeart*, the Gaelic word for Isthmus, which is of frequent occurrence in the Topography of Scotland, is found near the Mull of Galloway. There are in Wigtonshire such additional Gaelic names as *Glenluce, gleann au luis, the glen of the plant*: Drummore, *Druim mor*, the large ridge: Blairbowie, *blar buidhe*. the yellow plain: Loch Ryan, *reidh an*, the loch of the smooth river: *Machriemor*, the large field: Stranraer, *srath an rogha fheoir*, the Strath of the good pasture.

In Ayrshire are Ballantrae, *Baile 'n traighe* town or hamlet of the shore: *Maybole, magh*, a plain, *baile*, a town, the plain of the town: Mauchline, *magh linne*, the plain of the pool. *Magh* is a common word in the Topography of Ireland, *e.g.*, Armagh, Mayo, Omagh. In Ayrshire are also Dalry, *Dal-righ*, the field of the king: Dunlop, *Dun Luibe*, the foot of the corner or angle: Largs, *Learga*, a plain, and a word of constant occurrence in the phrase *Learga Ghallda*, the Lowland Largs.

In the Valley of the Clyde are Strathaven, *Straven*, the strath or valley of the river; and *Inbhiravon*, the confluence of the river. Melrose is compounded of *meall*, a heap, and *rois*, *ros* a promontory, the projecting hill. *Eildon* is *eile*, another, and *dun*, a fort, the other fort or hillock. *Linlithgow* is compounded of *linne liath, dhubh*, and accordingly means the grey-dark pool. The examples which have now been given from the Topography of Strathclyde may suffice to substantiate the conclusion, that the Gaels gave names to the rivers and prominent places of that region before the Cumbrians obtained possession of it.

From that portion of Scotland which has always been inhabited by Gaels, it will be well to take a few topographical names merely, if for no other purpose than to show how strong and unmistakable the correspondence is between the names of the rivers and streams of England and of Ireland (as will subsequently be seen), and between those names which are acknowledged alike by friendly and unfriendly critics to be purely Gaelic.

Achadh, the Gaelic word for *field*, is of frequent occurrence in the

Topography of Scotland. Achadhmore, the large field. Achray, *achadh reidh*, the smooth field.

Dal, another name for *field*, occurs in such words as Dalmore, the large dale: Dalness, *dal an eis*, the dale of the cascade; Dalhousie, *dal na h-oisne*, the dale of the corner.

Aber, a word of which mention has been made at some length already, compounded as it seems to be of *ath*, ford, and *bior*, water, water-ford, is frequently found in the Topography of Scotland, *e. g.*

Aberdour, *aber dur*, water: the confluence of the water.

Aberlour, *aber*, *luath*, fast; *dur* = the confluence of the rapid water.

Loch Aber = the loch of the confluence.

Aberfeldy, *aber feathail*, calm: the calm confluence.

Ard means a height, *e.g.*

Airdrie, *ard an righ*, the king's height.

Ardentinnie, *ard na teine*, the height of the fire.

Ardrossan, *ard ros fhonn* = the land of the high promontory.

Ardthornish, *ard thor an eis*, the high cliff of the cascade.

No word is of more frequent occurrence in Gaelic Topography than *amhainn*, Avon, which is supposed to be a compound of *abh*, water, and *-inne*, a channel. In addition to the names of rivers which have been already mentioned in connection with the Topography of Strathclyde such names may be cited as :—

Ness, *an eas*: the water or cascade.

Carron, *car amhainn*: the crooked river.

Nairn, *an ear an*: the east river.

Orchy, *oir*, edge, and *achadh*: the edge of the field.

Leven, *liath an*: the hoary river.

Cona, *cumhann, a*: the narrow water.

Bannockburn, *ban cnoc burn*: the water of the white hill.

Baile, a farm, or town, or hamlet, occurs often, *e.g.*

Balmoral, *baile morail*: the stately town.

Balfour, *baile fuar*: the cold town.

Beinn, *ben*, is everywhere to be found in the Topography of Scotland, *e.g.*

Ben Wyvis, *Beinn an uamhais*, the hill of terror.

Ben Nevis, *nimh bhathais*, the hill of the cold brow.

Ben Cruachan, *cruachan*, a hip, the cone-shaped hill.

Ben Mac Dui, *muc dubh*, the hill of the black pig.

Cairngorm, the blue cairn or mound.

Bennan, *Beinn an*, the mountain of the river.

Benvenue, *mheadhonaidh*, the middle mountain.

Benledi, *Beinn le Dia*, the hill of God.

Dun (Dun), a hillock, is an appellative which is present in very many names, *e.g.*

Duneidinn, *dun eidinn*, the hillock of Edwin.

Dundee, *dun dhia*, the hillock of God.

Dunbarr, *barr*, a point, the fort of the point.

Words into which *gleann*, a glen, enters, are very numerous, *e. g.*

Glencoe, *gleann cumhainn a*, the glen of the narrow water.

Glenbervie, *barr bhuidhe*, the glen of the yellow top.

Glengarry, *gath ruith* or *garbh ruith*, the glen of the straight or rough running [stream].

Coille is found in the first syllable of many words, *e. g.*

Kildarroch, *Coille daraich*, the wood of the oak.

Callander, *Coille an darach*, the wood of the oak.

Kill, a cell or Church or burial ground, enters largely into the names of Churches which had graveyards attached to them, *e. g.*

Kilcherran, *kill Ciaran*, the Church of Saint Ciaran.

Killean, *kill, Illeathain*, the Church of the servant of St. John.

Kilmory, *Muire*, the Church of Mary.

Inver, a confluence is supposed to be compounded of *Inne*, a channel, and *bior*, water. The examples of it are numerous in the Topography of Scotland, *e. g.*

Inverary, *inbhir a reidh*, the confluence of the smooth water.

Inversnaid, *snathad*, a needle, the confluence of the needle.

Inveresk, *esk*, *uisge*, water, the confluence of the water.

Inverleith, *liath*, hoary, the hoary confluence.

Loch is the Gaelic word for lake or lakelet, *e. g.*

Loch Aline, *aluinn*, splendid, the splendid loch.

Loch Carron, *car amhainn*, the loch of the crooked river.

Lochee, *I* an island, the loch of the island.

Lochness, *an eis*, the loch of the cascade.

Lochnell, *nan eala*, the loch of the swans.

Loch Laggan, *laggan*, a hollow, the loch of the hollow.

Locheil, *eile*, another, the other loch.

Srath—Strath embraces a wider extent of land than gleann words into which it enters as a component part are of frequen occurrence, *e. g.*

Strathaird, *aird*, high : the high strath.

Strathglass, *glass*, grey : the grey strath.

Strathearn, *iar an* : the strath of the western river.

Tigh, a *house*, is present in such words as Tyndrum, *tigh an druim* : the house of the ridge.

Tom, *knoll*, forms the first syllable in such words as Tomban, the white knoll; Tombreck, the spotted knoll.

Torr, a *heap*, appears in such words as Toraven, *torr amhainn*, the heap of the river; Torantuirc, *torr an tuirc*, the heap of the boar; Torness, *torr an eis*, the heap of the casade.

Tulach, a *hill* or *knoll*, forms the first syllable of such words as Tullochgorum, the blue hillock; Tillycoultry, *tulach cul tir*, the hillock of the back of the land.

It is instructive to observe how in the names of the hills and valleys, of the lochs and rivers, of the prominent headlands and picturesque cascades of Scotland, the Gaelic of our time is undoubtedly to be recognized; and how the strongest link is thus established between the Scottish Gael of the nineteenth century and the Gael of it may be several centuries before the Christian era.

The eary Irish annalists gave unbridled reins to a vigorous imagination for the purpose of tracing the first settlers of Ireland from a very remote antiquity. Dr. Sullivan, in an article on Celtic Literature in the *Encyclopædia Britannica*, thus remarks: "In any case, the time has scarcely come for dissecting and analysing the curious tissues of legends . . . which constitute the mythical parts of Irish history. As in the case of other nations of middle and north Europe, the true chronological history began in Ireland either by contact with the Romans, or with the introduction of Christianity; and like the mediæval chronicles the genealogists tacked on the pedigree of Irish kins and chieftains to those of Genesis."

The Topography of Ireland furnishes the most satisfactory evidence of purely Gaelic origin, and indicates that those who gave its names to the Topography of Ireland spoke the identical language which is now spoken in the Highlands of Scotland and in many parts of Ireland itself. The Scots, who gave the name to Scotland which it now has, came originally from Ireland. It is maintained that the word *Scot* is the Gaelic *Scuit*, a *wanderer*, and that from *Scuit* the Romans took the designation *Scoti*. Robertson remarks that Ammianus Marcellinus is the first writer that mentions the Scots, and that he calls them *Scoti vagantes*, i. e., the wandering Scots, proving thus that they could not be natives. Bede calls these marauders *Hiberni*, i. e., Irish, and Gildas says that "the Hibernian robbers return home." As it was only in the beginning of the sixth century that the Scots came to have any permanent home in Albin, it is evident enough that they came too late to have any material influence on the Topography of that country. In his introduction to the Dean of Lismore's book, p. 28, Skene thus effectually disposes of the allegation of Irish historians that the language of the *Scoti* or of Gaelic Dalriada had subsequently to the ninth century spread, with the rule of a Scottish king, over the whole of the Highlands not embraced in that limited territory: "They (the Irish historians) have never attempted to account for the entire disappearance of the previous language, and the expulsion of the previous population of so extensive a district, so mountainous and inaccessible in its character, and so tenacious of the language of its early inhabitants in its Topography, which such a theory involves."

Were it true that the *Scoti*, who eventually succeeded in giving their name to the country which was formerly known as Albin, displaced the Celtic tribes of that country, it is very strange that no word representing *Scoti* has hitherto found its way into the Gaelic language, and that to this day Scottish Celts are wont to say regarding themselves, *Is Albannaich mise*: I am a native of Albin; *Is Albannaich sinne*: We are natives of Albin. Even respecting those inhabitants of Scotland whose blood is not Celtic and whose language is not Gaelic, the Scottish Gael always says, *Is Albannaich iad*: They are natives of Albin. A refutation of the opinion that the Scoti subdued or exterminated the Gaels who occupied Scotland before their time, may surely be found in the entire absence from the Gaelic language of any word representing Scotland.

In turning attention to the Topography of Ireland, I shall, deferring to the extraordinary and sensible importance which Taylor assigns to the names of streams and rivers, first consider the names of the Irish streams and rivers that it may be seen how purely Gaelic they are.

In Antrim are the rivers Bann, a bend or hinge; Bush, *buas*, abounding in cattle; Braid, *braghad*, neck; Main, *min*, soft, gentle; and Don, *dubh-an*, the dark river.

In Londonderry are Roe, *ruadh*, red; Foyle, Feabhal, *fual*, water; Cas, rapid; Esk, *uisge*, water,—the name of a river that occurs in England and Scotland.

In Donegal are the rivers Finn, pale, white; Suilly, *suileach*, sparkling, or *saileach*, willowy.

In Tyrone are Derg, *dearg*, red; Mourne, *muirn*, delight.

In Fermanagh are Erne, *iar an*, the west river; Arney, *iar an*, diminutive west river.

In Sligo, Gara, *garbh*, rough; Easkey, *uisge*, water; Avengorm, the blue river.

In Mayo are Bangor, *beann char*, mountain-winding; Adar, *ath*, a ford, and *dara*, an oak, oak ford.

In Galway, Suck, suction, drawing, and Clare, flat or even, *clar*.

In Clare, Fergus, *fear*, person, one, *gus*, face; Dombeg, *dom*, a house or town, bush, and *beg*, small; Shannon, *sean*, old, *amhainn*, the old river.

In Limerick, Maig, pride or proud gait; Deel, *daol*, a leech; Starr, *storr*, rugged. The river Storr occurs several times in England.

In Kerry, Feale, *fual*, water; Flesh, *fleasc*, lawn or *fleasg*, moisture, *fliuch*; Lanne, *linnhe*, a pool; Roughty, *roichteadh*, a great cry, noise; Avenbui, the yellow river.

In Cork, Lee, *liath*, hoary, a word which occurs often in the river-names of England and Scotland; Bandon, *ban*, white, and *donn*, brown (perhaps); Islin, *is uisge*, water, and *linn*, pool, water-pool. In Waterford, *Suir*, water or river.

In Wexford, Barrow, *bearbha*, still water; Slanley, *slan*, sound, entire; Bann, a bend or hinge.

In Tipperary, Arra, *a*, water, and *reidh*, smooth, the smooth water. Arra is identical with Aire in Yorkshire, with Aray in Argylshire, and Ayr in Ayrshire; Tar, *across* or *tara*, quick; Nier, *an iar*, west.

In Kilkenny, Nore, *an fheoir*, the grass.

In Wicklow, Avenmore, the large river.

In Dublin, Liffey, *liath*, hoary, and *buidhe*, *bhuidhe*, yellow, the hoary yellow river; Dour, *dobhair*, water; the Dover of England, and Dour in Aberdour, and Calder, &c., in Scotland.

In Meath, Aney, *amhainn an*, diminutive of rivers; Boyne, *boinne*, drop or water.

In Louth, Dee, *da abh*, double water. Dee is the name of a river in Cheshire and of several rivers in Scotland.

In Cavan, Annalee, *an liath*, the hoary river.

In Down, Bann, a bend or hinge; Lagan, a hollow.

In Longford, Camlin, *cam*, crooked—the Cam of Cambridge—and *linn*, a pool.

The streams and rivers of Ireland perpetuate purely Gaelic names, names which occur in the Topography of England and Scotland, and which tell that the same people in ages, however remote, gave names to the streams and rivers of the British Isles.

The names of the Irish lochs are generally traceable to Gaelic.

In Fermanagh are Loch Erne, *iar an*, the loch of the west river; Melvin, *meall*, a mass or heap, and *min*, soft, *meall, mhin*; Gill, the *Loch Goil* of Scotland, from *goil* to boil.

In Mayo are Loch Conn, Loch Cuan, the loch of the ocean; Mask, *measca*, mixture or confounding; Loughrea, *riach, riabhach*, grayish loch.

In Clare, Loch Roe, *ruadh*, the reddish loch; Loch Derg, *red*, the red loch; Loch Doo, *dubh*, the black loch.

In Kerry, Loch Allua, *allaidh*, savage or wild loch.

In Cavan, Loch Ouchter, *uachdar*, upper, the upper loch; Loch Sheelin, *sith pass, linn*, pool or water; Loch Neagh, *loch n' eathach;* Loch Gur, *gair, gearr*, short; Loch Foyle, *feabhail, fuail*, water; Loch Suilly, *suileach* or *saileach*.

The names of the islands that lie along the Irish coast are also Gaelic, *e.g.:*

Rathlinn, rath, defence or way, and *linn*, pool.

Innistrahull, innis tri chaoil, the island of the three straits. The last syllable, *caol*, is the first syllable in Calais, and is identical with Caol in the Kyles of Bute, and in Caol Isle, &c.

Torry Island, on the western coast, from *torr*, a heap.

Inishbofin, *innis bofin*, cow white as milk: island of the milk or white cow.

Inishfree, *freadh*, plundering: the island of plundering.

North Inniskea, *sgiath*, a wing; Skye in Scotland: the island of the wing.

South Inniskea: island of the wing.

Innisturk, *torc*, a boar: the island of the boar.

Innishorc, *thorc* of boars; Orkney in Scotland—*Thorc innis* is the equivalent of *innis horc.*

The names of almost all the counties of Ireland are purely Gaelic, *e.g.*:

Antrim, *an druim*: the ridge.

Londonderry, *doire*: a thicket.

Tyrone, *tir Eoghain*: Owen's land.

Donegal, *dun nan gall*: the hillock or fort of the strangers.

Fermanagh, *fear manach, monk*, or *fear magh*: the grassy plain.

Leitrim, *liath dhruim*: the hoary ridge.

Sligo, *sligeach, shelly*: *slige*, a shell.

Roscommon, *ros*, a promontory.

Mayo, *magh*, a plain, and *o*, yew or beautiful.

Galway, *gaillimh* = *Gallthaobh*: the border of strangers.

Clare, even, flat.

Limerick, *luimneach.*

Kerry, *cearraidhe, ciar*, dusky.

Corc, *corcach*, moor, marsh.

Tipperary, *tobair, tiobraid*, or *tiprad*, well or fountain, and *ara*, the well or fountain of the river Ara.

Dublin, *dubh*, black, and *linne*, pool: the Linne of Loch Linne and Roslin in Scotland, and meaning the black pool.

Kildare, *coill*, a wood, and *dara*, oak: the oak forest.

Meath, *midhe*, the neck.

Monaghan, *mineachan.*

Waterford: its Gaelic name was *ath lairge, ath leargu*, the ford of the plain.

Armagh, *ard-magh*, the high plain or macha.

Down, *dun*: the hillock.

Cavan, *cabhan*: a hollow plain, a field.

The word *cluain, cluan, cluaine* is often found among the topographical names of Scotland: it means *lawn* or *pasture.* The word *Clune* occurs in Banff, Inverness, Perth, Ayr and Renfrew. *Clune mor* and *clune beg* are in Atholl. *Clunie* and *Cluny* appear in Perthshire, Fife and Banff. *Cluny* in Invernesshire is the name of the home and title of the chief of the Clan MacPherson. The same word, *cluain*, occurs with exactly the same meaning in the Topography of Ireland, *e. g.*

Cloyne, *cluain uamha*, the lawn of the cave.

Clonsost, *sosta*, abode, the lawn of the abode.

Clonfert, *feart*, a feat or action, the lawn of the action.

Clonard, the high lawn.

Clonakilty, *na coille*, the lawn of the wood.

Clontarf, *tarbh*, a bull, the bull's lawn or pasture.

Clonegal, *cluain nan gall*, the lawn of the strangers.

Clones, *cluain eois*.

Clonmel, *cluain meal a*, the pleasant or honey lawn.

Magh, a *plain*, (Anglicised *moy*) enters largely into the Topography of Scotland, *e. g.*

Megginch, *magh innis*, the plain of the pasture.

Mauchline, *magh linn*, the plain of the pool.

Machray, *reidh*, the smooth plain.

Methnen, *fionn*, white, the white plain.

Moidart, *ard*, high, the high plain.

Mochdrum, *magh dhruim*, the plain of the ridge.

Magh is frequently met also in the topography of Ireland, *e. g.*

Moville, *magh bhile*, the plain of the margin.

Magherboy, *buidhe*, the yellow plain.

Magherros, *ros*, the plain of the promontory.

Mayo, *magh o*, the plain of yew trees or the beautiful plain.

Omagh has the same meaning as Mayo.

Moyluing, *magh luine* = Mauchline, in Ayrshire.

Maylurg, *magh an lurg*, the plain of the end.

Magheralin, *aluinn*, excellent, the excellent plain.

A casual examination of the map of Ireland indicates unmistakably that, in spite of all the alterations that centuries may have effected in the spelling and pronouncing of topographical names, the Gaelic origin of them has by no means been obliterated. The citation of a few additional names will be sufficient.

In Cork, Bantry, *ban traighe*, the white shore; Ballydehob, *da thaobh*, the town of the two sides; Inchgeelagh = the Gaelic pasture; Ballyneen, *an fhion*, the town of the wine; Kinsale, *ceann saile*, the head or end of the salt water; Fermoy, *fear magh*, the grass of the plain.

In Kerry, Kenmare, *ceann mara*, the head of the sea; Killarney, *coill fhearnaidh*, the alder wood; Dunmore, the large hillock; Ardfert, the high land; Tarbert, *tairbeart*, isthmus; Tralee, *traighe liath*, the hoary shore.

In Limerick, Kenry, *ceann righ*, king's head.

In Clare, Ennis, pasture, *innis*; Kilrush, *coili ros*, the wood of the promontory; Killaloe, *da lua*, the cell or wood of the two heaps; Dromore, the large ridge; Ballyveaghan, *bheagan*, few, the town of the few; Killediseirt, the wood of the desert. Galway; Kenmarra, *ceann mara*, the head of the sea; Gort, garden, standing corn; Oranmore, *odharunmor*, the large cow parsnip; Glenamaddy, the glen of the dogs.

Mayo, Ballyhannis, *sanas*, the town of the warning; Ballina, *ath*, the town of the ford; Killamagh, the wood of the plain.

Sligo, Dromore, the large ridge; Drumkeeran, *druim ciar*, the dusky ridge.

Leitrim, Carrick, a rock, *carraig*.

Tyrone, Strabane, the white strath; Omagh, the beautiful plain or the plain of yew trees; Aughnacloy, the field of the stone.

Donegal, Malin, Maolan, *bare*, Mull; Donros, *dun rois*, the fort of the promontory; Leck = a stone; Innishowen, Owen's isle.

Londonderry, Limavaddy, the dog's leap; Kilrea, *riabhach*, the grayish wood; Tobermore, the large well.

Kildare, Clane, *cluain*; Athy, *ath*, a ford; Ballytore, the town of the boars.

Tipperary, Ballina, *ath*, the town of the ford; Roscrea, *ros criadh*, promontory of clay; Cahir, a city.

Antrim, Port Rush, *rois*; Carrickfergus, the rock of Fergus; Crumlinn, *crom*, bending, *linn*, pool; Lisburn, *lios*, garden or fort, *burn*, water.

Down, Bangor, *beann char*, the bend of the hills; Dundurm, the foot of the ridge; Ardglass, *glas*, the grey height.

Meath, Dunleek, *dun leac*, the foot of the stone; Drogheda, *drochaid ath*, the bridge of the ford; Dunboyne, *dun boinne*, the fort of the Boyne.

Wicklow, Donard, *dun ard*, the lofty hill fort; Ballymore, the large town or hamlet; Rathdrum, *rath druim*, the foot of the ridge.

Kildare, Naas, an assembly; Ballytore.

It may without any hesitation be asserted that, when regard is had to Ireland as a whole, its topographical names are more commonly and consistently and plainly Gaelic than those of either England or Scotland. It is impossible to resist the inference that the same people who gave names to Calais and Dover and to the streams and rivers of England, who gave names to the streams, and rivers, and lochs, and mountains, and headlands, and valleys of Scotland, must have been the same people who gave names to the streams and rivers, to the lochs and mountains and hillocks, to the headlands and valleys of Ireland. So far as a topographical argument can be admitted to be of much avail or consequence—and it is difficult to understand why, in the determining of questions that affect the settlement of countries in the far-off past, great value ought not to be attached to topographical names – it must be conceded that, without considering the presence of a previous race in the British Isles, there is sufficient evidence that the Gaels preceded the Cymry, and that in England, Scotland and Ireland the Gaels have left indelible traces of their presence at a remote time. There is certainly very much to justify the conjecture of Nicholas, who, in his "*Pedigree of the English People*," (p. 46), thus writes: "In the absence of historic record, we are justified in presuming on grounds of antecedent probability that Ireland would receive its first inhabitants from Wales or Scotland. Wonderful explorers were those ancient Celts. Probably they soon pushed their way through thicket and swamp to the Highlands of Scotland, and finding there an end to their territory, they there, from the highest eminences, looked out westward and descried the misty coast of the Green Isle. The first tribes to arrive in Britain would probably be the first settlers in Scotland and Ireland. Pressed toward the interior by subsequent arrivals, nomadic hordes but slightly attached to any particular spot, they would readily move forward to new pasturages rather than long contend for the old. The Gaelic or Gadhelic people, therefore, may be presumed to have had the advantage of priority of occupation." Aristotle, the first writer who refers to Britain, says: "Beyond the pillars of Hercules, the ocean flows round the earth, and in it are two very large islands called British (βρεττανικαι λεγομέναι) Albin and Ierne lying beyond the Keltoi." By the term *Albin* Aristotle must have intended that portion of the British Isles now embraced by England and Scotland. The Scottish Gaels still speak of their country as Albin, and of themselves as *Albannaich*, thereby showing that, if there is any force in the reference of Aristotle, they are the representatives of the earliest inhabitants of Albin, or of England and Scotland.

The topographical argument in favour of the peopling of the British Isles by the Gaels may be thus briefly expressed: Calais and Dover are Gaelic names which must have been given by Gaels who were in the habit of crossing at those points from the continent of Europe to the British Isles. Along the eastern coast of England there are indelible traces in the names of streams, and rivers, and hillocks of the presence of the Gaels. Owing to the powerful wave of invasion that successively rolled over England until it was subdued by William the Conqueror, Gaelic names, which doubtless were given to what is now the site of English towns and cities, were superseded by names of Roman origin, or by names which the later invaders chose to give. That such an opinion is correct may readily be seen by looking carefully at the map of England. That portion of Scotland which lies south of the Friths of Forth and Clyde was subjected from the time of the Roman invasions to inroads from other nations, and, as a natural consequence, the topographical names are not so commonly Gaelic as in the Highlands. A close similarity obtains between the topographical names of England, of the south of Scotland, and of the Highlands of the latter country; whence the inference may be drawn that the Scottish Gaels are now the representatives of those Celts who were the first to enter Britain, and to travel northwards from the south of England to the north of Scotland. From an examination of the Topography of Ireland, the inference may fairly be drawn that the same Gaelic race must have peopled that country, and that the Scottish Highlanbers of to-day can extract satisfactory evidence from the topographical names of Ireland to convince them, that their own remote ancestors and the Celts, who were the first to people Ireland, were one and the same people, and spoke the same language.

The topographical argument which has been now examined, leads to the conclusion, that the first powerful stream of immigration into the British Isles was Gaelic; that it entered the south of England and extended northwards and westwards; that from Scotland, where its branches were widely scattered, it passed into Ireland, and left there numerous and indelible proofs that the same Celts who gave names to Calais and Dover, gave also names to Innistrahull and Durrow, to Ballachulish and Aberdour; and that the same Celts who gave names to Fintry and Bannockburn in Scotland, gave names also to Bantry and Kinsale in Ireland.

ON THE OCCURRENCE IN CANADA
OF
TWO SPECIES OF PARASITIC MITES.

BY J. B. TYRRELL, B.A., F.G.S.

SARCOPTES MINOR, VAR. CATI, *Hèring.*

A short time since my attention was called to a cat whose face had apparently been scratched and torn and was now covered by a moist scab, which was especially noticeable at the base of the nose and around the eyes; however, on turning back the hair from the top of the head and base of the ears the same diseased condition was seen to prevail, though not to such a marked extent.

On removing the scab, the skin was found to be completely honey-combed, presenting the appearance of coarse cellular tissue, in the cells of which, and among the roots of the hair which had been pulled out with the scab, could be seen a number of exceedingly small white specks which, when picked up on the point of a needle, and placed under the microscope, proved to be a small itch-mite belonging to the species described by Fürstenberg as *Sarcoptes minor* (S. cati, Héring; S. notoëdres, Bourguinon and Delafond). It is the smallest species as yet described, not being more than half as long as Sarcoptes scabiei, the common itch-mite which infests man.

As this minute parasite has in many places proved very fatal to our domestic favourites, it will be interesting to notice shortly the peculiarities of its structure, and then to look for a moment at the way in which it commits its depredations.

The general shape of the body is almost globular, being slightly longer than broad, the female being about .12 mm. long and .1 mm. broad, the male somewhat smaller. To the naked eye it appears as a shining white spot, but under the microscope it has a grayish white appearance with light brown colored markings, showing the position of the chitinous skeleton.

The body is, as in S. scabiei, covered with a thin transparent epidermis raised into minute folds, which follow more or less closely the outline of the body, or rather circle round the anus, which, in this species, is placed almost in the centre of the back. As the folds approach nearer the anus they become less and less continuous, becoming first rows of rounded papillae, and then disappearing almost altogether. Towards the anterior end of the dorsal surface and near the median line are two short spines, one on each side; and a somewhat shorter one is present on each side near the lateral margin. On each side of the anus there are two curved rows of short, blunt bristles, forming a kind of double arch over it, and made up, the outer one of four, the inner one of two bristles on each side. These point in a general way backwards and inwards towards the anal opening. Anal bristles on the posterior end of the body are entirely wanting.

The dorsal position of the anus is very peculiar, and it was this that suggested the name "notoëdres," which Bourguinon and Delafond applied to this species. It is strange that the peculiarity should have escaped the notice of earlier observers, as it is very well-marked. Fürstenberg, who has given some very fine figures of this species, takes no notice of the dorsal opening, but indicates an opening on the ventral surface where none exists.

At the anterior end of the body is situated the rostrum, composed of the following parts: A pair of biting three-jointed mandibles, the third joint springing from the side of the second and growing out to an equal length with it, the opposed edges being furnished with blunt serrations, thus forming strong nippers on each side of the mouth. Below these are the immovably united maxillae with their three-jointed palps, which extend forward parallel with the mandibles. A thin fold of the integument surrounds the whole, enclosing it in a kind of sac open in front, called by Robin the *camerostomum.* Viewed from the dorsal surface a portion only of the rostrum is seen, as it is partially covered by a fold of the skin which projects over it.

The body is provided with four pairs of five-jointed legs, two anterior and two posterior, the anterior arising from the antero-lateral margins of the body, the posterior from the hinder portion of the ventral surface The first four joints of these legs are surrounded and strengthened by rings of chitin of a more or less irregular shape, and are armed along their sides with bristles whose positions are constant in the same species. The fifth joint is covered with a cone-shaped cap of chitin supporting the terminal processes. The two anterior legs on each side bear at the extremity of this latter joint four curved hook-like claws, and a relatively large bell-shaped sucker on a stem which, though long, is much shorter than in S. scabiei. In the female the posterior legs are terminated by long flexible bristles in place of suckers. In the male the third leg only ends in a bristle, the fourth bearing a long-handled sucker very much like that on the first and second legs. The legs articulate with and are supported by the *epimera*, which are light brown chitinous bands present in the walls of the body and extending in a general way along the ventral surface from the points of insertion of the legs towards the median line. Those of the front pair of legs run backwards and inwards, and, a short distance behind the rostrum, unite to form an elongated Y-shaped figure. The arms of the Y, however, are bifurcated, the anterior branch running forward to support the palps, the posterior articulating with the first leg. The second epimere also runs backwards and inwards for a considerable distance, but before reaching the median line it takes a sharp turn outwards and terminates abruptly. The third and fourth epimera in the female are short and slender, running forwards and inwards, and bending towards each other at their anterior ends. In the male the arrangement is more complicated; the third and fourth epimera run forwards and inwards joining the anterior portion of the *sternite*, a median chitinous band which runs backwaids along the posterior portion of the ventral surface, thus enclosing the male sexual organs under a sort of double arch, the keystones of which are prolonged until they meet each other.

The external sexual organs in the male are situated between the points of insertion of the fourth pair of legs, and are composed essentially of the three following parts: (1) the *sternite*, composed of a chitinous band on each side of the sexual opening, which runs forward and joins the one from the opposite side in front of the opening and becomes continuous with the median chitinous strip mentioned above; (2) a lid or *hyposternum*, made up of two arched bands and a connecting membrane, thus forming a triangular cover hinged to the sternite at its postero-lateral angles, and with the point directed forwards; and (3) a *penis*, which, when prone, is directed forwards under the episternum and may be seen through it, but in copulation it is turned backwards, when, of course, the episternum is also turned back beneath it.

The external sexual organ of the adult female is simply a narrow slit running across the under surface of the body, about half way between the insertions of the second and third pairs of legs. It is rather an interesting fact, however, that the male does not copulate with the fully developed female, but with the female in what has been called the *nymph* stage, when the ventral opening into the oviduct has not yet appeared; another ecdysis being necessary before the adult form is assumed. I have not had the opportunity of observing the mode of copulation, but there would appear to be no doubt that the anus serves for the opening both of the intestine and the vagina. Fürstenberg, in his comprehensive treatise on "Die Krätzmilben," does not mention the opening in the middle of the ventral surface, but in Sarcoptes scabiei figured the oviduct as opening into a cloaea along with the intestine, evidently not recognizing the fact that the oviduct and vagina opened at different parts of the body. He also states that he saw a male and female in copulation, and that the penis was inserted into the anal opening.

In the closely allied family of the "Dermaleichidae" also, the arrangement of the female sexual organs is essentially as follows:—There is a post-anal opening leading by a duct into the *Receptaculum seminis*, which opens into the oviduct, at one end of which the ovaries are placed, and the oviduct opens on the middle of the ventral surface. It appears very probable that an arrangement of the parts similar to the above exists in the genus Sarcoptes.

With the exception of the absence of a ventral sexual opening, and the slightly more posterior position of the anus, the nymph is very similar to the adult female.

The larva is somewhat smaller than the nymph, and is only provided with six legs, the hinder pair of which end in long bristles as in the adult females.

The egg is small, oval or somewhat ovate, and about half the length of the adult female.

We have adopted Fürstenberg's name *minor* for this species instead of *cati*, which had previously been given to it by Héring, as the first is characteristic of the species itself (it being very small), and not merely of its habitat, for though it was first found on the cat, it has since been found on the rabbit and other animals. On the rat, for instance, M. Mégnin has found a species of Sarcoptes which differs considerably from the one on the cat, but which he has shown to be only a variety of the same species, therefore we retain Héring's name *cati* for the variety from the cat, and adopt the name *muris* for that from the rat.

This little parasite first attacks the cat at the base of the nose, around the eyes, and at the base of the ears, where it forms small white pustules in which the mite may be found. From these points it spreads over the whole head, then it is stated to work backwards over the neck, and finally over the whole body, reducing the poor animal to the last stages of leanness and decrepitude. M. Mégnin, however, states that the mite does not attack any other parts of the body, except the head and neck. As I have not had any opportunity of observing cats which have been a long time diseased, it is impossible for me to say at present which of these statements is correct.

It has been asserted by some authors, who have no doubt drawn their conclusions from analogy to Sarcoptes scabiei rather than from direct observation, that this mite bores long and tortuous passages through the skin among the roots of the hair, but an examination of the diseased parts shows, not a number of winding passages filled with eggs and fœces, but a great number of round, cell-like cavities, in which the adult female is lying surrounded by several eggs and a quantity of fœcal matter, showing clearly that the mite has been in this nest for a considerable time. The male and young are not found imbedded in the tissue, but scattered through and under the scab and on the surface, when the copulation evidently takes place. After impregnation the *nymph* then bores into the tissue, takes on the form of the adult female, and lays her eggs in the nest which she hollows out for herself. In parts of the animal which have been long affected, these nests are packed together so closely as to be almost in contact.

It only remains for us to mention some of the remedies which have been recommended for the cure of this disease, always, however, bearing in mind the fact, that on account of the excessive sensitiveness of the skin of the cat, many of the washes and lotions, which would be exceedingly useful when applied to other animals, would in this case probably prove hurtful or even fatal.

Sulphur is the most generally useful insecticide, and where the mite can be reached by it, there is no doubt but that it will effect a cure. Sulphur ointment applied repeatedly to the diseased parts is said to effectually destroy the pest. A solution of Balsam of Peru in alcohol, applied carefully, has also been highly recommended.

PSORERGATES SIMPLEX, N. G. & SP.

While engaged in the study of Sarcoptes minor, a mouse was brought to me which had a crusty scab on the lower part of the back of the ear, extending round its outer edge and into the interior of the conch, where it assumed the appearance of a tough, leathery skin of a dirty grey colour. When a piece of this scab was pulled off with the forceps and placed under the microscope, a number of small mites were seen crawling over and burrowing their way into it. At first sight they appeared to me very much like small, short specimens of *Myobia musculi*, but a more careful study showed them to be separated by many marked characteristics from this latter species. It was seen, too, that they were all males, and that a further search must be made for the females and young. I therefore placed the scab in glycerine and tore it to pieces with needles, and in this way brought to view a number of round, white specks, which proved to be the females, nymphs and larvæ, resembling the male in very little else but the structure of the rostrum and the even distribution of the feet along the sides of the body.

This is in all probability the species mentioned by Gerlach, in a book entitled "Krätze and Räude," published in 1857, as occurring on the ear of the common mouse, though on this point I am unable to speak positively, as I have had no opportunity of seeing the original description and figures. As M. Megnin, however, in his invaluable work on "Les Parasites et les Maladies Parasitaires," says that it is impossible to determine from the original figure even to what family this mite belongs; and as neither Megnin, in the book just cited, nor Gerstäcker, in his review of Gerlach's work in "Archivs für Naturg eschichte," make any mention of a name having been given to it, and as Fürstenberg in his extended synopsis of *Krätze and Räude* does not even notice the fact that an itch-mite had been recorded from the mouse, it seems advisable to publish a new description of it and give it a name. If it appears afterwards that it has already received a name, the one now used will of course be abandoned and the previous one adopted in its stead.

In colour the body, over the greater part of its surface, is of a dirty white, though the epimera and the chitinous bands which encircle and support the legs are tinged with light yellowish-brown. In shape the two sexes differ very much. Looking at the dorsal surface the general outline of the male is ovate with the obtuse pole directed forwards and rather strongly truncated, and from the middle of this anterior end projects the conspicuous and almost quadrangular *rostrum*, close to which on each side the anterior extremities take their origin and point when at rest obliquely forwards and outwards. The lateral margin of the body is marked by three constrictions dividing it into four sub-equal segments, each of which bears a pair of legs, hence the legs are arranged at almost equal distances from each other along the sides of the body. This character creates a marked distinction between this species and those of the genus Sarcoptes, in which the legs, instead of being situated at equal distances from each other, are arranged towards the anterior and posterior ends of the body, a considerable distance separating the insertions of the second and third pairs. On the other hand it appears to point to a general relationship with the genus Myobia, which further examination only serves to strengthen, though the form of the female and the general course of development remove it very far from this genus. The surface of the back is considerably arched, rounding off along the sides into the belly which is flattened towards the anterior end, but deeply hollowed out from the level of the insertion of the second pair of legs backwards, evidently for the purpose of receiving the female during copulation. In the female the general shape is very different from that of the male. The body is almost globular, being rounded on both the ventral and dorsal surfaces; the rostrum projects but very slightly beyond the anterior end, and the legs are represented merely by little knobs situated along the sides of the body. The male averages about .12 mm. in length and .1 mm. in breadth. The female is not quite as large, both length and breadth being about .1 mm.

The body is covered with a thin, soft skin, which is smooth or irregularly dotted over the greater part of the ventral and dorsal surfaces, but along the sides in the male a few fine wrinkles can be made out, following in their course the general outline of the body. Imbedded in the skin are the epimera and the chitinous supports to the legs, which will be described below. The skin is thus very like that of Sarcoptes scabiei, except that the wrinkles are much fewer and finer. At the anterior end of the body the organs of manducation are grouped together into the form of a sub-quadrate *rostrum*, which projects considerably beyond the front of the cephalo-thorax, though it is, to a certain extent, retractile under it. The rostrum, seen from the dorsal surface, is somewhat rectangular in outline, the outer angles being slightly rounded off and the line of the front curved outwards to a certain extent. Its length is considerably greater than its breadth, being on an average about 0.025 mm. broad and 0.015 mm. long. It is composed essentially of the following parts, viz. : (1) A long delicate *lingua*, or tongue, which, however, is very difficult to discern clearly until the animal has been submitted to strong pressure, when it sometimes may be seen as a stout bristle projecting beyond the anterior margin. (2) A pair of long, acutely conical unjointed *mandibles* running parallel and close together during the greater part of their length, and apparently forming a sheath for the median tongue. (3) A pair of *maxillæ* firmly united at their base, but bearing at their outer and anterior angles a pair of two jointed palps, one on each side of the mandible, the first joint being large and sub-rectangular, the second small and conical. Towards the side from the insertion of the palp, the angle of the maxilla is extended into a short spine. With the exception of the characters which we have just enumerated, namely, those of the skin and of the rostrum, and perhaps also those of the digestive canal, which however we have not been able to make out, the male and female present an entirely different appearance, and it will be most convenient to consider them separately.

In the male, which as stated above is flattened from above downwards, the legs arise on the ventral surface a short distance in from the lateral margin, so that the first and part of the second joints are hidden from view when looked at from above. The number of joints present in each of the legs is four, the second probably corresponding to the second and third in Myobia musculi, and other closely allied species. They are all strengthened by very light brown rings of chitin which encircle them and form points of attachment for the flexor muscles. The first joint in all the eight legs is somewhat triangular in outline, the base of the triangle, which is the side nearest the middle line of the body, being somewhat incurved, with the angles adjacent to it slightly rounded, the anterior angle running forwards for a considerable distance to articulate with the epimera. The second joint is large, with a long and strongly curved outer and a short inner margin. On the outer side, but rather towards the dorsal surface of this joint, three small tubercles are present, bearing at their ends as many short bristly hairs. These are most strongly developed on the first and fourth legs, not being so conspicuous on the second and third. The third joint is smaller and more nearly round, though somewhat longer on its inner than on its outer border. On this latter border there is a short tubercle and spine present on the first leg, and a pair of blunt spineless tubercles on the fourth. Articulating with the distal end of the third joint is the fourth joint or tarsus, which at its proximal end is comparatively narrow, but after a short distance it suddenly increases to about double its original breadth, forming on the inner side of the first leg a backwardly projecting spine, which, however, is not present in the other extremities. After thus enlarging the tarsus does not again contract, but continues of about the same size to the end of the joint, when it is sharply truncated, the end being straight or even slightly incurved. In this emargination, but rather towards the dorsal surface of the joint, a short blunt spine takes its origin. On the same joint, but on the extreme outer angle, there is also present a rather strong, slightly curved claw, of about the same length as the spine and with it giving to the leg the appearance of being terminated by two claws. Besides the spine and claw the tarsus is armed with two bristles, one on the inner and one on the outer side.

Situated immediately under the thin transparent epidermis, and imbedded in the tissues of the body, the epimeræ, which are composed of strips of light-brown coloured chitin, extend from the anterior angle of the base of the legs towards the middle line of the body, and form with the small pieces of chitin behind the rostrum the framework or skeleton of the trunk. Their principal functions are to serve as supports for the legs and to form points of attachment for the muscles which move them. Those of the anterior pair of legs arise on each side of the rostrum and close to it, and run backwards and inwards for about one-fourth the length of the body, not meeting to form a point, however, as in Sarcoptes minor, but turning sharply outwards and ending abruptly. Those of the second, third and fourth legs are also each of them present as detached bands. The anus is present as a longitudinal slit on the posterior end of the body.

The sexual aparatus is situated between the insertions of the fourth pair of extremities, and is composed of two bands of chitin running backwards along the ventral surface, each having the appearance of two segments of circles placed end to end, one behind the other, the posterior including more of the circumference of the circle than the anterior. Between these two longitudinal bands the penis is present as an elongated cone, directed towards the posterior end of the body. Epidermal appendages are very poorly represented, the only ones of any importance being two long bristles which arise one on each side from the posterior end of the sexual chitinous bands, and extend a considerable distance beyond the hinder end of the body. Besides these there are the small bristles or hairs on the legs which have been already mentioned.

The structure of the female is exceedingly simple, having the appearance externally of a minute white ball, with the sub-rectangular rostrum projecting from its anterior surface. The feet, which occupy the same positions as in the male, are, however, very much smaller and quite useless for walking on a level surface, though probably very effective in boring through the soft tissues of the ear of their host. They are composed of but two short joints, the first of which is almost immovable, and is united by a triangular chitinous base of attachment to the skin of the body; the second is of a rounded triangular shape, and is movably articulated to the first. Epimera are present, but are very small, their place being taken functionally by the chitinous base of the legs. The surface of the body is smooth, no bristles or spines of any kind being present either at the posterior end or on the diminutive legs. The anus is at the hinder end of the body. The opening from the oviduct is in the form of a simple transverse slit on the ventral surface, a short distance behind the base of the rostrum.

The course of development of this aberrant form of itch-mite is very peculiar, for though in its adult condition it bears considerable resemblance to Dermatoryctes fossor, so carefully described by Prof. Ehlers in Zeit. f. w. Zool. Bd. XIX., yet it differs essentially from this latter, in the fact that the larva closely resemble in general form the adult female rather than the adult male, thus leading one to suppose that the male was a farther development of a mite like the female, and not that the female was degraded by more complete parasitism from a mite possessed of the higher type of structure presented by the male; thus the nymph or unimpregnated female is very much like the adult female, except that it is slightly smaller, and there is no ventral opening to the oviduct, and the larva also is very like the female, except that the fourth pair of legs have not yet appeared. The egg is more or less irregularly, oval in shape, and somewhat more than half as long as the adult female.

It will be seen from the above description that the mite found on the ear of the mouse differs considerably from any forms already described, resembling Dermatoryetes fossor (Ehlers) in the simple character of the female, but resembling much more nearly Myobia musculi in the structure of the rostrum and the general form of the male. It also differs from D. fossor in being oviparous and not viviparous.

Considering all the circumstances, it has appeared to me advisable to create for its reception a new genus, with the following characters:

PSORERGATES, *n. g.*

Ψωρα, a scab; *ἐργατης*, a builder.

General shape of the male and female quite different, the male being provided with legs which are terminated by a spine and claw, in the female the legs are very small and without terminal appendage, Mandibles styliform. The nymph and larva resemble the female rather than the male, Oviparous.

PSORERGATES SIMPLEX, *n. sp.*

Characters enumerated above.

Its habits were mentioned in the first part of this paper, namely, that it has been found living under a soft scab for the most part inside the conch of the ear of a mouse (*Mus musculus*); but attention must be drawn to the circumstance that the male, though very active, and often found on the surface of the scab, must also bore into and under it in order to copulate with the nymph, which, from the shortness of its legs, would be unable to move outside the tissues of its host. In this particular it differs essentially from Sarcoptes minor, in which it will be remembered the nymph is active and moves about on the surface; and it is only after copulation that it bores into the tissue and assumes the adult form.

DESCRIPTION OF PLATES.

PLATE III.

SARCOPTES MINOR, VAR. CATI.

1.—Adult female, ventral surface × 250.

2.—Male, ventral surface × 250.

3.—Nymph or immature female, dorsal surface (it very closely resembles the adult female, except that in this latter the anus is nearer the centre of the back), × 250.

4.—Six-legged larva, dorsal surface × 325. (After Fürstenberg. The anus has, however, been drawn on the dorsal instead of on the ventral surface).

5.—Rostrum of S. minor, var. muris, × 600. (After Mégnin).

PLATE IV.

PSORERGATES SIMPLEX.

1.—Male, dorsal surface.

2.—Male, ventral surface.

3.—Adult female, ventral surface.

4.—Nymph, or immature female, ventral surface.

5.—Larva, ventral surface.

6.—Rostrum, showing palps, mandibles and tongue.

7.—Egg.

All the figures magnified 455 times.

SOME OF THE PRESENT ASPECTS

OF THE

GERM-THEORY OF DISEASE.

[The following is a summary of a popular Lecture given by Prof. Wright under the auspices of the Canadian Institute on the Germ-Theory of Disease. The Lecture was intended mainly to elucidate the subject from a biological point of view, and reviewed the interesting facts which have been contributed to the Natural History of the lowest Fungi by researches into the relationship of microscopic organisms to Disease. The present synopsis may be of interest to the members of the Institute.]

During the last ten years a host of investigators have been busy in different parts of the world in attempting to discover the causes of certain forms of disease, and their labours have been so far attended with success that in almost all forms of contagious and infectious diseases, and in certain others which have not been included in that category, minute organisms of a special form have been found constantly associated with the particular diseases. The thought, of course, lay upon the surface that these organisms are not only the originators of the disease, but are simultaneously the means of spreading it. Such, indeed, has turned out to be the case. It is indisputably proved by means of laborious experiments that in some diseases the minute organisms are entirely responsible for all the course of the disease; and it is reasonable to conclude that when the same methods have been applied to the study of other diseases, a connection of the same nature will be demonstrated.

The first discovery affording a substantial basis for a Germ-Theory of disease was made more than twenty years ago by Casimir Davaine (who died in Paris towards the close of last year). He found in the blood of animals affected with Anthrax[1] a rod-like organism (now known as *Bacillus anthracis*), in immense quantities, which, accustomed as he was to the investigation of diseases caused by

[1] This disease, also known as Charbon, which has produced immense ravages especially among sheep and cattle in Europe is fortunately very little known in Canada. Isolated cases, however, have been recorded both from Ontario and Quebec, chiefly horses having succumbed to it.

internal parasites, he had no hesitation in accusing as the cause of the disease.

The actual proof of this, by separating the organism, cultivating it free from anything to which the disease might be ascribed, and subsequently producing the disease in a healthy animal by innoculation of such pure cultures, was delayed for many years. Nevertheless, Davaine's was an epoch-making discovery, and the insight which has been gained into the relationships between microscopic organisms and disease is very largely owing the classical researches of Pasteur, Koch and others on Anthrax. To these and similar researches biology is much indebted for additions to the knowledge of the group of Fungi to which these disease-producing organisms belong, and enquiries into the natural history of the group as a whole have been thereby stimulated, which have led to many interesting results. The present paper is intended to indicate a few of the most important of these.

Although the function of the green-colouring matter of plants cannot yet be regarded as definitely established,[1] coloured forms are nevertheless known to be able to draw their carbon from the carbonic acid of the medium in which they live, while colourless forms depend on living or dead organic matter for their food, and are thus either parasites or saprophytes. Most of the colourless plants belong to the lowest vegetable sub-kingdom (the Thallophytes), and constitute the class Fungi of that subdivision. Coloured and colourless Thallophytes exhibit various grades of organization, but with the exception of the Mould-Fungi all of the organisms which produce disease belong to the lowest grade, which reproduce themselves mainly by division or fission, and have on this account received the ordinal name of Schizophytes.

Among the Mould-Fungi both parasitic and saprophytic forms are to be found. Many diseases of plants are attributable to the former, and not a few of those incident to the surface of the body in animals. Under ordinary circumstances the interior of the body is not favourable to the development of moulds: not only is the temperature too high, but the alkaline reaction of the fluids and the scarcity of oxygen are both factors which hinder their growth. It is otherwise with the colourless Schizophytes; the conditions which

[1] Recent researches appear to indicate that Chlorophyll protects the first products of assimilation against the decomposing action of light.

interfere with the development of the moulds are favourable to them, and it is consequently with this group that we have alone to concern ourselves in connection with the Germ-Theory of Disease. The colourless Schizophytes or *Schizomycetes*, as they are also termed, present many difficulties to the investigator on account of their extremely small size.[1]

Various generic forms have been distinguished, such as *Micrococcus*, embracing the minutest globular or oval forms often in chains; *Bacterium*, short, rod-like forms; *Bacillus*, longer rods; *Leptothrix*, long jointed threads; and in addition various spiral forms, *Spirillum*, *Spirochate*. The constancy of these forms has been defended by some authorities and denied by others, but the recent researches of Zopf on Cladothrix and Beggiatoa indicate that all of these so-called genera may be merely different stages of development of higher members of the same group of Fungi. Thus the thread-like Cladothrix and Beggiatoa, two of the commonest aquatic fungi of cosmopolitan occurrence, give rise in the interior of the threads to Micrococcus or Bacterium-like spores which may grow out into Bacillus- and Leptothrix-like forms, or may first multiply themselves rapidly in a motionless or zoogloea condition. Again in both the adult threads may undergo a retrogressive development, becoming divided up into shorter or longer pieces (Bacillus- or Leptothrix-like), which again may fall into still shorter rods. Spiral forms are also described as belonging to the genetic cycle of Cladothrix and Beggiatoa. These are formed by the breaking up of a thread which had become spiral in virtue of one-sided growth, and the resulting fragments are *Spirillum*-like or *Spirochate*-like, according to the closeness of the spiral and thickness of the portion of the thread to which the fragment belonged. Whatever their length and shape the fragments formed in the course of this retrogressive development attain cilia on becoming free. It is similarly asserted that all of the *Micrococcus*, *Bacterium*, and *Bacillus*-like forms found in the mouth belong to the genetic cycle of *Leptothrix buccalis*.

A similar inconstancy of physiological peculiarities has also been asserted by recent observers, so that the view that disease-producing

[1] They are usually measured for convenience sake by micro-millimetres, one of these units being the $\frac{1}{1000}$ mm. = $\frac{1}{25000}$ inch, and represented by the sign μ.

Schizophytes are merely varieties of harmless forms which have acquired special virulence is defended by many authorities. Dr. H. Buchner, of Munich, has described the conversion by artificial culture of the ordinary *Bacillus* of Hay-Infusion into the virulent *Bacillus* of Anthrax and *vice versa.* Although many careful observers hesitate to recognize the value of his experiments, there can be no doubt that the virulence of the *Bacillus* of Anthrax may be "attenuated" by cultivation under certain conditions. Such attenuated virus has been employed by Pasteur for the protective innoculation of sheep and cattle against Anthrax. Although the results obtained have not been so satisfactory as could be desired, yet the establishment of the principle is a great step in advance in the fighting of the infectious diseases.

The physiological inconstancy of the Schizophytes is likely to prove as great a stumbling block in the way of their classification as their inconstancy of form. It has been proposed, however, to arrange them in three groups: colour-producing (Chromogenic), fermentation-producing (Zymogenic), and disease-producing (Pathogenic) forms.

To the Chromogenic forms belong the Micrococcus prodigiosus, which forms a red incrustation on bread, besides other Micrococci which produce the characteristic colours of "blue milk," "blue pus," "red sweat," &c. Higher members of the Schizophyte group may also be Chromogenic.

A very large number of forms are recognized as Zymogenic. The yeast plant (Saccharomyces) and its allies, although reproducing by budding and not by division, have nevertheless many points in common with the true Schizophytes, and are conveniently considered along with them. Several species of Saccharomyces are known capable of producing the alcoholic fermentation, but the amount of sugar destroyed and alcohol produced appear to be different for the different species. One form, *S. mycoderma,* is so avid of oxygen that if it should be formed in wine, the alcohol undergoes slow combustion, and eventually little but water is left behind. To the Zymogenic group, however, belong many true Schizophytes; such are the ferments of the acetic, lactic, butyric and viscous fermentations, as well as many others to which chemists and biologists are only now turning their attention. So putrefaction is now generally recognized to be a form of fermentation, complex on account of the complexity of the fermentable bodies on the one hand, and the complexity of the products of fermentation on the other. The common ferment organism of putrefaction is the *Bacterium termo*, with which others are unquestionably associated.

As already indicated, many authorities regard the pathogenic Schizophytes as constant species with constant physiological peculiarities. Naegeli has most ably defended the opposite view, in accordance with which they are at most physiological varieties, and points to the occurrence of new contagious diseases, and the sporadic appearance of already known diseases, as confirmatory of his theory.

Almost all the generic forms of Schizophytes have been recognized in connection with one or other of the diseases of which they are now generally believed to be the cause. Thus Micrococci have been found in small-pox, diptheria, erysipelas, and some forms of blood-poisoning; Bacteria in septicaemia of the pigeon; Bacilli in anthrax, various forms of septicaemia, malaria, tuberculosis and leprosy, and Spirochaete in relapsing fever. The list of diseases is in fact being daily increased (especially by investigation into various diseases of the domestic animals) with which specific pathogenic Schizophytes (or Microbes, as the French investigators term them), are found to be constantly associated.

Since the establishment of the Germ-Theory of Disease on the sound basis on which it now stands, increased interest has been evinced in the microscopic examination of air and water, the chief media from which the disease germs invade the body. With regard to the latter microscopic examination cannot yet be regarded as affording proof of the harmlessness or the reverse of water for drinking purposes, although the examination of suspected water has revealed in certain cases (Typhus-Brautlecht) micro-organisms to which disease has been attributed. Chemical examination which speedily reveals contamination by sewage, and therefore a possible source of infection, is as yet to be more depended upon. No doubt the researches on the Schizophytes which are now being carried on may tend to render the microscopic analysis of water of greater importance than it is at present. Michel and Hansen's observations with regard to the occurrence of micro-organisms in the atmosphere are of the highest interest. By far the greater number of the spores found floating in the atmosphere belong to moulds, and are therefore quite harmless to man. The same is probably true of the great majority of the spores of Schizophytes which are also found. Michel has calculated that in the neighbourhood of the observatory at Montsouris a man may inspire in 24 hours 300,000 mould spores and 2,500 Schizophytes. Probably not $\frac{1}{10}$th of these are possessed of any life or capacity for further development, but Michel has nevertheless discovered that the curve representing the occurrence of Schizophytes in the atmosphere, and the curve representing the prevalence of infectious diseases, are coincident. He has shown the necessity for ventilation by pointing out the great increase of microbes in the atmosphere of the Parisian hospitals during winter, when doors and windows are kept close for warmth's sake. He has also shown that microbes are not more abundant in the neighbourhood of open sewers than in the air generally, a fact which is confirmed by investigations of Hansen and Naegeli. The latter demonstrates that all micro-organisms must be previously dried before being carried into the atmosphere. They exist there generally in the spore-condition, a condition which usually steps in when changes unfavourable to the ordinary method of propagation by division have come into operation. The spores, which are produced in the interior of the cells of the Schizophytes, are possessed of much greater vitality than the mother-plants, being able to resist extremes of temperature, and deprivation of moisture and food immeasurably better than these. The discovery of such spores and their properties has given a death-blow to the doctrine of spontaneous generation, for it is now satisfactorily determined that any organic infusion may be kept perfectly free from micro-organisms in a sealed flask, if the proper precautions have been taken not only to kill the mature Schizophyte in it, but also their spores.

It is not surprising in view of these facts that the strength of the disinfectants used to kill septic material must be very different according as the material is in a vegetating or spore-condition. In the latter case no volatile antiseptics, except chlorine and bromine, have been found to possess any efficacy, and it has been shown that the antiseptic virtues of carbolic, salicylic, &c., have been greatly overestimated. As a result of various experiments made to determine the best means of disinfecting clothes (rags impregnated with spores of *Bacillus anthracis* being chiefly employed), prolonged boiling—for several hours—has been recognized as the simplest efficacious method. The experiments have shown that the process of disinfection of rooms, clothes, &c., during and after contagious disease ought to be under *the control of a health officer, in order that* this, the most important method of combating the spread of contagious diseases, should be efficiently and systematically carried out.

The introduction of an abundant supply of pure water, and the construction of proper drainage systems, are now aimed at by most large cities: in many the compulsory use of these by all the inhabitants remains to be carried out. So much knowledge has been acquired as to the origin of disease in course of the researches alluded to in the previous pages, that it becomes the obvious duty of educators to extend and provide for the increase of that knowledge. This can be most efficiently done by giving every medical student an opportunity of becoming practically acquainted with the methods of research which have been adopted in the enquiries referred to. It is obvious that medical men in practice will rarely combine leisure, inclination and capacity for such studies; but, on the other hand, much hard work has been expended with little or no result, simply from a want of rigid early training. *Such is particularly necessary* in the study of these lowest organisms, where errors of observation and experiment are avoided with the greatest difficulty.

CANADIAN INSTITUTE.

ANNUAL REPORT—SESSION 1882-83.

The Council of the Canadian Institute in presenting their Thirty-Fourth Annual Report, are pleased to be able to congratulate the members upon the termination of another successful year.

They are particularly gratified with the character of the communications which have been read at the meetings, and point with pleasure to the fact that some of the more important of them are the work of quite young men, from whom many additional valuable original investigations may be expected in the future. Another promising feature of the history of the Session that has just closed is the great increase in the number of members, which has risen from 139 to 225. The Council also have pleasure in reporting an increase in the average attendance at the Saturday evening meetings.

During the month of September a course of popular lectures on Sound was delivered in the Library Hall, under the auspices of the Institute, by Professor Loudon, of University College in this city, and Dr. Kœnig, of Paris. Another course, consisting of four lectures. including one by each of the following members, namely, President Wilson, Dr. Reeve, Professor Wright, and Mr. Lauder, was delivered in January and February, under the management of a Committee of the Council. The Council recall with pleasure the share they had in furnishing the public with an opportunity of hearing these exceedingly instructive and valuable lectures.

Early in the Session the Council deemed it advisable to adopt a resolution, providing that the Library and Reading Room should be kept open seven hours on Saturdays and five hours on other week days. This led to the resignation of the Assistant Secretary, Mr. Thomas Heys, to whose long and valuable services the Council gladly seize this opportunity of bearing testimony. He has been replaced by Mr. R. W. Young.

Though a considerable sum of money has been spent in furnishing the Library Hall with gas fixtures and seats, and in increasing the number of the periodicals taken for the Reading Room, the Council are gratified to find that the report of the Treasurer shows that the financial position of the Institute has not been weakened.

A large amount of work has been done during the year by members of the Council, and under their direction, with the view of putting in order and cataloguing the library, and preparing for binding the very considerable collection of transactions of scientific societies and other publications of value which we have in our possession. The binding has not actually been done, as it was thought best, before proceeding with it, to make exertions to complete imperfect sets and replace missing numbers, but the Council recommend the matter to the early attention of their successors. They also suggest the desirability of taking further steps, as soon as practicable, to put our scientific collections in complete order.

Appended to this report are abstracts showing: (1) The present condition of the membership; (2) the papers communicated at the meetings during the year; (3) the additions to the library and the donations during the same period; (4) the Treasurer's balance sheet; (5) the Lecture Committee's balance sheet.

All of which is respectfully submitted.

J. M. BUCHAN, *President.*

MEMBERSHIP.

Members at commencement of Session, 1882-83	139
Members elected during the Session	117
	256
Withdrawals and deaths	31
Total Membership, March, 1883	225
Composed of:	
Corresponding Member	1
Honorary Member	1
Life Members	17
Ordinary Members	206
	225

LECTURE COMMITTEE.

By Season and Single Tickets	$129 25
To Honorarium to Lecturers, Advertising, &c.	122 50
	$6 75

SUMMARY OF FINANCIAL STATEMENT FOR THE YEAR 1882-83.

I herewith submit my financial summary of accounts for the year of 1882-83.

The Annual Subscriptions are more than usual by reason of increased membership. Two Government Grants have occurred and been received during the financial year, and rent receipts have been more than usual. The interest payment has been reduced, while the only items of increased expenditure worthy of notice are those of fuel, furniture and gas fixtures, the last two of which are not likely to occur again. The Institute may well be congratulated upon its healthy condition, and its substantial balance now in the Bank and at its credit.

To Annual Subscriptions	$509 00
" Subscriptions to Building Fund	21 00
" Government Grants	1,500 00
" Rent from Warehouse	60 00
" Rent from Toronto Medical Society	50 00
" Rent from Elocution Society	25 00
" Rent from Catholic Literary and Debating Society	18 75
" Rent from Natural History Society	7 50
" Rent from J. Buchan for use of Hall	5 00
" Journals sold during the year	2 25
	$2,198 50

By Due to Treasurer from last Audit	$133 75
" Interest	238 78
" Salary	335 33
" Fuel	117 90
" Gas fixtures	146 34
" Furniture	115 00
" Printing	80 70
" Advertising	75 00
" Periodicals	69 75
" Painting	31 60
" Postage	48 87
" Carpenter work	27 57
" Gas supply	24 34
" Water supply	18 00
" Express charges	11 95
" Taxes	9 51
" Contingencies	25 07
" Balance in Bank	689 04
	$2,198 50

JOHN NOTMAN, *Treasurer.*

Examined, compared with vouchers, and found correct.

E. A. MEREDITH, } *Auditors.*
J. GALBRAITH, }

28th April, 1883.

LECTURES AND PAPERS.

On Sound: By Dr. Kœnig, Paris, France, and Prof. Loudon, University College, Toronto.

1.—Mechanism of the Ear: Noises, Notes and Tones. (Sept. 15th, 1882.)

2.—Qualities of Sounds: Pitch, Intensity and Timbre. (Sept. 18th, 1882.)

3.—Methods of Studying Vibrations: Determination of Pitch. (Sept. 20th, 1882.)

4.—Determination of Intervals: Scales, Propagation of Sound, Communication of Vibrations, Composition of Vibrations. (Sept 22nd, 1882.)

5.—Phœnomena produced by the Co-existence of Two Sounds: Interference, Beats, Sounds of Beats. (Sept. 25th, 1882.)

6.—Timbre of Sound: Analysis and Synthesis. (Sept. 27th, 1882.)

Reindeer and Mammoth Age of Southern Europe. (Dr. Daniel Wilson, President of the University of Toronto, January 19th, 1883.)

The Hygiene of the Eye. (Dr. Reeve, January 19th, 1883.)

The Germ-Theory of Disease. (Prof. Ramsay Wright, University College, Toronto, January 26th, 1883.)

Richard Wagner and the Music of the Future. (Prof. W. Waugh Lauder, February 2nd, 1883.)

Science and Progress. (The President's Inaugural Address, November 4th, 1882.)

Some Laws of Phonetic Change in the Khitan Languages. (Prof. Campbell, of Montreal; read for him by Prof. Loudon, November 11th, 1882.)

The Presence of Tellurium, in connection with Gold, Silver and Lead, in Specimens of Ore from Lake Superior. (Prof. Ellis, School of Practical Science, Toronto, November 11th, 1882.)

Anthropological Discoveries in Canada. (C. A. Hirschfelder, Esq., November 18th, 1882.)

The Transit of Venus. (Mr. Carpmael, Superintendent Toronto Observatory, November 25th, 1882.)

The Classification of Languages. (Mr. W. H. Vander Smissen, December 2nd, 1882.)

The Ophidians of Texas. (Prof. Croft: read for him by Dr. J. E. White, December 9th, 1882.)

Description of an Interesting Historical Monument of the 15th Century. (Dr. Daniel Wilson, President of the University of Toronto, December 16th, 1882.)

A Demodex in the Skin of a Pig. (Prof. Ramsay Wright, University College, Toronto, December 16th, 1882.)

Description of a New Micro-photo-graphic Apparatus, and a Résumè of Cohn's Experiments on Trichinæ. (Prof. Ramsay Wright, January 20th, 1883.)

Evidence of Water-action on the Surface of the Moon. (Mr. A. Elvins, January 20th, 1883.)

Some Reasons Why so many Persons Die of Consumption, (Dr. P. H. Bryce, January 27th, 1883.)

On Spelling Reform. (Mr. W. Houston, February 3rd, 1883.)

A Topographical Argument in favour of the Early Settlement of the British Isles by Celts whose language was Gaelic. (Rev. Neil McNish, D.D., Cornwall; read for him by Mr. W. H. Vander Smissen, February 10th, 1883.)

On the Water supplied to the City of Toronto. (Prof. Ellis, School of Practical Science, Toronto, February 17th, 1883.)

Some Forms of Canadian Infusoria. (Prof. J. Playfair McMurrich, February 17th, 1883.)

The Poisonous Snakes of North America. (Dr. Garnier, Lucknow, February 23rd, 1883.)

The Principles of the Solutions of Equations of the higher Degrees. (Prof. Young, University College, March 3rd, 1883.)

On the Analysis of Tea. (Prof. Ellis, March 3rd, 1883.)

On Lord Durham's Report, 1839. (Mr. William Creelman, March 10th, 1883.)

On Nomenclature. (John Notman, Esq., March 17th, 1883.)

On Some Experiments on Ice. (W. J. Loudon, B.A., March 24th, 1883.)

On Pendulum Curves. (W. J. Loudon, B.A., March 24th, 1883.)

The Practical and Theoretical Study of Archæology. (C. A. Hirschfelder, Esq., March 31st, 1883.)

On the Microscopic Organisms found in Toronto Tap-water. Messrs. Acheson and McKenzie, April 7th, 1883.)

A Chemical Analysis of the Toronto Water Supply. (Prof. Ellis, April 7th, 1883.)

The Hymenoptera of Ontario. (Mr. William Brodie, April 14th, 1883.)

What is Wealth? (W. A. Douglas, Esq., April 21st, 1883.)

Some new Emendations in the Text of Shakespeare. (E. A. Meredith, Esq., LL.D., April 21st, 1883.)

Colonies for Invalid School Children. (Dr. Covernton, April 28th, 1883.)

On the Discovery of the Pelly River. (J. H. Hunter, Esq., M.A., May 5th, 1883.)

On the Prairie Chicken. (Ernest E. T. Seton, May 5th, 1883.)

ADDITIONS TO THE LIBRARY OF THE CANADIAN INSTITUTE.

Received from April 1st, 1882, to March 31st, 1883.

I.—DONATIONS.

Le Figaro et Supplement, Paris. Presented by G. E. Shaw, Esq., M.A.

Le Temps, Paris. Presented by Dr. C. W. Covernton.

The Spectator, London. Presented by Prof. Hutton, University College.

Das Echo, Berlin. Presented by W. H. Vander Smissen, M.A., University College.

The Historye of the Bermudas, edited from a MS. in the Sloane Collection, by General Sir J. H. Lefroy, R.A., C.B. Presented by the Editor.

Obstetric Table, by G. Spratt. 3rd Ed., 2 Vols. Presented by Dr. T. Cowdry.

The Financial Reform Almanac for 1883. Presented by the Cobden Club.

On the Results of Recent Explorations of Erect Trees, containing Animal Remains in the Coal Formation of Nova Scotia, by J. W. Dawson, LL.D., F.R.S. Presented by the Author.

First Annual Report of the Bureau of Ethnology for 1879-80. Presented by the Director, J. W. Powell, Esq.

Documents Relating to the Colonial History of the State of New York. Vol. 2. New Series. Presented by the Trustees of the New York State Library.

The Century Magazine for March, 1882. Presented by James Bain, jun., Esq.

Papers on "Canadian Fresh Water Polyzoa," "Parasites in the Pork Supply of Montreal," and "Certain Parasites in the Blood of the Frog," by William Osler, Esq., M.D. Presented by the Author.

Paper on the Origin of the so-called "Test Cells," in the Ascidian Oran, by J. Playfair McMurrich, B.A. Presented by the Author.

II.—EXCHANGES.

CANADA:

The Statutes of Ontario for 1882.

The Canadian Entomologist, Nos. 5-12, 1882, and Nos. 1-3, 1883.

Transactions of the Ottawa Field Naturalists' Club, No. 3, and Circular.

The Canadian Naturalist, Vol. X., Nos. 2, 3, 4, 5, 7.

Bulletin of the Natural History Society of New Brunswick, Nos. 1 and 2.

Discovery of Tripoli, near St. John. Pamphlet.

Annual Report of the Natural History of New Brunswick.

Medicinal Plants of New Brunswick.

Transactions of the Literary and Historical Society of Quebec, 1881-82.

The Canadian Practitioner and Canadian Journal of Medical Science to March, 1883.

Publications of the Manitoba Historical and Scientific Society, Winnipeg, Nos. 1-4.

Transactions, No. 3.

Annual Report, 1882-83.

The Monthly Weather Review of the Meteorological Service, Dominion of Canada, April, 1882, to March, 1883.

General Meteorological Register for the year 1882.

The Weekly Health Bulletin, issued by the Board of Health of Ontario.

First Annual Report of the Provincial Board of Health of Ontario for 1882.

UNITED STATES OF AMERICA:

Transactions of the New York Academy of Sciences, 1882-83.

Annals of the New York Academy of Sciences, 1882.

Memoirs of the Boston Society of Natural History, 1882.

Proceedings of the Boston Society of Natural History, 1882.

Bulletin of the Essex Institute, Salem, 1881.

Flora of Essex Co., Mass., by J. Robinson, 1880.

The Penn Monthly, New York, June, 1882.

Publications of the Missouri Historical Society, Nos. 5-7, 1881-83.

Proceedings of the Academy of Sciences, Philadelphia, 1882.
The Pennsylvania Magazine of History and Biography, Nos. 21–23, 1882.
Annual Report of the Peabody Institute, Baltimore, 1882.
Smithsonian Report, 1880.
Bulletin of the Minnesota Academy of Natural Sciences, Vol. 2, No. 2. Proceedings, 1881.
Annual Report of Yale Observatory, 1881–82.
Bulletin of the Museum of Comparative Zoology, Harvard College, Vol. X., Nos. 1–4.
Annual Report of the Curator of the Museum of Comparative Zoology, at Harvard College, for 1881–82.
Worcester Town Records, 1882.
Proceedings of the American Antiquarian Society, Vol. 2, Parts 1 and 2. 1882.
Proceedings of the Davenport Academy of Natural Sciences, Vol. III., Part 2, 1882.
The Journal of Speculative Philosophy, Vol. XVI., Nos. 1 to 4, 1882.
Scientific Proceedings of the Ohio Mechanics' Institute, Vol. 1, No. 4; Vol. 2, No. 1, 1882–83.
Annual Address of the President before the Bridgeport Scientific Society, 1882.
Bulletin of the Buffalo Society of Natural Sciences, Vol. IV., No. 3, 1882.
Thirty-first Annual Report of the New York State Museum of Natural History, by the Requests of the University of the State of New York.
Sixty-second, Sixty-third and Sixty-fourth Annual Reports of the Trustees of the New York State Library for the years 1880 and 1881.

MEXICO:

Anales del Museo Nacional de Mexico, Iomo 2 and 3, 1882–83.

ENGLAND:

Proceedings of the Royal Geographical Society, 1882–83.
Transactions of the Royal Geographical Society, July, 1882.
Journal of the Anthropological Institute of Great Britain and Ireland, Vol. 11, No. 4; Vol. 12, Nos. 1–3.
The Journal of the Transactions of the Victoria Institute, March, 1882, No. 61, No. 62, and November, 1882.
Journal of the Royal Microscopical Society, Nos. 27 to 32.
Minutes and Proceedings of the Institute of Civil Engineers, Vols. 53, 59, Part 3, 67, 70.
Journal of the Linnean Society, Zoology, Vol. 13, No. 72, 1878; Vol. 14, Nos. 73–80, 1877–79; Vol. 15, Nos. 81–88, 1880–81; Vol. 16, Nos. 89–94, 1881–82.
Journal of the Linnean Society, Botany, Vol. 16, Nos. 93–97, 1877–78; Vol. 17, Nos. 98–105, 1878–80; Vol. 18, Nos. 106–113, 1880–81; Vol. 19, Nos. 114–121, 1881–82.

Proceedings of the Linnean Society of London from November, 1875, to June, 1880.

List of the Linnean Society of London for 1877-78; November 1, 1879; January, 1881.

Proceedings of the Literary and Philosophical Society of Liverpool, Vols. 33 and 34.

Proceedings of the Royal Colonial Institute, Vol. 13, 1881-82.

Transactions of the Manchester Geological Society, Vol. 16, Parts 14-18; Vol. 17, Parts 1-4.

Transactions of the Royal Geological Society of Cornwall, Vol. X., Part 3.

Catalogue of the Royal Geological Society of Cornwall, 1882.

Annual Report of the Leeds Philosophical and Literary Society, 1881-82.

Eighth Annual Report of the Public Library and Gallery of Art Committee, 1881-82.

The Scientific Roll, by Alexander Ramsay, F.G.S., Nos. 1-10. 1880-83.

SCOTLAND:

Proceedings of the Society of Antiquaries of Scotland, 3 Vols, 1878-79, 1880, 1881.

Proceedings of the Philosophical Society of Glasgow, 1881-82, Vol. 13, No. 2.

Transactions of the Royal Society of Edinburgh, 1880-81.

Proceedings of the Royal Society of Edinburgh, 1880-81.

Transactions of the Royal Scottish Society of Arts, Vol. X., Part 4.

IRELAND:

Proceedings of the Royal Irish Academy, Vol. 2, No. 3; Vol. 3, Nos. 7 and 8.

Transactions of the Royal Irish Academy, Vol. 28, Nos. 6-10.

Annual Reports, Belfast Natural History Society, 1879 80, 1880, 1881.

Index of Proceedings, Vol. 1, 1873-80.

Annual Report and Proceedings of the Belfast Naturalists' Field Club, Series II., Vol. 1, Part 4.

INDIA:

Geology of India, Part III.

Economic Geology.

Records of the Geological Survey, Parts 2, 3, 4, Vol. XIII., 1881.

Memoirs of the Geological Survey, Parts 1, 2, 3, Vol. XVIII.

Palæontologia Indica, Series II., XI., XII., XIII., XIV.

NEW SOUTH WALES:

Annual Report, Department of Mines, 1881.

Mineral Products of New South Wales, 1882.

NEW ZEALAND:

Transactions of the New Zealand Institute, Vol. XIV., 1881.

TASMANIA:

Proceedings of the Royal Society of Tasmania for 1880.

GERMANY AND AUSTRIA:

Abhandlungen herausgegeben vom Naturwissenschaftlichen Vereine zu Bremen, Bremen, Band VII., Heft 3, 1882.

Verhandlungen des Naturhistorischen Vereines der Preussichen Rheinlande und Westfalens, Bonn, 1881 and 1882.

Die Käfer Westfalens, 1 and 2 Abtheilung.

Supplement zu den Verhandlungen, 1881-82.

Sitzungsberichte und Abhandlungen der Naturwissenschaftlichen Gesellschaft Isis in Dresden, Dresden, 1881-82.

Einundzwanzigster Bericht der Oberhessischen Gesellschaft für Natur und Heilkunde, Giessen, 1882.

Nachrichten von der K. Gesellchaft der Wissenschaften und der Georg Augusts Universität zu Göttingen, Göttingen, 1881, Nos. 1-16.

Unterhaltung des Naturwissenschaftlichen Vereins von Hamburg-Altona, Hamburg, 1879.

Verhandlungen des Naturwissenschaftlichen Vereins von Hamburg-Altona, Hamburg, 1881.

Abhandlungen des Naturwissenschaftlichen Vereins von Hamburg-Altona, Hamburg, 1883.

Schriften der Physikalisch-Ökonomischen Gesellschaft, Königsberg, 1881-82.

Meteorologische und Magnetische Beobachtungen der K. Sternwarte bei München, Munich. 1881.

Berichte und Abhandlungen der K. Bayerischen Akademie der Wissenschaften zu München, Munich, 1881-82.

Beobachtungen der K. K. Sternwarte zu Prag, Prag, 1881.

Führer zu den Excursionen der Deutschen Geologischen Gesellschaft, Vienna.

Katalog der K. K. Geologischen Reichsanstalt, Vienna.

Jahrbuch der K. K. Geologischen Reichsanstalt, Vienna, 1881-82.

Verhandlungen der K. K. Geologischen Reichsanstalt, Vienna, 1882.

General-Register K. K. Geologischen Reichsanstalt, Vienna, 1872.

Mittheilungen der K. K. Geographischen Gesellschaft in Wien, 1881.

Verhandlungen der K. K. Zoologisch-Botanischen Gesellschaft in Wien, XXXI. Band, 1882.

HOLLAND:

Jaarboek van de Koninklijke Akademie van Wetenschappen, Amsterdam, 1880.

Verhandelingen der Koninklijke Akademie van Wetenschappen, 21 Part, 1881.

Verslagen et Mededeelingen der K. Akad., Reeks, Deel XVI., Stuk 1 and 2, 1881.

Archives Néerlandaises des Sciences Exactes et Naturelles par la Societé Hollandaise des Sciences à Harlem, Haarlem, Tome 17, 1882.

Archives du Musée Teyler, 2 Part.

Nederlandsch Meteorologisch Jaarboek, Utrecht, voor 1881.

ITALY :

Pubblicazioni del R. Istituto di Studj Superiori Pratici e di Perfezionamento in Firenze, Florence, 5 Parts.

Atti della Società Toscana di Scienze Naturali, Pisa, 1881–82.

Cosmos dœ Guido Cora, Turin, Vol. 7, 1882, Parts 5 and 6,

DENMARK :

Oversigt over der Kongelige Danske Videnskabernes Selskabs, Copenhagen, Nos. 2 and 3, 1881 ; No. 1, 1882.

NORWAY :

Nyt Magazin for Naturvidenskaberne, Christiania, 1880–82.

Beretning om Bodsfaengslets Virksomhed, 1878–81.

Foreningen til Norske Fortidsmindes-Merkers Bevaring, 1880.

Fordhandlinger i Videnskabs-Selskaber i Christiania, 1879–81.

Enumeratio Insectorum Norvegicorum, 1880.

Kunst og Haandverk fra Norges Fortid.

Norske Bygringer fra Fortiden.

Carcinologiske Bidrag til Norges Fauna.

III.—PURCHASES.

The following are subscribed for and regularly received :

Edinburgh Review.
Westminster Review.
London Quarterly Review.
British Quarterly Review.
Contemporary Review.
Fortnightly Review.
North American Review.
Nineteenth Century.
Princeton Review.
Popular Science Monthly.
Blackwood's Magazine.
Atlantic Monthly Magazine.
Century Illustrated Magazine.
Longman's Magazine.
Macmillan's Magazine.
Mind.
Brain.
Athenæum.
Critic.
St. James's Gazette.
London Times, Weekly Edition.
Graphic.
Punch.
London Lancet.
American Journal of the Medical Sciences.
Medical News.
Scientific American and Supplement.
Nature.
Builder.
English Mechanic and World of Science.
Bystander.