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ON THE

REDUCTION OF THE BAROMETER TO SEA LEVEL.

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The application of an approximately correct reduction to barometric readings, taken at various levels, in order to reduce them to what they would have been at one specified level, is absolutely necessary for their intercomparison. In the following paper several formulæ which have been employed for this purpose are examined; and tables are appended by means of which, with very little calculation, a sufficiently correct reduction may be obtained, and which are, moreover, peculiarly adapted to the computation of tables of reduction for individual stations.

Guyot's Tables* D, XVI. and XIX'., are commonly employed, on this continent, for the purpose of effecting the reduction. These give the height, in English feet, of a column of air corresponding to a tenth of an inch in the barometer at various temperatures, the barometric pressure at the base of the column being from 22 inches to 30·4 inches.

A formula is given for use with Table XVI., which may be written

$$R = \frac{Z}{N} \times \frac{\beta}{10b}, \qquad \text{(i.)}$$

where R represents the required reduction in inches; Z the difference of height between the two stations, or the height above the sea (expressed in feet), N the number in the table, β the observed reading of the barometer reduced to 32° Fahr., and b the pressure on which the tabular number N is based,† that is, 30 inches.

*Meteorological and Physical Tables. Third edition. Washington, 1859. By Arnold Guyot, P.D., LL.D., Professor of Geology and Physical Geography, College of New Jersey.

†Guyot defines what is here represented by b, as "the normal height of barometer at the sea-level," and in an example which he gives, he employs 30 in. It is, however, only because the table is based on a barometric reading of 30 in., that this value of b is to be employed.

No formula is given for use with Table XIX.′, but it is stated that the table may be employed "for reducing barometrical observations to the level of the sea, and also to any other level by a similar process." An example is, however, given, applying tables in French measure, corresponding to XIX.′, the method of which example may be represented by the formula

$$R = \frac{2\,Z}{{}_{\beta}N_{t} + {}_{B}N_{T}} \cdot \frac{1}{10}, \qquad \text{(ii.)}$$

where ${}_{\beta}N_{t}$ is the number in the table corresponding to the barometric reading* and temperature at the upper station, and ${}_{B}N_{T}$ that corresponding to those at the lower station; an approximate reduced barometric reading and temperature being employed in taking out the latter quantity.

Formula (i.) may also be employed with Table XIX.′, b being any height and N the number in the table corresponding to b. No advantage is, however, gained, by using this table instead of Table XVI. with formula (i.), unless b be taken nearly equal to β, so that we may have, nearly

$$R = \frac{Z}{10\,N}.$$

Laplace's formula for computing differences of elevation from barometrical observations, from which each of the above is deduced, may be written

$$Z = A_{t} \log \frac{B}{\beta}, \qquad \text{(iii.)}$$

where A_{t} is a constant, depending on the mean between the temperatures at the upper and lower stations. Strictly, it also depends upon the latitude of the station, and on the height above the sea; but the variations due to these may be neglected, unless the height is very considerable.

Now the number ${}_{b}N_{t}$, in the above mentioned tables, for barometer reading b, and temperature t, is the difference of elevation

* Throughout this paper, when a barometric reading is spoken of, the reading reduced to temp. 32° Fahr. is to be understood.

of two stations, the temperature being t, the barometer reading at lower station b, and at the upper station $b - \frac{1}{10}$. Hence, by (iii.),

$$ {}_bN_t = A_t \log \frac{b}{b - \frac{1}{10}}. $$

Also R being the reduction, (iii.) may be written

$$ Z = A_t \log \frac{\beta + R}{\beta}. $$

Combining these, we get

$$ \log \left(1 + \frac{R}{\beta}\right) = \frac{Z}{{}_bN_t} \log \frac{10b}{10b - 1}; $$

hence, $$ 1 + \frac{R}{\beta} = \left(\frac{10\,b}{10\,b - 1}\right)^{\frac{Z}{{}_bN_t}} = \left(1 - \frac{1}{10\,b}\right)^{-\frac{Z}{{}_bN_t}} $$

$$ = 1 + \frac{Z}{{}_bN_t} \cdot \frac{1}{10\,b} + \frac{1}{1.2} \cdot \frac{Z}{{}_bN_t} \cdot \overline{\frac{Z}{{}_bN_t} + 1} \cdot \overline{\frac{1}{10\,b}}\Big|^2 + \dots. $$

by the binomial theorem.

$$ \therefore R = \beta \left(\frac{Z}{{}_bN_t} \cdot \frac{1}{10\,b} + \frac{1}{1.2} \cdot \frac{Z}{{}_bN_t} \cdot \overline{\frac{Z}{{}_bN_t} + 1} \cdot \overline{\frac{1}{10\,b}}\Big|^2 + \dots \right) \text{(iv.)} $$

Formula (i.) is deduced from (iv.), by neglecting all terms beyond the first; and making $b = 30$ inches, if used with Table XVI.; but, if used with Table XIX.', b may be any reading within the range of the table, and ${}_bN_t$ the *corresponding* number from the table.

Although (i.) is sufficiently accurate for small heights, it is evident, on comparing it with the full formula (iv.), that it becomes more and more inaccurate as the height increases.

If, in (i.), the reduced height B, were substituted for the observed height β, the error would be relatively less; for Laplace's formula may also be expanded in the form

$$ R = B \left(\frac{Z}{{}_bN_t} \cdot \frac{1}{10b} - \frac{1}{1.2} \cdot \frac{Z}{{}_bN} \cdot \overline{\frac{Z}{{}_bN} - 1} \cdot \overline{\frac{1}{10\,b}}\Big|^2 + \dots \right) \text{(v.)} $$

In this formula each term, after the first, is relatively smaller than the corresponding term in (iv.); and if $\dfrac{Z}{{}_{b}N_t}$ is large, the terms having sensible magnitude, are alternately positive and negative. Therefore the error, introduced by neglecting all terms beyond the first, is relatively less in (v.) than in (iv.); but, since B is not known until R has been determined, this formula could only be employed by successive approximation, and is therefore inconvenient.

It may be seen by inspection that, in Table XIX.', ${}_{B}N_t$ is very nearly equal to $\dfrac{\beta}{B} \cdot {}_{\beta}N_t$. That this should be so, may be proved thus:—

As already explained

$$ {}_{B}N_t = A_t \log \frac{10\,B}{10\,B - 1}, $$

$$ {}_{\beta}N_t = A_t \log \frac{10\,\beta}{10\,\beta - 1}. $$

$$ \therefore \frac{{}_{B}N_t}{{}_{\beta}N_t} = \frac{\log \dfrac{10\,B}{10\,B - 1}}{\log \dfrac{10\,\beta}{10\,\beta - 1}} = \frac{\log \left(1 - \dfrac{1}{10\,B}\right)^{1}}{\log \left(1 - \dfrac{1}{10\,\beta}\right)}. $$

$$ = \frac{\dfrac{1}{10\,B} + \dfrac{1}{2} \cdot \overline{\dfrac{1}{10\,B}}\Big|^{2} + \dots}{\dfrac{1}{10\,\beta} + \dfrac{1}{2} \cdot \overline{\dfrac{1}{10\,\beta}}\Big|^{2} + \dots}. $$

$$ = \frac{\beta}{B} \text{ nearly,} \qquad \text{(vi.)} $$

$$ \therefore {}_{B}N_t = \frac{\beta}{B} \cdot {}_{\beta}N_t \text{ nearly, as above stated.} $$

From (iv.) and (v.), together with (vi.), we may deduce (ii.), thus: In (iv.), let $b = \beta$, we obtain

$$R = \frac{Z}{{}_{\beta}N_t} \cdot \frac{1}{10} + \frac{1}{1.2} \cdot \frac{Z}{{}_{\beta}N_t} \cdot \overline{\frac{Z}{{}_{\beta}N_t} + 1} \cdot \frac{1}{100\,\beta} + \cdots\cdot$$

$$\therefore\ {}_{\beta}N_t \cdot R = \frac{Z}{10} + \frac{1}{1.2} \cdot \frac{Z}{10} \cdot \overline{\frac{Z}{{}_{\beta}N_t} + 1} \cdot \frac{1}{10\,\beta} + \cdots\cdot$$

Similarly from (v.) making $b = B$,

$${}_{B}N_t \cdot R = \frac{Z}{10} - \frac{1}{1.2} \cdot \frac{Z}{10} \cdot \overline{\frac{Z}{{}_{B}N_t} - 1} \cdot \frac{1}{10\,B} + \cdots\cdot$$

$$\therefore\ \left({}_{\beta}N_t + {}_{B}N_t\right) R = \frac{2Z}{10} + \frac{1}{1.2} \cdot \frac{Z}{10} \cdot \left(\frac{Z}{10\beta . {}_{\beta}N_t} - \frac{Z}{10B . {}_{B}N_t} + \frac{1}{10\beta} + \frac{1}{10B}\right) + \cdots$$

But from (vi.) $B . {}_{B}N_t = \beta . {}_{\beta}N_t$ nearly.

$$\therefore\ \left({}_{\beta}N_t + {}_{B}N_t\right) R = \frac{2Z}{10} + \frac{1}{1.2} \cdot \frac{Z}{10} \cdot \left(\frac{1}{10\,\beta} + \frac{1}{10\,B}\right) \text{ nearly,}$$

or, neglecting the second term on the right,

$$R = \frac{2\,Z}{{}_{\beta}N_t + {}_{B}N_t} \cdot \frac{1}{10} \text{ nearly.}$$

Here t is the mean between the temperatures at the upper and lower stations; whilst in (ii.) these two temperatures are respectively employed, in taking out the two numbers. The difference thus introduced is very trifling; as may easily be seen, if the value given below for A_t, be substituted in the expression for N_t.

Formula (ii.), like (v.), is objectionable, in that it assumes a knowledge of the reduced reading, which it is the object to ascertain.

The foregoing formulæ being all either inconvenient, or not sufficiently accurate except for small elevations, I have formed the accompanying tables (A and B), to facilitate the calculation of the reduction.

It will be noticed from the form of (iii.) that, at any place, the temperature being constant, the reduced reading, and therefore *also the reduction, varies as* β. It is, therefore, sufficient to calculate the reduction ${}_Z N_t$, for one barometer reading (b) only; from which that for any other reading may be obtained by a simple proportion. It is immaterial whether the value adopted for b be one which could be attained, or not; it may therefore be chosen with reference to convenience alone. In Table A, b is taken equal to 100 inches, so that the reduction for any reading (β) of the barometer, may be obtained by the formula

$$R = \frac{\beta}{100} \cdot {}_Z N_t .$$

Table A was calculated by means of formula (iii.), the value of A_t being taken as* $60345.51 \left(1 + \frac{t-32}{450}\right)$. In this table is given the quantity ${}_Z N_t$, for values of Z equal to 100, 200, 300, &c. feet, for every second degree of temperature from $-40°$ to $100°$ Fahr., and also, the difference for the next 100 feet at each height. It is sufficient to employ first differences only, in using the table.

Table B is intended to diminish the labour in applying formula (iii.), as will be explained in the sequel.

Since calculating these tables, my attention has been called to a paper by Lieut. H. H. C. Dunwoody, U. S. Army, in the Report of the Chief Signal Officer, Washington, 1876. In this paper tables are given, based in part on observations taken by direction of the Chief Signal Officer, U. S. A., on Mount Washington, Mount Mitchell, and Pikes Peak.

In the first table is given the decrease of temperature for each 100 feet of elevation at each hour in the day. In the second table is given the "weight of a column of air 100 feet high, at different barometric pressures and temperatures, expressed in decimals of an inch, calculated for north latitude 40°." The third table "shows a

* See Guyot's Paper D, pp. 9 and 88.

small empirical correction, determined from accurate comparison of reduced readings and actual observations, to be applied to Table II." A formula is also given, which may be written $R = (N + N')\ Z$, in which N is the number from Table II., and N' that from Table III.

If we compare this formula with (iv.), it is evident that some correction to N is necessary, since R does not *vary as* Z. The correction should, however, depend on the reading of the barometer (β) as well as on Z and t; but the empirical correction N' is given without regard to β.

The constants and formula, on which Table II. is based, are not given; and the rate of variation of the numbers, with the pressure, seems to deviate more than it should, from Boyle's Law.

Lieut. Dunwoody's Tables have not, so far as I am aware, been anywhere brought into use. The results given by his Tables II. and III. do not, however, differ much at moderate altitudes from those given by Table A, as will be seen from the following examples:

EXAMPLES OF THE USE OF TABLE A.

Example (1).—At a station 815 ft. above the sea, the reading of the barometer being 29.112 in., the temperature of the air 46° Fahr., to find the reduced reading.

From Table A we find ${}_{800}N_{46} = 3.0047$, and the difference for 100 ft. = 0.3819.

Hence the reduction,

$$R = \left(3.0047 + \frac{15}{100} \times 0.3819\right) \times 0.29112 = 3.0620 \times 0.29112$$
$$= 0.891,$$

and the reduced reading is 30.003.

Guyot's tables D, XVI. and XIX.' used with formula (i.), each give, for this reduction, 0.876 in. Lieut. Dunwoody's tables (ii.) and (iii.) give 0.890.

Example (2).—At a station 1100 ft. above the sea, the reading of the barometer being 28 in., the temperature of the air 30° Fahr., to find the reduction to sea level.

Here ${}_{1000}N_{30} = 3.9071$, and the difference for 100 ft. is 0.3990,

hence $$R = (3.9071 + 0.3990) \times 0{\cdot}28 = 4.3061 \times 0.28$$
$$= 1.206.$$

Guyot's Tables D, XVI. and XIX.', if extended, used with formula (i.), would give in this case 1.179, and Lieut. Dunwoody's give 1.204.

The value of Table A does not, however, consist so much in supplying a basis for working out isolated examples, as in furnishing data, in a convenient form, for the calculation of tables of reduction to sea level, for individual stations. To construct these all that is necessary is, first, to obtain the numbers ${}_Z N_t$ for every second degree of temperature, the value assigned to Z being the height of the cistern of the barometer above the sea; and then, to multiply these numbers by $\frac{b}{100}$, and tabulate the values of the reduction so obtained for values of b, between convenient limits, and at larger or smaller intervals, according as the station is at a slight or considerable elevation above the sea. The products for any given temperature need not be obtained separately, but may be found, one from another, by continued addition, and the whole process may be very quickly performed with the aid of the Arithmometer of Thomas de Colmar, for use with which the table is specially adapted.

The time occupied in forming a table in this way, is less than one half of what is required if the formula of Laplace (iii. of this paper) be employed.

For stations more than 1100 ft. above the sea, Table B (from which Table A was deduced) may be employed. In this table the values of $\frac{100{,}000}{A_t}$ are given; so that if N_t is the number in the table for temperature t, formula iii. becomes

$$\log \frac{B}{\beta} = \frac{Z}{100{,}000} N_t ,$$

$$\text{or} \log B = \frac{Z}{100{,}000} N_t + \log \beta .$$

For isolated examples this form is sufficiently convenient; but, in constructing a table for any station, it is better to make $\beta = 100$. The formula then becomes

$$\log \left(100 + {}_Z N_t \right) = \frac{Z}{100{,}000} N_t + 2 ,$$

and the table may be calculated from the value of ${}_Z N_t$ in the same way as when Table A is employed.

A table for reducing the barometer to sea level is furnished from the Central Office, Toronto, to each station in connection with the Meteorological Service of the Dominion.

Formerly these were computed directly from formula iii. (using a slightly different constant from that given above.) The accompanying tables were recently calculated to diminish the labour of computation.

In Canada, no reduction for height is applied to the observed temperature of the air; as, although some correction might be of advantage, it is by no means certain that a correction, obtained from observations on a mountain, would be suited to a station on an elevated table-land. The correction, if it were applied, would, however, be very small at nearly all our stations.

I hope to discuss, more fully, on some future occasion the question of the necessity for a correction to the observed temperature of the air in reducing barometric readings.

TABLE A.

Giving the value of $\underset{Z\ \ t}{N}$ for various temperatures and elevations, and the difference for an additional 100 feet at each height.

Temperature.	100 Feet.		200 Feet.		300 Feet.		400 Feet.		500 Feet.		Temperature.
	$\underset{Z\ \ t}{N}$	Diff. for 100 ft.	$\underset{Z\ \ t}{N}$	Diff. for 100 ft.	$\underset{Z\ \ t}{N}$	Diff. for 100 ft.	$\underset{Z\ \ t}{N}$	Diff. for 100 ft.	$\underset{Z\ \ t}{N}$	Diff. for 100 ft.	
—40°	0.4553	.4573	0.9126	.4595	1.3721	.4615	1.8336	.4636	2.2972	.4658	—40°
—38	0.4529	.4549	0.9078	.4570	1.3648	.4590	1.8238	.4612	2.2850	.4632	—38
—36	0.4505	.4525	0.9030	.4546	1.3576	.4566	1.8142	.4587	2.2729	.4607	—36
—34	0.4482	.4501	0.8983	.4522	1.3505	.4542	1.8047	.4562	2.2609	.4583	—34
—32	0.4458	.4478	0.8936	.4498	1.3434	.4519	1.7953	.4538	2.2491	.4558	—32
—30	0.4435	.4455	0.8890	.4475	1.3365	.4494	1.7859	.4515	2.2374	.4534	—30
—28	0.4412	.4432	0.8844	.4452	1.3296	.4471	1.7767	.4491	2.2258	.4510	—28
—26	0.4390	.4409	0.8799	.4428	1.3227	.4448	1.7675	.4468	2.2143	.4487	—26
—24	0.4368	.4386	0.8754	.4406	1.3160	.4425	1.7585	.4444	2.2029	.4464	—24
—22	0.4345	.4365	0.8710	.4383	1.3093	.4402	1.7495	.4422	2.1917	.4440	—22
—20	0.4324	.4342	0.8666	.43[illegible]	1.3027	.4380	1.7407	.4398	2.1805	.4418	—20
—18	0.4302	.4320	0.8622	.4339	1.2961	.4358	1.7319	.4376	2.1695	.4395	—18
—16	0.4280	.4299	0.8579	.4317	1.2896	.4336	1.7232	.4354	2.1586	.4373	—16
—14	0.4259	.4277	0.8536	.4296	1.2832	.4314	1.7146	.4332	2.1478	.4351	—14
—12	0.4238	.4256	0.8494	.4274	1.2768	.4293	1.7061	.4310	2.1371	.4329	—12
—10	0.4217	.4235	0.8452	.4253	1.2705	.4271	1.6976	.4289	2.1265	.4307	—10
— 8	0.4197	.4214	0.8411	.4232	1.2643	.4250	1.6893	.4267	2.1160	.4286	— 8
— 6	0.4176	.4194	0.8370	.4211	1.2581	.4229	1.6810	.4247	2.1057	.4264	— 6
— 4	0.4156	.4173	0.8329	.4191	1.2520	.4208	1.6728	.4226	2.0954	.4243	— 4
— 2	0.4136	.4153	0.8289	.4171	1.2460	.4187	1.6647	.4205	2.0852	.4222	— 2
0	0.4116	.4133	0.8249	.4151	1.2400	.4167	1.6567	.4184	2.0751	.4202	0
2	0.4097	.4113	0.8210	.4130	1.2340	.4147	1.6487	.4164	2.0651	.4182	2
4	0.4077	.4094	0.8171	.4110	1.2281	.4128	1.6409	.4144	2.0553	.4160	4
6	0.4058	.4074	0.8132	.4091	1.2223	.4107	1.6330	.4125	2.0455	.4141	6
8	0.4039	.4055	0.8094	.4071	1.2165	.4088	1.6253	.4105	2.0358	.4121	8
10	0.4020	.4036	0.8056	.4052	1.2108	.4069	1.6177	.4085	2.0262	.4101	10
12	0.4001	.4017	0.8018	.4033	1.2051	.4050	1.6101	.4065	2.0166	.4082	12
14	0.3982	.3999	0.7981	.4014	1.1995	.4031	1.6026	.4046	2.0072	.4063	14
16	0.3964	.3980	0.7944	.3996	1.1940	.4011	1.5951	.4028	1.9979	.4043	16
18	0.3946	.3961	0.7907	.3978	1.1885	.3992	1.5877	.4009	1.9886	.4025	18
20	0.3928	.3943	0.7871	.3959	1.1830	.3974	1.5804	.3990	1.9794	.4006	20
22	0.3910	.3925	0.7835	.3941	1.1776	.3956	1.5732	.3972	1.9704	.3987	22
24	0.3892	.3908	0.7800	.3922	1.1722	.3938	1.5660	.3954	1.9614	.3968	24
26	0.3875	.3889	0.7764	.3905	1.1669	.3920	1.5589	.3935	1.9524	.3951	26
28	0.3857	.3872	0.7729	.3888	1.1617	.3902	1.5519	.3917	1.9436	.3932	28

TABLE A.—*Continued.*

Temperature.	600 Feet. $\frac{N}{Z\ t}$	600 Feet. Diff. for 100 ft.	700 Feet. $\frac{N}{Z\ t}$	700 Feet. Diff. for 100 ft.	800 Feet. $\frac{N}{Z\ t}$	800 Feet. Diff. for 100 ft.	900 Feet. $\frac{N}{Z\ t}$	900 Feet. Diff. for 100 ft.	1000 Feet. $\frac{N}{Z\ t}$	1000 Feet. Diff. for 100 ft.	Temperature.
−40°	2.7630	.4678	3.2308	.4700	3.7008	.4721	4.1729	.4743	4.6472	.4764	−40°
−38	2.7482	.4653	3.2135	.4675	3.6810	.4695	4.1505	.4717	4.6222	.4738	−38
−36	2.7336	.4629	3.1965	.4649	3.6614	.4670	4.1284	.4690	4.5974	.4713	−36
−34	2.7192	.4603	3.1795	.4624	3.6419	.4645	4.1064	.4666	4.5730	.4686	−34
−32	2.7049	.4579	3.1628	.4599	3.6227	.4620	4.0847	.4640	4.5487	.4661	−32
−30	2.6908	.4555	3.1463	.4574	3.6037	.4595	4.0632	.4616	4.5248	.4636	−30
−28	2.6768	.4531	3.1299	.4550	3.5849	.4571	4.0420	.4591	4.5011	.4611	−28
−26	2.6630	.4507	3.1137	.4526	3.5663	.4546	4.0209	.4567	4.4776	.4586	−26
−24	2.6493	.4483	3.0976	.4503	3.5479	.4522	4.0001	.4543	4.4544	.4562	−24
−22	2.6357	.4460	3.0817	.4480	3.5297	.4498	3.9795	.4519	4.4314	.4538	−22
−20	2.6223	.4437	3.0660	.4456	3.5116	.4475	3.9591	.4495	4.4086	.4514	−20
−18	2.6090	.4414	3.0504	.4433	3.4937	.4453	3.9390	.4471	4.3861	.4490	−18
−16	2.5959	.4391	3.0350	.4411	3.4761	.4429	3.9190	.4448	4.3638	.4467	−16
−14	2.5829	.4369	3.0198	.4388	3.4586	.4406	3.8992	.4425	4.3417	.4444	−14
−12	2.5700	.4347	3.0047	.4365	3.4412	.4384	3.8796	.4403	4.3199	.4421	−12
−10	2.5572	.4325	2.9897	.4344	3.4241	.4362	3.8603	.4380	4.2983	.4398	−10
− 8	2.5446	.4303	2.9749	.4322	3.4071	.4340	3.8411	.4358	4.2769	.4376	− 8
− 6	2.5321	.4282	2.9603	.4300	3.3903	.4318	3.8221	.4336	4.2557	.4354	− 6
− 4	2.5197	.4261	2.9458	.4278	3.3736	.4297	3.8033	.4314	4.2347	.4332	− 4
− 2	2.5074	.4240	2.9314	.4257	3.3571	.4275	3.7846	.4293	4.2139	.4310	− 2
0	2.4953	.4219	2.9172	.4236	3.3408	.4254	3.7662	.4271	4.1933	.4289	0
2	2.4833	.4198	2.9031	.4215	3.3246	.4233	3.7479	.4250	4.1729	.4268	2
4	2.4713	.4178	2.8891	.4195	3.3086	.4212	3.7298	.4230	4.1528	.4246	4
6	2.4596	.4157	2.8753	.4175	3.2928	.4191	3.7119	.4209	4.1328	.4225	6
8	2.4479	.4137	2.8616	.4153	3.2769	.4173	3.6942	.4188	4.1130	.4205	8
10	2.4363	.4118	2.8481	.4134	3.2615	.4151	3.6766	.4168	4.0934	.4184	10
12	2.4248	.4098	2.8346	.4115	3.2461	.4131	3.6592	.4147	4.0739	.4165	12
14	2.4135	.4078	2.8213	.4095	3.2308	.4111	3.6419	.4128	4.0547	.4144	14
16	2.4022	.4059	2.8081	.4076	3.2157	.4092	3.6249	.4107	4.0356	.4125	16
18	2.3911	.4040	2.7951	.4056	3.2007	.4072	3.6079	.4089	4.0168	.4104	18
20	2.3800	.4021	2.7821	.4038	3.1859	.4053	3.5912	.4069	3.9981	.4085	20
22	2.3691	.4002	2.7693	.4019	3.1712	.4034	3.5746	.4049	3.9795	.4066	22
24	2.3582	.3984	2.7566	.4000	3.1566	.4015	3.5581	.4031	3.9612	.4046	24
26	2.3475	.3965	2.7440	.3981	3.1421	.3997	3.5418	.4012	3.9430	.4027	26
28	2.3368	.3948	2.7316	.3962	3.1278	.3978	3.5256	.3994	3.9250	.4008	28

TABLE A.—*Continued.*

Temperature.	100 Feet.		200 Feet.		300 Feet.		400 Feet.		500 Feet.		Temperature.
	$\frac{N}{Z\,t}$	Diff. for 100 ft.	$\frac{N}{Z\,t}$	Diff. for 100 ft.	$\frac{N}{Z\,t}$	Diff. for 100 ft.	$\frac{N}{Z\,t}$	Diff. for 100 ft.	$\frac{N}{Z\,t}$	Diff. for 100 ft.	
30°	0.3840	.3855	0.7695	.3869	1.1564	.3885	1.5449	.3899	1.9348	.3915	30°
32	0.3823	.3838	0.7661	.3852	1.1513	.3867	1.5380	.3882	1.9262	.3896	32
34	0.3806	.3820	0.7626	.3836	1.1462	.3849	1.5311	.3864	1.9175	.3879	34
36	0.3789	.3804	0.7593	.3818	1.1411	.3832	1.5243	.3847	1.9090	.3862	36
38	0.3773	.3786	0.7559	.3801	1.1360	.3816	1.5176	.3830	1.9006	.3844	38
40	0.3756	.3770	0.7526	.3785	1.1311	.3798	1.5109	.3813	1.8922	.3827	40
42	0.3740	.3753	0.7493	.3768	1.1261	.3782	1.5043	.3796	1.8839	.3810	42
44	0.3723	.3738	0.7461	.3751	1.1212	.3765	1.4977	.3780	1.8757	.3793	44
46	0.3707	.3722	0.7429	.3734	1.1163	.3749	1.4912	.3763	1.8675	.3777	46
48	0.3691	.3706	0.7397	.3718	1.1115	.3733	1.4848	.3746	1.8594	.3760	48
50	0.3676	.3689	0.7365	.3703	1.1068	.3716	1.4784	.3730	1.8514	.3744	50
52	0.3660	.3673	0.7333	.3687	1.1020	.3700	1.4720	.3714	1.8434	.3728	52
54	0.3644	.3658	0.7302	.3671	1.0973	.3685	1.4658	.3698	1.8356	.3711	54
56	0.3629	.3642	0.7271	.3656	1.0927	.3668	1.4595	.3682	1.8277	.3696	56
58	0.3614	.3627	0.7241	.3640	1.0881	.3653	1.4534	.3666	1.8200	.3679	58
60	0.3599	.3611	0.7210	.3625	1.0835	.3637	1.4472	.3651	1.8123	.3664	60
62	0.3584	.3596	0.7180	.3609	1.0789	.3623	1.4412	.3635	1.8047	.3648	62
64	0.3569	.3581	0.7150	.3594	1.0744	.3607	1.4351	.3620	1.7971	.3633	64
66	0.3554	.3566	0.7120	.3580	1.0700	.3592	1.4292	.3604	1.7896	.3618	66
68	0.3539	.3552	0.7091	.3564	1.0655	.3577	1.4232	.3590	1.7822	.3602	68
70	0.3525	.3537	0.7062	.3550	1.0612	.3562	1.4174	.3574	1.7748	.3588	70
72	0.3510	.3523	0.7033	.3535	1.0568	.3547	1.4115	.3560	1.7675	.3573	72
74	0.3496	.3508	0.7004	.3521	1.0525	.3533	1.4058	.3545	1.7603	.3557	74
76	0.3482	.3494	0.6976	.3506	1.0482	.3518	1.4000	.3531	1.7531	.3543	76
78	0.3468	.3480	0.6948	.3492	1.0440	.3504	1.3944	.3516	1.7460	.3529	78
80	0.3454	.3466	0.6920	.3477	1.0397	.3490	1.3887	.3502	1.7389	.3514	80
82	0.3440	.3452	0.6892	.3464	1.0356	.3475	1.3831	.3488	1.7319	.3499	82
84	0.3426	.3438	0.6864	.3450	1.0314	.3462	1.3776	.3473	1.7249	.3486	84
86	0.3413	.3424	0.6837	.3436	1.0273	.3448	1.3721	.3459	1.7180	.3471	86
88	0.3399	.3411	0.6810	.3422	1.0232	.3434	1.3666	.3446	1.7112	.3457	88
90	0.3386	.3397	0.6783	.3409	1.0192	.3420	1.3612	.3432	1.7044	.3443	90
92	0.3372	.3384	0.6756	.3395	1.0151	.3407	1.3558	.3418	1.6976	.3430	92
94	0.3359	.3371	0.6730	.3382	1.0112	.3393	1.3505	.3404	1.6909	.3416	94
96	0.3346	.3358	0.6704	.3368	1.0072	.3380	1.3452	.3391	1.6843	.3403	96
98	0.3333	.3344	0.6677	.3356	1.0033	.3366	1.3399	.3378	1.6777	.3389	98
100	0.3320	.3332	0.6652	.3342	0.9994	.3353	1.3347	.3365	1.6712	.3376	100

TABLE A.—*Continued.*

Temperature.	600 Feet.		700 Feet.		800 Feet.		900 Feet.		1000 Feet.		Temperature.
	$\frac{N}{Z\ t}$	Diff. for 100 ft.	$\frac{N}{Z\ t}$	Diff. for 100 ft.	$\frac{N}{Z\ t}$	Diff. for 100 ft.	$\frac{N}{Z\ t}$	Diff. for 100 ft.	$\frac{N}{Z\ t}$	Diff. for 100 ft.	
30°	2.3263	.3929	2.7192	.3945	3.1137	.3959	3.5096	.3975	3.9071	.3990	30°
32	2.3158	.3912	2.7070	.3926	3.0996	.3941	3.4937	.3957	3.8894	.3972	32
34	2.3054	.3894	2.6948	.3909	3.0857	.3923	3.4780	.3939	3.8719	.3953	34
36	2.2952	.3876	2.6828	.3891	3.0719	.3905	3.4624	.3921	3.8545	.3935	36
38	2.2850	.3859	2.6709	.3873	3.0582	.3888	3.4470	.3903	3.8373	.3917	38
40	2.2749	.3842	2.6591	.3855	3.0446	.3871	3.4317	.3885	3.8202	.3899	40
42	2.2649	.3824	2.6473	.3839	3.0312	.3853	3.4165	.3868	3.8033	.3882	42
44	2.2550	.3807	2.6357	.3822	3.0179	.3836	3.4015	.3850	3.7865	.3864	44
46	2.2452	.3790	2.6242	.3805	3.0047	.3819	3.3866	.3833	3.7699	.3847	46
48	2.2354	.3774	2.6128	.3788	2.9916	.3802	3.3718	.3816	3.7534	.3830	48
50	2.2258	.3757	2.6015	.3771	2 9786	.3785	3.3571	.3799	3.7370	.3813	50
52	2.2162	.3741	2.5903	.3755	2.9658	.3768	3.3426	.3783	3.7209	.3796	52
54	2.2067	.3725	2.5792	.3738	2.9530	.3752	3.3282	.3766	3.7048	.3779	54
56	2.1973	.3709	2.5682	.3722	2.9404	.3735	3.3139	.3750	3.6889	.3763	56
58	2.1879	.3693	2.5572	.3706	2.9278	.3720	3.2998	.3733	3.6731	.3747	58
60	2.1787	.3677	2.5464	.3690	2.9154	.3704	3.2858	.3717	3.6575	.3730	60
62	2.1695	.3661	2.5356	.3675	2.9031	.3688	3.2719	.3700	3.6419	.3715	62
64	2.1604	.3646	2.5250	.3659	2.8909	.3672	3.2581	.3685	3.6266	.3698	64
66	2.1514	.3630	2.5144	.3644	2.8788	.3656	3.2444	.3669	3.6113	.3682	66
68	2.1424	.3616	2.5040	.3627	2.8667	.3641	3.2308	.3654	3.5962	.3666	68
70	2.1336	.3600	2.4936	.3613	2.8549	.3625	3.2174	.3638	3.5812	.3651	70
72	2.1248	.3585	2.4833	.3597	2.8430	.3610	3.2040	.3623	3.5663	.3636	72
74	2.1160	.3570	2.4730	.3583	2.8313	.3595	3.1908	.3608	3.5516	.3620	74
76	2.1074	.3555	2.4629	.3568	2.8197	.3580	3.1777	.3592	3.5369	.3605	76
78	2.0989	.3540	2.4529	.3552	2.8081	.3566	3.1647	.3577	3.5224	.3590	78
80	2.0903	.3526	2.4429	.3538	2.7967	.3551	3.1518	.3562	3.5080	.3575	80
82	2.0818	.3512	2.4330	.3524	2.7854	.3535	3.1389	.3548	3.4937	.3561	82
84	2.0735	.3497	2.4232	.3509	2.7741	.3522	3.1263	.3533	3.4796	.3545	84
86	2.0651	.3484	2.4135	.3495	2.7630	.3507	3.1137	.3518	3.4655	.3531	86
88	2.0569	.3469	2.4038	.3481	2.7519	.3493	3.1012	.3504	3.4516	.3514	88
90	2.0487	.3455	2.3942	.3467	2.7409	.3479	3.0888	.3490	3.4378	.3502	90
92	2.0406	.3441	2.3847	.3453	2.7300	.3465	3.0765	.3476	3.4241	.3488	92
94	2.0325	.3428	2.3753	.3439	2.7192	.3451	3.0643	.3462	3.4105	.3474	94
96	2.0246	.3414	2.3660	.3425	2.7085	.3437	3.0522	.3448	3.3970	.3460	96
98	2.0166	.3401	2.3567	.3411	2.6978	.3424	4.0402	.3434	3.3836	.3446	68
100	2.0088	.3387	2.3475	.3398	2.6873	.3409	3.0282	.3421	3.3703	.3432	100

TABLE B,

Giving the value of $\frac{100,000}{A_t}$ for various values of t, the value of A_t being $60345.51 \left\{ 1 + \frac{t-32}{450} \right\}$

Temperature.	$\frac{100,000}{A_t}$	Temperature.	$\frac{100,000}{A_t}$	Temperature.	$\frac{100,000}{A_t}$
—40°	1.972767	8°	1.750483	56°	1.573219
—38	1.962384	10	1.742303	58	1.566609
—36	1.952110	12	1.734200	60	1.560054
—34	1.941942	14	1.726171	62	1.553554
—32	1.931880	16	1.718216	64	1.547108
—30	1.921922	18	1.710335	66	1.540715
—28	1.912066	20	1.702525	68	1.534374
—26	1.902311	22	1.694786	70	1.528086
—24	1.892654	24	1.687117	72	1.521849
—22	1.883096	26	1.679518	74	1.515662
—20	1.873633	28	1.671986	76	1.509526
—18	1.864265	30	1.664522	78	1.503439
—16	1.854990	32	1.657124	80	1.497401
—14	1.845807	34	1.649792	82	1.491412
—12	1.836714	36	1.642524	84	1.485470
—10	1.827710	38	1.635320	86	1.479575
— 8	1.818795	40	1.628179	88	1.473727
— 6	1.809966	42	1.621100	90	1.467925
— 4	1.801222	44	1.614082	92	1.462168
— 2	1.792562	46	1.607125	94	1.456457
0	1.783985	48	1.600227	96	1.450790
2	1.775490	50	1.593389	98	1.445166
4	1.767075	52	1.586608	100	1.439587
6	1.758740	54	1.579885		

THE AFFILIATION OF THE ALGONQUIN LANGUAGES.

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One of the modern schools of philologists has not heeded the scholastic maxim concerning *entia*, but has shown itself ready to multiply *origins* indefinitely without cause. Catlin, the artist, who, however, was very far from being a philologist, saw no necessity for showing how the Americans came to America, or that they ever came there at all. And at a conference on American subjects, held some three years ago, the President of the Anthropological Society of Paris found a warm reception for the statement, that the true solution of the question concerning the peopling of America is that the Americans are neither Hindoos, nor Phœnicians, nor Chinese, nor Europeans—they are Americans. An exception has been almost universally made in favour of the Esquimaux families of the far north, whose relations, physical and linguistic, with the Aleutan islanders and the Asiatic Tchuktchi are too striking to permit denial. In order to maintain the independent origin of the American tribes, it has been found necessary to deny the existence of any true likeness between the languages of the Old World and those of the New. The peculiar agglutination or synthetical character of American grammar, which, from the Athabascan area of the north to the Fuegian in the south, presents innumerable shades and broad lines of difference, has been represented as without parallel on the Eastern continent. Yet there are synthetic languages in Europe, Asia, Africa, Australia and the Islands of the Sea. At one time the Indo-European and Semitic grammars were the only systems compared with those of other families of speech. To these the Ural-Altaic, comprising the Ugrian of Europe and the Tartar-Mongolian of Asia, and the Monosyllabic, represented by the Chinese, have been added. But these do not exhaust the systems of the Eastern hemisphere. Wild as have been the statements made regarding the construction of languages, they have not equalled in folly the hasty utterances on the subject of their vocabularies. Messrs. Rivero and Tschudi, in their work on Peruvian Antiquities, write as follows: "The analogy so much relied on between the words of the American languages and those of the ancient continent have induced us to make an approximate estimate, *as far as our means would permit*, of the numerical value of the idioms of both hemispheres; and the result was that, from between eight and nine thousand American words, *one* only could be found analogous in sense and sound to a word of any idiom of the ancient continent." It is evident that these gentlemen, who deserve well for their services to ethnological science, never consulted even the imperfect lists of the Mithridates, and pursued their researches within such a narrow field as to falsify the doctrine of chances itself. Mr. Hubert H. Bancroft, to whom we owe a work of great value, "The Native Races of the Pacific States," allows himself to be led away to somewhat similar conclusions; but as he furnishes us with a list of so-called Darien numerals which are almost pure Gaelic, without noticing the phenomenon, it is to be presumed that, while a diligent and successful collector, Mr. Bancroft is no philologist.

Turning from philological to physical ethnology, we find that all the American families have been called Mongolian, and that nearly all attempts to affiliate the tribes of the Northern Continent have led inquirers to the Mongolian area in Eastern Asia. Even Dr. Latham, than whom there is no better authority on this subject, terms his large American class, American Mongolidæ. Yet, after stating that the Esquimaux are essentially Mongols, he adds: "On the other hand, in his most typical form, the American Indian is not Mongol in physiognomy. With the same black straight hair, he has an aquiline nose, a prominent profile, and a skin more red or copper-coloured than either yellow or brown. Putting this along with other marked characteristics, moral as well as physical, it is not surprising that the American should have been taken as the type and sample of a variety in contrast with the Mongolian."

It is not my intention in this paper to deal in a loose and general manner with the subject of American ethnology, but to confine myself to the connections of a single but large family of the aborigines of the Northern Continent with the Old World. This is the extensive Algonquin family, reaching from Newfoundland to the Rocky Mountains, and from the Labrador Esquimaux and Hudson's Bay Athabascans to the Choctaw area in the Carolinas. Their collective name was Wapanachki, or *men of the east,* a term which still designates the Abenaki tribe of Maine. Their traditions universally refer to a migration from the far west, and the Great Spirit whom they worshipped had his home in no forest, prairie or lake, but on an island in the distant ocean. The principal tribe of this large family from the earliest period to which traditions refer was that of the Lenni Lenape, or Delawares. Closely allied to them in language are the Illinois, including the Miami, Piankashaws and other clans. The word Illinois, like the Lenni of Lenni Lenape, signifies *men.* The Shawnoes, who have been removed from Kentucky to the Western Reservation, speak a somewhat similar tongue, also using the word *ilenni* to designate *man,* but favouring the lisping *th* in place of the *s,* and cognate letters of other tribes. The Missisaguas, who originally held the site of Toronto and the coast of Lake Ontario down to its outlet in the St. Lawrence, were likewise *linneeh.* North of these we find the Ojibbeway or Chippewa tribe, with whose name, appearance and language, Canadians are most familiar. They make a sparing use of the letter *l*, and term man *eneneh,* replacing that letter by *n.* The Crees, who call themselves *Nehethowuck,* and border on the Ojibbeways to the west of Lake Superior, thence spreading to the Esquimaux in the east and the Athabascans in the west, differ much among themselves in their pronunciation of certain liquids. The Athabascan Crees in the west turn the Lenape *l* into *r;* the Wood Crees, into *th;* the Hudson's Bay Crees, into *y;* the Plain Crees into *n;* while those of Labrador retain the Lenape form. At the same time the Cree has a tendency towards a species of alliteration in the same word, repeating the characteristic letter in place of the consonant which follows it. Thus the *ilenni* of the Illinois and Shawnoes becomes indeed *inenew* among the Plain Crees, *ithinew* among the Wood Crees, and *eyinew* among those of Hudson's Bay; but at Moose Factory it is *ililew,* and *eyiyew* on the East Main coast. Passing over the Nipissings, Ottawas and Algonquins proper, whose languages are closely allied and resemble more or less the Ojibbeway, we meet with the Micmacs of Nova Scotia, New Brunswick, &c., whose speech connects with the Lenape through the Abenaki, Etchemin,

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Passamaquoddy and Penobscot of Maine. They also use the form *alnew* for man. Many extinct tribes, such as the Mohicans, Narragansets, Massachusetts, &c., once inhabited the New England States. Other tribes, like the Menomenies and Potawatomies, dwell south of Lakes Superior and Michigan in the Western States. Four tribes have lately been added to the Algonquin family. One of these, the Bethucks of Newfoundland, is extinct. The others are the Blackfoots on the Saskatchewan, extending west to the Rocky Mountains; and the Arrapahoes and Shyennes farther to the south. Dr. Latham has suggested a connection of the Blackfoot with the Hailtsa in the neighbourhood of Vancouver's Island, thus linking the Algonquin with the *Nas* languages of the Pacific coast. It is but a suggestion, however, and I have not been able to verify the connection. But there seem good reasons for finding Algonquin resemblances among the Sahaptin or Nez Percé tribes, whose habitat lies farther south on the same side of the Rocky Mountains, over against the Blackfoot and Shyenne country. Let this be established, and the Algonquin area extends across the whole continent from the east to the extreme west. To the Sahaptin relationship I make for the present no reference.

The Old World family of languages with which I have affiliated the Algonquin dialects is the Malay-Polynesian, a vast group extending from the Malayan peninsula to New Zealand, and from Madagascar to Easter Island. My vocabularies, while sufficiently extensive to indicate the relationship of the two families, are not sufficiently so to permit me to point out the particular divisions, Malay or Polynesian, Micronesian or Polynesian proper, with which the Algonquins coincide. Nor do I imagine for a moment that the Algonquins are the only American tribes whose course of migration is to be found in the line of Malay-Polynesian languages and influence. In the tables which accompany this paper I have taken a selection of words, thirty in all, representing nouns, adjectives and verbs, the most simple and characteristic, and thus least liable to suffer from foreign influences; and, grouping them according to their varying Algonquin forms, have compared them with analogous forms occurring within the Malay-Polynesian languages. They will be found to present such close and widespread resemblances as, I think, to render difficult the task of the objector. At the same time, the very partial representation of the Malay-Polynesian languages which my materials have enabled me to give, leads to the belief that, with a more extensive stock of vocabularies, still more striking and definite results might have been obtained. To the thirty words above mentioned I have added the numerals of the Algonquin languages up to *ten*, similarly comparing them, but with results not quite so favourable. Still, even in this difficult field of comparison, important analogies appear. To exhibit the negative side of the argument, I have placed over against the Algonquin and Malay-Polynesian words the corresponding terms in the Asiatic and allied languages from which the American forms of speech might naturally be expected to take their derivation. Such are the Ugrian, Mongol, Tartar and Mantchu tongues, forming the Ural-Altaic class; the Samoied, Yenisei and Yukagir, conveniently termed Asiatic-Hyperborean; and the Japanese, Aino, Tchuktchi and Kamtschatdale, which are grouped as Peninsular. While a few analogies appear among some of these, their dissimilarity from the families under consideration is well worthy of attention. Here also I must confess that the imperfection of my lists, which are not selections, but contain all the material at present in my possession, hinders me from drawing too strict a line of demarcation. Lest it might be supposed that the analogy of the Algonquin with the Malay-Polynesian languages to which I have compared them is shared by other American families of speech, I have set forth the prevailing forms of the terms chosen for comparison in the Athabascan or Tinneh, the Wyandot-Iroquois, the Dacotah or Sioux, and the Choctaw classes, with all of which the Algonquin tongues are in geographical relation.

As far as my knowledge of the Malay-Polynesian languages extends, and it is very limited, I must admit that the striking lexical affinities are not borne out by equally close resemblances in the structure of language, as we compare for instance the grammar of the Algonquin with that of the Malays or of the Tonga islanders. There are, however, many widely differing grammatical forms among the large Oceanic class to which these belong. The Tagala spoken in the Philippine islands is, according to Dr. Latham, "essentially agglutinate in respect to its inflection;" and I must leave to those who are better versed in these tongues the task of comparing their agglutination with that of the Algonquin languages. While far from disparaging the value of grammatical forms in such connections as that under consideration, I am as far from believing in their permanence. Words are the bones of language, and we might as well take the whale and the bat out of the Mammalia as to separate tongues using identical common terms on account of minor differences in grammatical combination. The resemblances between the Algonquin and the Malay-Polynesian vocabularies are the rule, not the exception; and on this ground I believe that an exhaustive analysis of the grammatical forms of the latter will yet exhibit at least a near approach to Algonquin structure.

In addition to the agglutination of the Tagala and kindred languages, a feature that appears more or less in all the Polynesian tongues, there are many points of resemblance as well as of difference between the Malay-Polynesian and the Algonquin. They agree in the absence of anything like true gender, and in the substitution for it of a distinction of nouns into animate and inanimate. The Algonquin languages, however, have a termination for the plural, while, as far as I am aware, the Malay-Polynesian mark plurality by a prefixed article or particle, or by the suffix of a numeral adjective. The Algonquin nouns have properly speaking no declension, and this is true of the Malay-Polynesian. But when case is marked in the latter, it is by forms of the article or by prefixed prepositions which frequently coalesce, while in the former the locative is denoted by a suffix. The genitive also precedes the nominative in Algonquin, but follows it in the Malay-Polynesian. The Malay-Polynesian languages have prepositions, and such are many of the Algonquin particles; but others are postpositions. This would seem, with other points of a similar character, to indicate the position of the Algonquin languages as one midway between the postponing Turanians of Asia and the preposing Malay-Polynesians. The Athabascans, Iroquois, Dacotahs and Choctaws, who surround the Algonquins on every side, all use postpositions; and their influence in this and other directions may have tended largely to render the Algonquin grammar somewhat Turanian. The substantive and the verb are but feebly distinguished in the two families under consideration, and in many cases not at all. In the formation of derivative nouns the Malay employs a prefix as well as an affix, and has been contrasted with the Algonquin, which makes use of the suffix only. Thus from Malay *tidor*, to sleep, comes *pe-tidor-an*, a bed; while from Cree *nipow*, to sleep, is derived *nipawin*, a bed. The Polynesians do not follow the Malays in this respect; for the Tonga *mohe*, to sleep, gives us *mohenga*, a bed, in a form that is thoroughly Algonquin. In both families the adjective is invariable; but in the Malay-Polynesian its place is generally after the noun while in the Algonquin it generally precedes it. There are, however, suffix particles that take the place of adjectives in the latter class, and in most cases they are represented by verbs. The Malay-Polynesian adjectives are often hard to distinguish from substantives and verbs. The sign of comparison precedes the adjective in Algonquin, but follows in Tonga. But the accusative or object of the verb follows it in both Algonquin and Polynesian, and this separates them from the Turanian languages. Tense is designated by special marks in each case. These are Algonquin perfect *ki, gi,* future *ka, ga;* in Tonga present *gooa,* perfect *na,* future *te.* A larger acquaintance with Algonquin and Malay-Polynesian forms might reduce the differences between these. In the Tonga the index of tense is placed before the personal pronoun which precedes the verbal root, *e.g.*, makee, *give;* na-oo-makee, *I gave;* na-ger-makee, *thou gavest;* te-oo-makee, *I shall give;* te-ger-makee, *thou wilt give.* In Algonquin the temporal indices come between the pronoun and the verbal root, *e.g.*, makew, *give;* ni-ki-makew, *I gave;* ki-ki-makew, *thou gavest;* ni-ki-makew, *I shall give,* ki-ka-makew, *thou wilt give.* In spite of the difference in the order of pronoun and temporal index, the two classes agree in placing both these before the verbal root, thus entirely disagreeing with the Turanian languages in their Ural-Altaic and Dravidian divisions. The possessive pronoun or its equivalent precedes in the Algonquin, and either precedes or follows in the Malay-Polynesian languages. These languages also agree in dispensing with the relative pronoun. The forms of the demonstrative in Cree and Tonga are not unlike; Tonga, *this* aheni, *that* ahena; Cree, *this* anah, *that* naha. The same is true of the interrogative; Tonga ahai, coeha *who, which;* Cree awewe, kekway. The Polynesian languages have an article, and have on account of it been affiliated with the Bantu or Caffre languages of Southern Africa. Duponceau and other writers have insisted that the initial *M* of many Algonquin nouns, which generally precedes those that are not in a construct state, is the article. Others as firmly deny the statement, but have not accounted for the frequent dropping of this letter, *e.g.*, mistik, *a tree;* meyw-atik, *a good tree;* much-atik, *a bad tree; face,* mikwakun; *my face,* ni-kwakun. Undoubtedly there is some analogy here with the common Bantu prefixes *mo, ma, me,* and the Tagala article *ang.* The Caffre analogies, apart from language, with the Algonquins are striking. One important point of resemblance between the Algonquins and the Malay-Polynesian is that both employ the pronoun of the first person plural in an inclusive and in an exclusive form:

Algonquin—ninawint, *they and I.*
kinawint, *you and I.*
Tonga—mow, gimowoa, *they and I.*
tow, gitowoa, *you and I.*

I may also add that both families of language have special terms to denote elder and younger brother, sister, &c. Such are the main points of agreement and diversity that have occurred to me, agreements which I think no more extended research can invalidate, and differences which, if not due to purely American influences derived from Northern Asia in the manner already indicated, may disappear in the progress of investigation. In any case the difficulties in the way of connecting the Malay-Polynesian and the Algonquin systems are far from insuperable. One important feature which the two classes possess in common, and by which they are distinguished from other families, Asiatic and American, is the absence of harsh sounds—the softness, which has been called the distinguishing characteristic of the Polynesian tongues, and which has attracted the attention of all who are in any way familiar with Algonquin speech.

I have not had time to investigate the relations subsisting between the manners, customs, superstitions, &c., of the Algonquins on the one hand and of the Malay-Polynesians on the other. Some of these, as tree worship, the use of totems and similar points, have been indicated by Sir John Lubbock. Dr. Pickering makes, I know not on what grounds, but doubtless for very satisfactory reasons, the following statement: "If any actual remnant of the Malay race exists in the eastern part of North America, it is probably to be looked for among the *Chippewas* and the Cherokees." The Chippewas or Ojibbeways are the Algonquins with whom it is likely the distinguished ethnologist was most familiar. The long black straight hair, the prominent features, the practice of depilation, and even the copper colour of the American Indian in general, are found in Polynesia; and the moral traits of the Algonquins find many analogies in the same region. The stage of culture attained by both peoples coincides. The maritime habits of the Malay-Polynesians have simply changed to the fluviatile and lacustrine in the Algonquin, while they serve to indicate the means by which the islander became the inhabitant of a continent. Dr. Pickering testifies with others to the long sea voyages of many Polynesians, and thus designates the point at which such voyages might end on the American coast: "The Polynesian groups are everywhere separated from South America by a vast expanse of ocean, where rough waves and perpetually adverse winds and currents oppose access from the west. In attempting from any part of Polynesia to reach America, a canoe would naturally and almost necessarily be conveyed to the northern extreme of California; and this is the precise limit where the second physical race of men makes its appearance. So well understood is this course of navigation, that San Francisco, I am informed, is commonly regarded in Mexico as being on the route to Manilla."

Dr. Edkins, of Pekin, in "China's Place in Philology," says: "On the American continent, Turanian and Polynesian linguistic principles meet in the various Indian languages." And elsewhere he affirms that "we are warranted by linguistic data in concluding that there was a Polynesian immigration from the Ocean, and a Turanian immigration by the Aleutan Islands, and by Iceland and Greenland, which united to form the population of the American continent." Yet, like many other writers, Dr. Edkins seeks his Polynesians in Mexico and Peru, and would relegate the Algonquin origines to a Mongolian source.

Mr. Wallace, in his "Malay Archipelago," thus describes the peculiarities of Malay feature and character: "The colour of all these varied tribes is a light reddish brown, with more or less of an olive tinge, not varying in any important degree over an extent of country as large as all Southern Europe. The hair is equally constant, being invariably black and straight, and of a rather coarse texture, so that any lighter tint, or any wave or curl in it, is an almost certain proof of the admixture of some foreign blood. The face is nearly destitute of beard, and limbs are free from hair. The stature is tolerably equal, and is always considerably below that of the average European; the body is robust, the breast well developed, the feet small, thick and short, the hands small and rather delicate. The face is a little broad and inclined to be flat; the forehead is rather rounded, the brows low, the eyes black and very slightly oblique; the nose is rather small, not prominent, but straight and well shaped, the apex a little rounded, the nostrils broad and slightly exposed; the cheek bones are rather prominent, the mouth large, the lips broad and well cut, but not protruding, the chin round and well formed.

"In this description there seems little to object to on the score of beauty, and yet, on the whole, the Malays are certainly *not handsome*. In youth, however, they are often very good-looking, and many of the boys and girls up to twelve or fifteen years of age are very pleasing, and some have countenances which are in their way almost perfect. I am inclined to think they lose much of their good looks by bad habits and irregular living. At a very early age they chew betel and tobacco almost incessantly; they suffer much want and exposure in their fishing and other excursions; their lives are often passed in alternate starvation and feasting, idleness and excessive labour; and this naturally produces premature old age and harshness of features.

"In character the Malay is impassive. He exhibits a reserve, diffidence, and even bashfulness, which is in some degree attractive, and leads the observer to think that the ferocious and bloodthirsty character imputed to the race must be grossly exaggerated. He is not demonstrative. His feelings of surprise, admiration or fear are never openly manifested, and are probably not strongly felt. He is slow and deliberate in speech, and circuitous in introducing the subject he has come expressly to discuss. These are the main features of his moral nature, and exhibit themselves in every action of his life.

"Children and women are timid, and scream and run at the unexpected sight of a European. In the company of men they are silent, and are generally quiet and obedient. When alone the Malay is taciturn; he neither talks nor sings to himself. When several are paddling in a canoe, they occasionally chant a monotonous and plaintive song. He is cautious of giving offence to his equals. Practical joking is utterly repugnant to his disposition, for he is particularly sensitive to breaches of etiquette, or any interference with the personal liberty of himself or another. As an example, I may mention that I have often found it very difficult to get one Malay servant to waken another. He will call as loud as he can, but will hardly touch, much less shake, his comrade.

"The intellect of the Malay race seems rather deficient. They are incapable of anything beyond the simplest combination of ideas, and have little taste or energy for the acquirement of knowledge. Their civilization, such as it is, does not seem to be indigenous, as it is entirely confined to those nations who have been converted to the Mahometan or Brahminical religions."

There is hardly a single particular in all the above description which is not equally applicable to the Ojibbeway or any other member of the Algonquin family.

The precise form Lenni Lenape I have not yet met with in any Malay or Polynesian locality as a national or tribal designation, but the analogous forms Oran Benua, Oran Malaya, Oran Akkye, sufficiently shew whence the Delawares derived their title. The Javanese and Malagasy forms *lanan* and *ulun*, which take the place of the Malay *oran*, help to make the coincidence all but complete. As confirmatory evidence of the connection which I have established, I add comparisons of the personal pronouns and of a number of miscellaneous words in the two families related, comparisons which might be indefinitely extended.

The preparation of this paper having been made somewhat hurriedly in the midst of many other engagements, in order to bring the facts discovered as soon as possible before the Institute, I crave the indulgence of its members for unavoidable imperfections, trusting that the results obtained may not be without value to students of American antiquities and the science of comparative philology.

I.—COMPARATIVE VOCABULARY.

	ALGONQUIN.	MALAY-POLYNESIAN.	URAL-ALTAIC.	ASIATIC-HYPERBOREAN.	PENINSULAR.
man,	lenno, linnon, *Del.*	lanan, *Java;* laki, *Mal.*	loman, *Mordwin*		el ku, *Kamtschatka*
husband	lenno, *Miami*	belane, *Gah* (Ceram)			
	linneeh, *Missisagua*	pulahan, *Wahai* (Ceram)			
	illini, *Illinois*	ulun, *Malagasy*	olona, *Lapp*		
	helaniah, *Miami*	umlanei, *Cajeli* (Bouru)	ulmo, *Tcheremiss*		
	netihelon, *Delaware*	maiona, *Liang, Morella*	ellem-cholles, *Vogul*		
	llenni, *Shawno*	*Lariki* (Amboyna)	sulahane, *Finn*		
	alnew, *Micmac*	helameranna, *Matabello*	nialma, *Mantchu*		
	illew, *Cree*	lelah, *Baju;* lelay, *Malagasy*			
	renoes, *Sankikani*	oran, *Mal.;* arracat, *Pelew*	er, *Turk, Uigur*	eri, *Yenisei*	guru, *Kurile*
	irirew, irinew, *Cree*	roraki, *Bolanghitam* (Celebes)	erkhak, *Kasan*		
		remau, *Amblaw*	ere, *Mongol*	toromina, *Yukagir*	
	nemarough, *Virginia*	maroka, *Galela* (Gilolo)	murt, *Votiak*		
	weewarah, *Miami*	maranna, *Teor*	mari, *Tcheremiss*		
		marananna, *Matabello*	feri, ember, *Magyar*		
		mori, *Wayapo* (Bouru)			
		burani, *Salayer* (Celebes)	taho, *Ostiak*		
	ethini, *Cree*	tane, *Tahiti*	tungus, donki, *Tunguse*		hito, otoko, *Japanese*
	inini, *Algonquin, Nipissing*	omani, *Bouton* (Celebes)	ilminen, *Finn*		aino, *Aino*
	oyinew, *Cree*	ohana, *Tonga*	innimene, *Esthonian*	nienec, *Samoied*	momo, *Japanese*
	enainneew, *Menoment*	anamhana, *Massaratty* (Bouru)	kumun, *Mongol, Kalmuk*	nganang, "	okkai, *Aino*
		anow, *Galela* (Gilolo)	kouhn, *Kalmuk*		oikyo, *Insu*
		emanow, *Amblaw*	kun, *Buriat*	cet, *Yenisei*	uika, *Tchuktchi*
	ninnow, *Blackfoot*	nonan, nau, *Tidore*	mies, *Finn*	hatket, "	chu, ikkega, *Loo Choo*
	nnin, *Narraganset*	man, *Mysol*		hadkip, "	
	neeah, *Potawatomi*	mon, *Gani* (Gilolo)		blet, "	
	nah, *Shyenne*	manowa, *Saparua*		btet, "	
		manowai, *Awaiya* (Ceram)		ilset, "	
	nash, *Arrapaho*	manesh, *Sanguir* (Siau)			
		manusia, *Telutl* (Ceram)			
	enanitah, *Arrapaho*	mundai, *Batumerah* (Amboyna)		onneto, *Samoied*	
	mahtseo, muttupi-o, *Blackfoot*	motu, *Mysol;* ndako, *Baju*			
		moudoo, *Tonga*			
	menapema, *Miami*	mondomapiu, *Gani* (Gilolo)			
	ninappem, *Cree*				
	ninabem, *Ojibbeway*				
	wechian, *Delaware*	weholn, *Teor*	bey, *Tunguse*		
	wessia, *Shawno*	essah, *Salibabo*	kissoe, *Yakut*		
	tommawshow, *New England*	taumata, *Menado* (Celebes)	kiischon, *Uigur*	hasawa, *Samoied*	
		tomata, *Salibabo*	kese, *Kirghis*	kasa, "	
		tumata, *Saparua*	hago, chacha, *Mantchu*	yadu, *Yukagir*	
		tumata, *Ceram*	kassek, *Ostiak*		skoch, *Kamtschatka*

	wasik, *Narraganset*			wesako, *Samoied*	uskaams, "
	wasukeh, *Natick*				
woman, wife	wowimow, *Cree*	wowina, *Teor*	chatun, *Turk*	pugutsa, *Samoied*	
		bini, *Malay*			
	wokomakun, *Cree*	bawine, *Bouton* (Celebes)	avret, *Turk*	pugica, *Samoied*	
	wecheakun, *Cree*	babineh, *Salibabo*	chatuni, *Mongol*	bgim, *Yenisei*	
		wadhon, *Java*			
	weewan, *Ojibbeway*	pipina, *Saparua*	chatuni, *Kalmuk*	byk hamalto, *Yenisei*	
	weewon, *Mohican*	ianne, *Tonga, Samoa*	geregen, *Mongol*	alwaley, *Yukagir*	
		wahine, *Sandwich*	kaddi, *Tartar*		
		wahine, *New Zealand*	yaghtarim, *Yakut*		
		vahine, *Tahiti*	feleseg, *Magyar*		
	wiwah, *Piankashaw*	babaye, vabai, *Tagala*	aszoni, "		
		vaivave, *Malagasy*	imi, ne, *Ostiak*		
		fofoya, *Tidore*	ne, *Vogul*		
		bibo, *Bolanghitam* (Celebes)	neischa, *Mordwin*		
	neeweewah, *Miami*	mahoweni, *Sanguir* (Sian)		neu, naigum, *Samoied*	innago, *Loo Choo*
	newah, *Shawno*	mewina, *Teor*		nelgum, "	meanako, *Insu*
	neowoh, *Potawatomi*	nifata, *Sula*			mennokoosi, *Aino*
	neeseeweeok, *Penobscot*				newem, *Tchuktchi*
	abitase, *Micmac*	opedeka, mapideka, *Galela*			aganak, "
	nougeuse, *Algonquin*	mumahena, *Awaiya*			nulliak, "
		nimahena, *Camarian* (Ceram)			tackki, *Loo Choo*
	iekwee, *Algonquin*	ahehwa, *Matabello*	akka, *Lapp*		
	ochkeu, *Delaware*	gagijan, *Menado* (Celebes)	asi, akee, *Tunguse*		
	aque, *Ottawa*	jiyu, *Mysol*	heghe, checho, *Mantchu*		
	ichque, *Shawno*		izi, *Mongol*		
	iekoe, *Illinois*				
	acquahique, *Nanticoke*				
	kwyokih, *Sac & Fox*				
	ahkeea, *Blackfoot*				
	squaha, *Pampticoke*	sawa *Sanguir* (Sian)	kyschuo, *Finn*	tschutscha, *Samoied*	squaaw, *Kamtschatka*
	eskwa, *Cree*	sowom, *Cajeli* (Bouru)			
	quaiwaw, *Shawno*				
child, infant	eneso, *Narraganset*	anak, *Malay, Java, Tagala*	kichkinga, *Kasan*	ngaceky, *Samoied* (boy)	iegnika, *Tchuktchi* (boy)
(boy, son)	niechan, *Shawno*	*Salayer* (Celebes), *Sanguir* (Sian)	koakan, *Tunguse*	niama, " "	rinaka, " "
	nitseh, *Delaware*	anik, *Teor*; anako, *Baju*	kootian, "	nutschu, "	warrabee, *Loo Choo*
	negusis, *Algonquin* (boy)	anako, *Bolanghitam* (Celebes)	uli, "	esi, "	kodoma, *Japanese*
	unquece, *Micmac* (boy)	anahei, *Saparua*	dsui, *Mantchu* (boy)		qua, *Loo Choo*
	muckiese, *Narraganset*	niana, *Liang* (Amboyna)	koolron, *Mongol*		
	awansis, *Abenaki*	wana, *Awaiya* (Ceram)	oghlanjek, *Turk*	lukoolu, *Yukagir*	
	uhbenoojeeh, *Ojibbeway*	wana, *Morella* (Amboyna)	hubegun, *Mongol* (boy)		
	awaunsees, *Mohican*	oanana, *Bouton* (Celebes)	koeben, *Kalmuk* (boy)		
	owasis, *Cree*	wai, *Mysol*	pi, *Sirianian, Votiak* (boy)	uwa, oua, *Yukagir*	
	pappoos, *Piankashaw*	fawha, *Tonga*	pojka, *Finn* (boy)		vassasso, *Insu*

	MALAY-POLYNESIAN.	ALGONQUIN.	URAL-ALTAIC.	ASIATIC-HYPERBOREAN.	PENINSULAR.
child, infant (boy, son)	papoos, *Narraganset* pappouse, *New England* poissea, *Natick* pokah, *Blackfoot* memendid, *Delaware* apilossah, *Miami* hippelutha, *Shawno* bobeloshin, *Ojibbeway* necovis, *Souriquois* (boy)	bibigi, *Tonga* piginench, *Salibabo* naanati, *Massaratty* (Bouru) nanat, *Wayapo* (Bouru) opoliana, *Batumerah* (Amboyna)	pum, pu, py, *Vogul* (boy) pox, pax, *Ostiak* (boy) ilu, *Magyar* (boy) uassum, *Vogul* gyerek, *Magyar* gyermek, "	pup, *Yenisei* pijwo, *Yenisei* (boy) antou, *Yukagir* (boy)	pahatshitsh, *Kamtschatka* pec, paca, *Kamtschatka* (boy)
boy, son (*vocabularies deficient*)	negusis, *Cree*, *Algonquin* nkos, *Passamaquoddy* nekeesh, *Menomeni* nekwessa, *Shawno* neechaunis, *Missisagua* ianis, *Ojibbeway* naah, *Arrapaho* bawtoos, *Micmac*	ngofa, *Tidore* anak, *Malay* anak, *Malagasy* anak, *Tagala* zan, *Malagasy* zanac, " budak, *Malay* butu, *Borneo*	ogo, oal, *Yakut* ugli, *Turk* ol, oglan, *Tartar* dsui, *Mantchu* hubegun, *Mongol* zon, *Siriantan* czenk, *Magyar* (see *child*)	(see *child*)	(see *child*)
girl, daughter (*vocabularies defective*)	quises, *Delaware* koisso, *Shawno* tahana, *Illinois* danis, *Delaware* tanis, *Ottawa* tanes, *Sac & Fox* penumpun, *Massachusetts* panum, *Mohican* phainem, *Powhattan* pehanum, *Penobscot* po, *Abenaki* woaseesh, *Bethuck* tanetha, *Shawno* mitanis, *Cree* netawnah, *Miami* netouche, *Souriquois* nahtch, *Shyenne* naunais, *New England* neeshan, *Miami* opidek, *Micmac* ahkeequoin, *Blackfoot*	tahine, *Tonga* parumpuan, *Mal.* (woman) penaulen, *Malay* " ifneinin, *Alfuros* (Ceram) " binei, *Gah* (Ceram) " vina, *Ahtiago* (Ceram) " bibo, *Bolanghitam* (Celebes) " baini, *Salayer* (Celebes) " fina, *Sula* " fineh, *Massaratty* (Bouru) " dindah, *Baju* " betina, *Malay* " wadbon, *Java* " motyu, *Mysol* " mainai, mahina, *Amboyna* " mowina, *Teor* " mahoweni, *Sanguir* (Sian) " opideka, *Galela* "	parno, *Lapp* keschi, *Tcheremiss* koeben, *Kalmuk* tytto, tytär, *Finn* asatkan, *Tunguse* ghoorkan, *Tunguse* leany, *Magyar* njejda, *Lapp* non, *Mantchu* okin, *Kalmuk*	marchet, *Yukagir* marhloo, " nädek, *Samoied* nitteng, " baitaga, *Yukagir* vaiendendi, "	tacki, *Loo Choo* paunika, *Tchuktchi* ungua, *Loo Choo* sooguing, *Kamtschatka* ucipek, " komusime, *Japanese*

	ickwessen, *Algonquin*		kiz, *Turk*		musmo, "
	squasese, *Narraganset*		kissun, keesa, *Yakut*		gogo, "
	ohkwisis, *Delaware*				chtshitshoo, *Kamtschatka*
head	wil, wile, *Delaware*	ulu, *Malay, Timor*	del, *Tunguse*	monoli, *Yukagir*	killa, *Kurile*
		Salayer, Camarian	tologai, *Mongol*	hollud, *Samoied*	
		olo, *Tagala*		kolka, *Yenisei*	
		hooloo, *Tonga*			
	wilan, *Shawno*	ilon, *Malagasy*			
		ulu, *Teor*			
		yulin, *Ahtiago*			
		olun, *Massaratty*			
		olum, *Cajeli*			
	weelekeh, *Shawno*	uruka, *Liang, Morella*			
		lobo, *Malagasy*			
		aluda, *Matabello*			
	wilustikan, *Minsi*	ulukatim, *Alfuros*			
	stikwan, *Cree*	kadou, *New Zealand*			tchoosa, *Kamtschatka*
	ochitigoine, *Algonquin*	katou, *Tavoo*			
	otokan, *Blackfoot*	kahutu, *Mysol*			
	wyer, *Sankikani*	uru, *Lariki, Saparua*			
		urie, *Bolanghitam*			
		kokore, *Timor*			
	pubkuk, *Massachusetts*	oupoko, *New Zealand*	bash, *Turk*	eba, *Samoied*	bosi, *Loo Choo*
	pahhih, *Arrapaho*	obaku, *Bouton*	bas, *Yakut*		kubi, *Japanese*
	bequoquo, *New England*	poi, *Gani*	fej, *Magyar*	iok, *Yukagir*	
	uppaquontup, *Narraganset*		poenk, *Vogul*		
	uppa, *Algonquin*		poe, poja, *Finn*		
	weessee, *Shawno*		oajve, *Lapp*		
	dup, utup, *Mohican*	tumbo, *Sanguir*			atama, *Japanese*
	nectop, *Penobscot*	timbonang, *Menado*	udjoo, *Mantchu*	tshig, *Yenisei*	kashko, *Tchuktchi*
	indepecone, *Miami*				
	neppuhkuk, *Natick*	nap, *Sula*			
	menougi, *Souriquois*	nangasahi, *Galela*		ngaewa, *Samoied*	naskok, *Tchuktchi*
	mononchi, *Micmac*				
mouth	madoon, *Penobscot*	moudoo, *Tonga*	awus, *Turk*	angda, *Samoied*	kandak, *Tchuktchi*
	muttoon, *Massachusetts*	motoo, *Mariannes*	ayach, *Yakut*	ak, aiwa, "	ekigin, "
	mettoon, *Nanticoke*	moda, *Tidore*	hamun, *Tunguse*	ngang, "	jeep, *Corea*
	maytone, *Menomeni*	motpo, *Mysol*	amga, "	nia, namo, "	cooche, *Loo Choo*
	mitoon, *Cree*	sumut, *Gani*	am, amma, *Mongol*	anga, *Yukagir*	kuzha, *Kamtschatka*
	namadthun, *Bethuck*	numatea, *Amblaw*	aman, "	khan, *Yenisei*	
		simud, *Malay*	umma, *Volga*	kohuj, "	
	indown, *Potawatomi*	gnootoo, *Tonga*	wom, *Lapp*		
	endonnee, *Miami*	nhoutou, *Ticopia*	sma, *Tcheremiss*		
	nettee, *Arrapaho*		czad, szaj, *Magyar*		
	ootoun, *Abenaki*	vudin, *Ahtiago*	ayak, "		

	ALGONQUIN.	MALAY-POLYNESIAN.	URAL-ALTAIC.	ASIATIC-HYPERBOREAN.	PENINSULAR.
mouth	otoun, *Mohican* wuttoon, *Narraganset* marthe, *Shyenne* netlee, *Arrapaho* meessey, *Ojibbeway* mahoi, *Blackfoot*	mulut, *Malay* mouloo, " nuku, *Saparua* mangai, *New Zealand* mohong, *Menado* mohon, *Sanguir* mueu, *Wayapo* naoneu, *Massaratty*	njalbme, *Esthonian* oaiwe, *Lapp*		
tongue	weelauloo, *Penobscot* nyllal, *Etchemin* wilano, *Delaware* ouelane, *Miami* weelinwee, *Shawno* otalenee, *Cree* nirnou, *Souriquois*	ileeloo, *Tonga* lelo, *Malagasy* lilah, *Celebes, Sanguir* leho, *Sandwich* wowelli, *Allor* ellah, *Sasak* ewel, *Solor* melin, *Ahtiago* hilat, *Java* elunto, *Celebes* nangaladi, *Galela* dilah, *Celebes* dilah, *Tagala* dila, *Bolanghitam* delah, *Baju* arau, *Mysol* arero, *Tahiti* munartea, *Amblaw* tumoma, *Matabello*	kyle, *Kalmuk* kelen, *Mongol* kelli, *Finn* keli, *Esthonian* kil, *Permian* dil, *Turk* till, *Yakut*	alup, *Yenisei* alyap, " siolo, *Samoied* suro, *Samoied* onnor, *Yukagir*	nutshel, *Kamtschatka*
tooth, teeth	otaineni, *Ojibbeway* teuanian, *Ottawa* ninanuh, *Mohican* neenaunoh, *Natick* neannan, *Nanticoke* minan, *Massachusetts* nennanewch, *Sac & Fox* mitalune, *Cree* ooton, *Ojibbeway* nibit, *Algonquin* neebeet, *Abenaki, Micmac* nebidie, *Souriquois* neepeetah, *Miami* mepit, *Cree*	ninum, *Alfuros* meen, *Camarian* maanen, maan, *Bouru* man, *Timor*; maan, *Rotti* numawa, *Batumerah* mecolo, *Teluti* yeidi, *Gilolo* nifll, *Malagasy* nifo, *Tonga, Ticopia* niphin, *Mariannes* nifin, *Teor* nifan, *Ahtiago* mopon, *Celebes* nifoa, *Matabello*	ingni, *Tunguse* enga, " njuove, *Lapp* njuokcam, *Lapp* nych, *Magyar* nyelv, " nadam, *Ostiak* dish, *Turk* tees, *Yakut* itsh, *Tunguse*	njami, *Samoied* se, sie, " andzbub, *Yukagir*	chay, *Corea* steha, *Loo Choo* sita, *Japanese* kuppet, *Kamtschatka* ha, *Loo Choo* jea, *Japanese* ji, *Corea* gutuk, *Tchuktchi* watinka, "

	wipi, *Cree*	iffi, *Malagasy*	badne, *Lapp*		meemack, *Insu*
	wipit, *Delaware*	afod, *Gani*	penk, *Ostiak*		
	webit, *Potawatomi*	ipa, *Solor*			
	wypyt, *Sankikani*	ipan, *Celebes*			
	weebeetah, *Penobscot*				
	veisike, *Shyenne*	vessi, *Ombay*			
		waang, *Celebes*			
	nepitallah, *Shawno*	ungelell, *Pelew*			
		kal-ifin, *Mysol*		tody, *Yukagir*	
	tibbit, *Ojibbeway*		tibu, *Ostiak*	tiu, tiw, *Samoied*	
	tibit, *Algonquin*		tewa, "	tibbe, tim, "	
nose	yoch, *Ojibbeway*	inka, *Morella*	ogot, *Tunguse*		ko, *Corea*
	cochay, *Montaug*	hihiou, *New Zealand*			
	oocheeush, *Menomeni*	ihoo, *Tonga*			
	yash, *Arrapaho*	issou, *Ticopia*			
	okissis, *Blackfoot*	ingok, *Bugis*			
	chassie, *Shawno*				
	gheen, *Bethuck*	ijunga, *Bolanghitam*		ang, haug, *Yenisei*	honna, *Loo Choo*
	kiouane, *Miami*	oanu, *Buton*			ohynga, *Tchuktchi*
	akywan, *Sankikan*	nguro, *Galela*			kaaukang, *Kamtschatka*
	okowon, *Mohican*	ngunu, *Sahos*			
	uchichun, *Micmac*	sonina, *Gah*			
	chichkon, *Souriquois*				
	wuchaun, *Narraganset*	swanga, *Tavoo*			
	wikiwon, *Delaware*				
	oskiwin, *Cree*				
	ochengewane, *Algonquin*	hewonga, *Savu*			
	keeton, *Penobscot*	hidong, *Celebes*			
		hidom, *Batchian*			
	matchamo, *New England*	idong, *Malay*, *Sasak*			
		Rotti, *Celebes*			
	mikoot, *Cree*	hengento, *Celebes*			
	peechten, *New England*	panan, *Timor*		patsch, *Samoied*	fanna, *Japanese*
	chalik, *Shawno*	gilinkani, *Teor*		jogul, *Yukagir*	
	ochalie, "	shonggulu, *Mysol*		iougul, "	
		olicolo, *Teluti*	chabar, *Mongol*	olen, *Yeniset*	
		ngilung, *Celebes*	aforo, *Mantchu*	olgen, "	
	ocrisis, *Blackfoot*	hiraka, *Liang*	orr, *Magyar*		
		ngerun, *Celebes*	mooron, *Yakut*		
		uroh, *Baju*	burun, *Turk*		
eye	miskichi, *Cree*	massou, *Malagasy*	silmo, *Finn*		ni, mi, *Loo Choo*
	mishishi, *Arrapaho*	missak, *Pelew* (see)	zialme, *Lapp*		liloegin, *Tchuktchi*
	nesiquo, *Miami*	matada, *Matabello*	calbmo, "		lelengi, *Koriak*
	neskesich, *Potawatomi*	matah, *Tagala*			
	matshkaishaik, *Menomeni*	madda, *Tavoo*			

	ALGONQUIN.	MALAY-POLYNESIAN.	URAL-ALTAIC.	ASIATIC-HYPERBOREAN.	PENINSULAR.
eye	mate, *Cree* (see, behold)	mata, *Malay*, &c., &c.	nitoun, *Mongol*	umat, *Yukagir* (see)	dun, *Corea*
	matoo, " (weep)	mato, *Java*	nidoun, *Kalmuk*		nanit, *Kamtschatka*
	schinquay, *Sankikani*	kanohi, *New Zealand*	szem, *Magyar*	sima, seme, *Samoied*	
	oskingick, *Ojibbeway*	tengo, *Malay* (see)	sem, *Ostiak*		
	kechekoue, *Miami*	tangi, *Tonga* (weep)	ujihu, *Mongol* (see)		
	nepiquigour, *Souriquois*		gueurmek, *Turk* (see)		kwatshquikotsh, *Kamt.* (see)
	owopspec, *Blackfoot*		bakmak, " "		netra, *Japanese*
	keesg, *Mohican*		gueuz, "	sai, saeu, *Samoied*	
	seeseeko, *Penobscot*		kasak, *Yakut*	hai, "	
	wuskesuck, *Natick*		kus, *Uigur*	angszha, *Yukagir*	
	wuchkink, *Delaware*		kys, *Tartar*	dees, *Yenisei*	
	wuskink, *Missisagua*		jasza, *Mantchu*		
ear	otawagune, *Algonquin*	tayinga, *Tagala*	schan, "	ko, ku, *Samoied*	qui, *Corea*
	badowugan, *Micmac*	tadigny, *Malagasy*	songsa, *Mongol* (hear)		eew, eewt, *Kamtschatka*
	touwango, *Penobscot*	taringa, *New Zealand*	kugach, *Yakut*		
	towakah, *Shawno*	talinga, *Malay*, &c., &c.			
	towohque, *Mohican*	dinglier, *Mal.* (hear)			
	taouako, *Miami*	tenaan, *Mysol*			
	ottowug, *Ojibbeway*	tinacono, *Teluti*			
	wittawak, *Delaware*				
	wuttoowag, *Narraganset*				
	wehtough. *Massachusetts*				
	mitowukai, *Cree*				
	nootaweo, *Abenaki*	motna, *Mysol*		oonomma, *Yukagir*	mime, *Japanese*
	mootchiman, *Bethuck*			kalogau, *Yenisei*	mime, Loo Choo
	hyttrwack, *Sankikani*	taria, *Tahiti*	korwa, *Finn*	kologau, "	mime, *Insu*
		turi, *Menado*	korot, *Tunguse*	klokau, "	
	chalksee, *Passamaquoddy*	codeelou, *Tavoo*	kulak, *Turk*	pil, *Samoied*	
		telekein-luni, *Alfuros*	fül, *Magyar*		
		toli, *Salayer*, *Sanguir*	pil, *Ostiak*		
		tilgar, *Matabello*			
hand	oleechee, *Penobscot*	ala, *Awaiya*	el, *Turk*	ol, *Samoied*	tatlichka, *Tchuktchi*
	olatshi, *Shawno*	wulaba, *Tavoo*	gol, kol, *Tartar*		meejeeree, *Loo Choo*
	lichic, "	limaka, *Morella*	kol, *Uigur*		feejeeree, "
		yari, *Mal.*, *Java* (finger)	illi, *Yakut*		ki, "
		erike, *Baju* (finger)	gala, *Mantchu*		ti, *Japanese*
		ringa, *New Zealand*	gal, *Tunguse*		soan, *Corea*
	niligee, *Shawno*	ngalan, *Tagala*	gar, *Mongol*, *Kalmuk*		
		tanaraga, *Mangarei*	lagel, *Finn*		
	onahkee, *Miami*	inoa, *Sandwich*	lagol, *Ostiak*	nugan, *Yukagir*	
	nachk, *Delaware*	ingoa, *New Zealand*	kez, *Magyar*		
	nachk, *Sankikani*	bingoa, *Tonga*			
	oniskan, *Mohican*	ouino, *Ombay*			
	michicho, *Cree*	angaro, *Malagasy*			myngitt, *Tchuktchi*

	wunnicheoko, *Narraganset*	dinga, *New Zealand*			
	neningeen, *Ojibbeway*	tangan, *Mal.*, *Java*, *Bajw*		tokan, *Yenisei* (finger)	
	neninoh, *Potawatomi*	numouina, *Gah*		tok, " "	
		niman, *Ahtiago*			
	peton, *Micmac*	fahan, *Wayapo*			settoo, *Kamtschatka*
3	mpatcen, *Abenaki*	fahan, *Massaratty*			
		afencena, *Tonga*			
	maharts, *Shyenne*	mimaro, *Wahai*			
		motmor, *Mysol*			
	macmed, *Bethuck*	komud, *Gani*			
		dumada, *Matabello*			
		limado, *Sanguir* (finger)			
foot	kussie, *Shawno*	kakeo, *Malay*	ajak, *Uigur*		assi, *Japanese*
	oaksakah, *Blackfoot*	aika, *Liang*, *Morella*			assi, *Loo Choo*
		yohu, *Tidore*			ijuk, *Tchuktchi*
	kuut, *Micmac*	hoots, *Malagasy*	attauch, *Yakut*		tchou-atchou, *Kamtschatka*
	katah, *Miami*	kadan, *Wayapo*			atschi, *Japanese*
	syt, *Sankikani*	cacto, *Malay* (leg)			tshquatshoo, *Kamtschatka*
	ozit, *Delaware*				gitket, *Tchuktchi*
	seet, *Natick*				shanna, *Loo Choo*
	seetuck, *Penobscot*				
	ahocatchis, *Blackfoot*				
	waseed, *Delaware*	wed, *Gani*			
	wussete, *Narraganset*	oweda, *Matabello*			
	misit, *Cree*	tombut, *Malagasy*			
		afouivus, *Tonga*			
	nauthauitah, *Arrapaho*	matwey, *Mysol*		ngho, *Samoied*	
	nechahtei, *Miami*	makalata, *Ombay*			
	nesit, *Potawatomi*	nandohu, *Galela*			
	nesittun, *Ojibbeway*	ungoor, *Malagasy*			
	[illegible]ekkisitan, *Cree* (toes)	lefatunga, "	boodal, *Tunguse*	noel, *Yukagir*	
		fitineu, *Massaratty*	kul, *Mongol*		
		bitim, *Cajeli*	lab, *Magyar*		
black	kuskota, *Cree*	kokotu, *Tidore*	siah, *Turk*	saga, seak, *Samoied*	dochsae, *Kamtschatka*
	suckesa, *Narraganset*	kokotu, *Ternate*	kara, "	hay, "	tanjachtu, *Tchuktchi*
	shikayo, *Long Island*	kokotu, *Sahoe*	chara, *Yakut*	sagar, "	kouni, *Aino*
	sicksoh, *Potawatomi*	kitkudu, *Gani*	kara, *Tunguse*		kuroi, *Japanese*
	suckgek, *Delaware*	kuda, *Kaioa*	fahala, *Mantchu*		korosa, *Loo Choo*
	skaynatsee, *Blackfoot*	kass, *Pelew*	beho, *Mongol*		
	kuketa, *Cree*	kameichei, *Amblaw*	hara, kura, *Mongol*		
	nsikkayooh, *Mohican*	ngeo, *Rotti*	fekete, *Magyar*		
	mooi, *Massachusetts*	ngoa, *Batchian*	cap, *Lapp*		
	mowesu, *Narraganset*	paisim, *Dorey*		newai, *Samoied*	mowukain, *Koriak*
	mokkum, *Algonquin*	moitomo, *Bolanghitam*		smaukua, *Samoied*	
		maitun, *Sanguir*		aimaivi, *Yukagir*	

	ALGONQUIN.	MALAY-POLYNESIAN.	URAL-ALTAIC.	ASIATIC-HYPERBOREAN.	PENINSULAR.
black	mukuta, *Cree*	moito, *Celebes*	musta, *Finn*	ommitsh, *Yukagir*	
	mukkudaiwah, *Ojibbeway*	muhonde, *Celebes*			
	mackatay, *Ottawa*	mahitum, maitang, *Celebes*			
	mahkateonquinque, *Miami*	memetan, *Ahtiago*			
	mukkoote, *Shawno*	malotong, *Bugis* (Celebes)			
	mandz^ey, *Bethuck*	meteh, *Saparua*			
		meddi, *Savu*			
		mete, *Liang*, *Morella*, &c.			
		malta, *Salibabo*			
white	opee, *Shawno*	boo, bus, *Mysol*	ak, *Turk*	jallena, *Samoied*	siro, *Japanese*
	opeh, *Minsi*	kebo, *Macassar*	irungk, *Yakut*	poinnei, *Yukagir*	sheeroosa, *Loo Choo*
	wabi, *Algonquin*	babut, *Ahtiago*	shaygan, *Mantchu*		attagho, *Kamtschatka*
	wobee, *Bethuck*	bobudo, *Ternate*	shangien, "		katulje, *Tchuktchi*
	wape, *Delaware*	piuper, *Dorey*	geltadi, *Tunguse*		kachtschuktuk, *Tchuktchi*
	wapisew, *Cree*	boti, *Bouru*, *Sula*	chagan, *Mongol*		
	wawbizze, *Ojibbeway*	potih, *Baju*	zagan, "		
	wabeck, *Micmac*	putih, *Malay*, *Ceram*, *Amboyna*	walkia, *Finn*		
	wapiyo, *Passamaquoddy*		welkes, *Lapp*		
	waupaceck, *Mohican*	pudi, *Savu*	vielgad, "		
	wauppauyu, *Nanticoke*	budo, *Sahoo*	foyer, *Magyar*		
	wapeskaya, *Sac & Fox*	maputi, *Bouton*			
	wapokinggek, *Miami*	mabida, *Menado*			
	wompi, *Massachusetts*	umpoti, *Cajeli*			
	wampi, *Natick*	mopotiho, *Bolanghitam*			
	waubegan, *Abenaki*	maphuti, *Matabello*			
	wompesu, *Narraganset*	maphutu, *Goh*			
red (blood)	squayo, *Long Island*	kao, *Liang*, *Morella*	kisil, *Tartar*	kelenni, *Yukagir*	akasca, *Loo Choo*
		Saparua, *Camarian*, *Teluti*	kasil, *Yakut*		tahaang, *Kamtschatka*
		shei, *Mysol*	kirmizi, *Turk*		
	ahsain, *Blackfoot*	hashnatea, *Amblaw* (blood)	fulg, *Mantchu*		
	milk, miskoosew, *Cree*	mia, *Sula*	koolani, *Tunguse*		
	mahe, *Shyenne* (blood)	miha, *Massaratty*	mopses, *Lapp*		
	mesquah, *Ojibbeway*	miba, *Wayapo*	veres, *Magyar*		
	misqueh, *Massachusetts*	mecoit, *Gani*	wyry, *Ostiak*		
	mescoue, *Algonquin*	mehani, *Amblaw*			
	mokum, *Delaware* (blood)	mahamu, *Menado*			
	mohisenum, *Blackfoot*	mosina, *Wahai*			
	mainkhe, *Menomeni* (blood)	mame, *Mysol*			
	nihpeekannch, *Miami* "	mopoha, *Bolanghitam*			
	bahe, *Arrapaho* "	poha, *Sula* (blood)			
	bagakkan, *Abenaki* "	abaug, *Java*	puna, *Finn*		
	poraghkan, *Mohican* "				
	pocagun, *Passamaquoddy* "				
	puckcuckquo, *Nanticoke* "				

bad	mattik, *Nanticoke* myaton, *Cree* muchisow, *Cree* monadud, *Ojibbeway* makhtiton, *Delaware* motchic, *Shawno* matchit, *Mohegan* mudji, *Ojibbeway* matchi, *Miami* matche, *Ottawa* malatisew, *Cree* maratisew, " matoualkr, *Micmac* pahkaps, *Blackfoot*	maduki, *Bouton* molatu, *Bolanghitam* magăsăki, *Bissayan* mungeot, *Pelew* masama, *Tagala* nakie, *Cajeli* ishot, *Malay* jahat, " ahati, *Wahai* avet, *Ahtiago* nungalotuck, *Gah* maraut, *Bissayan* mogull, *Pelew* mugkasalla, *Bissayan* behei, *Amblaw* boossooc, *Malay*	muchai, *Buriat* moo, ada, *Kalmuk* uscho, *Mongol* eche, egot, *Mantchu* kaniult, *Lamute* elang, " fona, *Turk* jaman, " schor, " geman, *Tartar* pis, *Kirghis* kuttir, *Yakut* wika, *Finn* wikke, *Lapp* baj, *Magyar* paha, *Finn*, *Lapp*	buschtenga, *Samoied* bilu, " orritsh, *Yukagir* kurjast, *Esthonian* losogod, *Ostiak* rosz, *Magyar* gonosz, " kul, *Vogul* booktshalran, *Tunguse*	neesha, *Loo Choo* wasa, " kiwo, *Japanese* warri, " warikakuro, *Japanese* faradato, " khatkin, *Koriak* guetkin, *Tchuktchi* guerkin, " adkang, *Kamtschatka*
good	wulilisiwi, *Delaware* meloo, *Cree* galosit, *Micmac*	weel, *Pelew* aolo, *Awaiya* alla, *Baju* laha, *Tidore* lille, *Tonga* lelei, *Samoa* maholi, *Sanguir* malopi, *Saparua* taloha, *Galela*	iol, *Magyar* ariooldooln, *Tunguse*	nanitallitsh, *Yukagir*	
	ouret, *Sankikani* meroo, *Cree* meyoo, *Cree* mino, *Algonquin*	parel, *Amblaw* marope, *Bouton* mai, *Loriki*, *Camarian* maikai, *Sandwich* mapiya, *Salibabo*		tauritsh, *Yukagir*	kurassa, *Loo Choo*
	mithoo, *Cree*	maitai, *Tagala*, *Austral.* metaki, *Mariannes* mutaki, *Raratonga* ko-muin, *Ahtiago*	ttugai, *Yakut*		matschinka, *Tchuktchi* hota, *Corea*
	onishishin, *Nipissing* oonesheeshing, *Ojibbeway* hacksaw, *Blackfoot* aghseo, " owaisaw, *Shawno*	ungano, *Cajeli* sahenie, *Menado* chia, *Tonga* dagosa, *Wayapo* dagosa, *Massaratty* amaisi, *Batumerah* bahai, baik, *Malay* butje, *Java* baji, *Salayer*	sain, *Mongol* ssain, *Mantchu* ayi, *Turk* jo, *Magyar*		jukka, *Japanese*
great, large	kiche, *Cree*	aiyuk, *Ahtiago*	jaikai, *Kalmuk*	agga, *Samoied*	ikai, *Japanese*

	ALGONQUIN.	MALAY-POLYNESIAN.	URAL-ALTAIC.	ASIATIC-HYPERBOREAN.	PENINSULAR.
great, large	gitcho, *Ojibbeway*	gede, *Java*	ekzsham, *Tunguse*		okii, *Japanese*
		haat, *Massaratty*)	kookas, *Finn*		kaaguk, *Tchuktchi*
	missi, *Shawno*	naiki, naaik, *Timor*	magas, *Magyar*		
	messha, *Algonquin*	monghi, *Bouton*	nagy, "	tshomoi, *Yukagir*	
	ohmohco, *Blackfoot*	wanko, *Celebes*			
	makauk, *Mohican*	owhosi, "	amba, *Mantchu*	paca, *Yenisei*	weesa, *Loo Choo*
		bobuk, *Gah*	boyuk, *Turk*	birkha, "	
		bakeh, *Salayer*		pirce, "	
		moneai, *Savu*			
		maina, *Wahai*			
	ispisew, *Cree* (high)	bagewa, *Salibabo*			
	misikiti, *Cree*	bagut, *Wayapo*			
		maata, *Raratonga*			
		matua, *Rotti*			
		enda, *Batumerah*			
	innuya, *Blackfoot* (long)	jinny, *Arru*			
		nui, *Tahiti*, *Sandwich*			
		Mariannes, *New Zealand*			
	machkilk, *Micmac*	musolah, *Celebes*	azimilshan, *Turk*		
		morokaro, *Bolanghitam*	oolachan, *Yakut*		
		oleeakeck, *Pelew* (high)			
small	chuckio, *Shawno*	chi, igi, oohigi, *Tonga*	kuchuk, *Turk*		ko, *Japanese*
	sahkeo, *Blackfoot* (short)	koi, *Cajeli*, *Liang*, *Lariki*			kusa, *Loo Choo*
		kickarny, *Pelew*			
	aguchin, *Algonquin*	kokaneii, *Camarian*	kichkinga, *Kasan*	kisigena, *Yenisei*	ucinan, *Kamtschatka*
		kichil, *Malay*	ukka, *Lapp*	khennonam, *Yenisei*	komaka, *Japanese*
	chimasin, *Cree* (short)	keni, *Tidore*	isi, *Tcheremiss*	kanok, *Samoied*	ucinolo, *Kamtschatka*
		gunam, *Mysol*			
	takoosew, *Cree* (short)	decheki, *Galela*			
		didiki, *Baju*	unna, *Lapp*		
	enahcootsio, *Blackfoot*	ngiti, *Raratonga*	kutshugai, *Yakut*	ngoliu, *Samoied*	
	langtitti, *Delaware*	unto, *Sandwich*	nukishookan, *Tunguse*	lukun, *Yukagir*	liuchiu, *Koriak*
		ahuntai, *Morella*	madshigo, *Mantchu*	tanu, *Samoied*	ekitachtu, *Tchuktchi*
		itiiti, *Samoa*	tytto, *Finn*		
		kadodo, *Salibabo*	kistin, *Magyar*		
		kidikidi, *Bouton*	kiesiny, "		
		küti, *Wahai*	icet, *Permian*		
	upises, *Cree*	fek, *Tcor*	baga, bacha, *Mongol*		
	abisashow, *Ojibbeway*	wotawota, *Gah*	waha, *Finn*		
		waiwalo, *Gani*			
		bakoti, *Amblaw*			
	pistakwin, *Blackfoot*	pindeck, *Malay*			
	pungo, *Ojibbeway*	bougnia, "			
come	paohio, *Cree*	paituco, *Baju*	guel, *Turk*	(defective)	kuru, *Japanese*

	pahezhe, *Ojibbeway*	bomun, *Mysol*	iraku, *Kalmuk*		arkeo, *Insu*
	pittasimous, *Algonquin*	buoma, *Amblaw*	lähestyn, *Finn*		
	pokhsapiti, *Blackfoot*		toole, *Tcheremiss*		
	paunatao, *Cree*		tule, *Ostiak*		
	astamotch, *Cree*	tommymai, *Sandwich*			
		dumahi, *Sanguir*			
		maika, *Salayer*			
	ondjipi, *Nipissing*	n apa, *Tagala*			
		simepu, *Menado*			
		maive, *Bouton*			
	tootoo, *Blackfoot*	datan, *Malay*	tschi, *Mantchu*		koquasitch, *Kamtschatka*
	tukoosin, *Cree*	tae, *Tahiti*	dsime, "		
	wigun, *Micmac*	ikomai, *Wayapo*	tussim, *Mongol*		chung, *Loo Choo*
		jogmah, *Mysol*			
		gumahi, *Massaratty*			
	ome, *Shawno*	omai, *Cajeli*, *Batumerah*	joni, *Magyar*		
		hammamai, *Marquesas*	uini, *Votiak*		
		hoemy, *Sandwich*			
		uimai, *Liang*			
		mai, *Sula*, *Gani*, *Teluti*, *Gah*, *Wahai*, &c., &c.			
go	ache, *Cree*	ako, *Ahtiago*	jangam, *Ostiak*	(*defective*)	yuki, *Japanese*
	aji, *Algonquin*	iko, *Wayapo*			kung-chung, *Loo Choo*
		wiki, *Massaratty*			
		jog, *Mysol*			
		ai, *Saparua*			
	mahjod, *Ojibbeway*	hoe, *Sandwich*			
	machew, *Cree*	mako, *Menado*	megy, *Magyar*	inghorghodak, *Yukagir*	
	madji, *Nipissing*	notagi, *Galela*	menni, "		
	waiptuai, *Shawno*	buoh, *Amblaw*	yabu, *Mongol*		
		wo, *Tonga*	bar, *Yakut*		
		bo, *Mysol*			
		owcho, *Cajeli*			
		mapuretch, *Salibabo*	choorli, *Tunguse*		
	elmyet, *Micmac* !	lampa, *Salayer*			
		lipano, *Bouton*			
		lungo, *Java*			
	kitootao, *Cree*	ketango, *Gah*	guitmek, *Turk*		howisitch, *Kamtschatka*
		taha, *Gani*			
		tetak, *Alfuros*			
		itai, *Teluti*			
eat	mechew, mechisoo, *Cree*	makeu, *Malay*	enni, *Magyar*		
	wisin, *Algonquin*				
(*vocabularies*	mennisi, *Arrapaho*	munga, *Pelew*			
defective)	mitishin, *Menomeni*	amu, *Tahiti*			

	Algonquin.	Malay-Polynesian.	Ural-Altaic.	Asiatic-Hyperborean.	Peninsular.
eat	maguhet, *Micmac*				
	kitow, *Cree*	kaheo, *Tonga*	assa, *Yakut*	myall, *Yenisei*	owa, *Japanese*
(*vocabularies*	oyoot, *Blackfoot*	kai, *Malay*	yomek, *Turk*	lagul, *Yukagir*	
defective)	wawithone, *Shawno*	faky, *Tonga*	buis, *Yakut*	lak, "	
	oowayo, *Blackfoot*		ide, *Mongol*	lang'dal, "	
	megolhet, *Micmac*		dschemo, *Mantchu*		
drink	maynaan, *Menomeni*	meenum, *Malay*	ichmek, *Turk*	ondzshok, *Yukagir*	nomu, *Japanese*
(*vocabularies*	meninguo, *Miami*	minum, *Malagasy*	issiem, *Yakut*	bedeam, *Samoied*	nominono, *Japanese*
defective)	minikwy, *Ojibbeway*	molim, *Pelew*	koldakoo, *Tunguse*	birebo, "	numu, *Loo Choo*
	mineckwao, *Cree*	unu, *New Zealand*	jugham, *Lapp*	bitlom, "	horopsee, *Insu*
	minikwe, *Nipissing*	inu, *Tahiti*	iovva, *Finn*		
	mawminwaw, *Shawno*	inoo, *Tonga*	ilem, *Ostiak*		
	minno, *Shyenne*		ilal, *Magyar*		
	banna, *Arrapaho*				
	semate, *Blackfoot*				
	missoboguet, *Micmac*				
give	makew, *Cree*	makoo, *Tonga*	mijän, *Lapp*	keick, *Yukagir*	jaru, okuru, *Japanese*
(*vocabularies*	meenuh, *Mohican*	mahoume, *Malagasy*	annam, *Finn*		fureru, "
defective)	noumia, *New England*	nahoume, "	meian, *Esthonian*		hodekoshi, "
	minat, *Nipissing*	minta, *Moluccas*	adni, *Magyar*		quiung, *Loo Choo*
	mith, *Cree*	ujookan, *Java*	ani, *Vogul*		ozagadi, "
	mih, *Algonquin*	nato, *Tahiti*	wot, *Permian*	vormeho, *Kirghis*	khineelgui, *Koriak*
	eguimow, *Micmac*	homai, "	tallel, *Ostiak*	pu, bumbi, *Mantchu*	
	oummeinsh, *Narraganset*	homy, *Sandwich*	vermek, *Turk*	og, *Mongol*	
	melaw, *Shawno*	ambil, *Moluccas*	omul, *Tunguse*	öcku, *Kalmuk*	
	ootookoot, *Blackfoot*	atoo, *Tonga*	omuli, *Lamute*	aza, *Buriat*	tunni, tunim, *Tchuktchi*
		hoatu, *Sandwich*	bier, aghel, *Yakut*		chylgin, "
		angi, *Tonga*	vormeho, *Tartar*		ketam, "
speak	kitoo, *Cree*	kata, *Malay*	daneck, *Turk*	aniak, *Yukagir*	ju, *Japanese*
(*vocabularies*	ikito, *Nipissing*		ittaro, *Yakut*		monoju, *Japanese*
defective)	owaw, *Shawno*	ubu, *Samoa* (speech)	kiesun, *Tunguse*		musmasu, "
	apooyaty, *Blackfoot*	boa, *Tonga*	kapsir, *Yakut*		moosaru, "
	pekiskwao, *Cree*	peeau, *Mariannes* (speech)	kisuremo, *Mantchu*		munuyung, *Loo Choo*
	telawin, *Micmac*	tala, *Tonga, Samoa*	suuilemek, *Turk*		kahalkau, *Kamtschatka*
	alumew, *Cree*	belau, *Malay*	holhu, *Mongol*		
	ieroothack, *Bethuck*	kololo, *Sandwich* (speech)	szolni, *Magyar*		
		korero, *New Zealand* "	beszelni, "		
		lolooy, *Pelew*	kemen, *Kalmuk*		
		lea, *Tonga* (speech)	mondani, *Magyar*		
		parnu, *Tahiti*			
	itwau, wetum, *Cree*	tuatua, *Raratonga* (speech)			
	athimetak, "				
	aninutng, *Algonquin*				

kill	nitago, *Algonquin*	matheo, *Pelew*	ouldirmok, *Turk*	amda, *Yukagir* (death)	korosu, *Japanese*
(*vocabularies*	naulat, *Arrapaho*	matto, *Tahiti*	alana, *Mongol*		shinung, *Loo Choo*
defective)	nissa, *Nipissing*	maki, *Kissa* (die)	kokan, *Tunguse* (die)		kurashung, "
	onikko, *Blackfoot*	maki, *Sandwich* (die)	ölni, megölni, *Magyar*		tokok, *Tchuktchi* (die)
	nobutoo, *Micmac*	avita, *Fiji*	öldökolni, "		
		fasi, *Samoa*			
	nipahao, *Cree*	popchi, *Sandwich*	ledofni, *Magyar*		
	oshnainlinay, *Menomeni*	kukuni, *Mariannes*	knolettaa, *Finn*		
	tahnotow, *Blackfoot*	tamato, *Tonga*	kulto, *Votiak*		
	thaw, *Shawno*	toussoo, *Malay*			
		tai, *Tonga*			
		ta, *New Zealand*,			
		Raratonga, *Austral*.			
day					
(*light, sun*)	kijik, *Ottawa*	cocook, *Pelew*	ketcho, *Tcheremiss* (sun)	kayo, *Samoied* (sun)	gaunak, *Tchuktchi*
	kijiss, *Algonquin* (sun)	coyoss, " (sun)	schi, tschi, *Mordwin*	kuja, " "	nitchi, *Loo Choo*
	kagigah, *Cree*	gawak, *Cajeli*	kouyach, *Tartar* (sun)	ega, *Yenisei* "	matschak, *Tchuktchi* (sun)
	kisik, *Illinois*	dawika, *Sula*	koun, " "	innag, innagi, *Yenisei*	
	kiscoukon, *Abenaki*	kikir, *Liang*	gun, *Turk*	ingui, *Yenisei*	
	keeshqua, *Shawno*	kasalella, *Wahai*	giin, *Kasan*	kiuni, "	
	keeshekeh, *Sac & Fox*	kai, *Saparua*	gundus, *Kirghis*	magi, *Samoied*	
	keesuck, *Narraganset*	esug-esug, *Borneo* (morning)	kuin, *Yakut*		
	kesuk, *Natick*	esuk, *Malay* (morning)	kion, *Uigur* (sun)		
	kouso, *Bethuck* (sun)	seasun, *Mysol*	inengi, *Mantchu*		
	kishesana, *Kickapoo* (sun)	ingkong, *Timbora* (sun)	ining, *Tunguse*		tida, *Loo Choo* (sun)
	keshowghes, *Virginia* (sun)	sunjinji, *Java* "	juggut, *Votiak*		doh, *Kurile*
	kigigatto, *Algonquin*	hangat, *Wayapo* "	xat, *Ostiak* (sun)		quaatsh, *Kamtschatka* (sun)
	ogunnegat, *Ojibbeway*	taginiia, *Gaela*	schondi, *Votiak* (sun)		schekunuk, *Tchuktchi* "
	kesikastao, *Cree* (light)	conang, *Bisayan*	slouna, *Ostiak* "		aghynak, "
	peounceah, *Potawatomi*	pagniarco, *Malay*	paiwe, *Lapp*, *Finn*	pondshirka, *Yukagir*	fi, *Japanese* (sun)
		pongi-pongi, *Tonga* (morning)			
	pisim, *Cree*	aivan, *Java*	paaw, *Esthonian*	tepunnan, *Samoied*	
		popongi, *Raratonga* (morning)			
	ifpeto, *Miami*	fowo, *Gani* (sun)			tokaf, *Aino*
	chequikompuh, *Natick* (sun)	batta, *Batta* "			tofskaf, " (sun)
		poipoi, *Tahiti* (morning)			
	nippauus, *Narraganset* (sun)	unuveno, *Bolanghitam*	nap, *Magyar*		gaunegpok, *Kamtschatka*
	wastawin, *Cree* (light)	dowa, *Wayapo*			
	wahsabyah, *Ojibbeway* (light)	woloh, *Gah* (sun)			
	wasayow, *Cree* (light)	wangi, *Tidore* (sun)	choun, *Mantchu* (sun)		
	wasayawin, " "	wangi, *Galela* "			
		wagi, wai, *Formosa*	vilag, *Magyar* (light)		
	kilswa, *Miami* (sun)	kallha, *Sanguir* (sun)	culgas, *Lapp* "	col, jale, *Samoied*	hallo, *Koriak*
	gilswa, *Shawno* "	kila, *Teluti*	jalakas, " "	tjel, tala, "	alvui, "
	kristoque, *Blackfoot*	biloytuong, *Rejang*	nultiau, *Tunguse* (sun)	jalo, " (light)	liugiut, *Tchuktchi*

	Algonquin.	Malay-Polynesian.	Ural-Altaic.	Asiatic-Hyperborean.	Peninsular.
		alowata, *Morella*	nunal, *Votiak*	cel, *Samoied* (sun)	
		wollusita, *Tidore*	lun, *Permian, Siriantan*	jolonsha, *Yukagir* "	
		low, *Teor*	gorel, *Mongol* (light)	hajer, *Samoied* "	karui, *Japanese* (light)
	kisipol, *Sac & Fox* (sun)	pilia, *Alfuros*	narau, " (sun)		akari, " "
		apalawe, *Awaiya*	eduro, "		heeroo, *Loo Choo* "
	wasalow, *Cree* (light)	watiela, *Batumerah*	eder, *Kalmuk, Buriat*		feeroo, " "
	wasarow, " "	mataron, *Menado* (sun)	tirgani, *Tunguse*		
	wasalawin, " "	matalima, *Ahtiago*	nur, *Turk* (light)		
	wasarawin, " "	mantarai, *Malay* (sun)	sirdik, *Yakut* (light)		
		massoanro, *Malagasy* (sun)			
		matalon, *Baju* "			
		matualo, *Salayer* "			
		mataari, *Malay* "			
	nishiish, *Arrapaho* (sun)		nunass, *Votiak*		nitji, *Japanese* (sun)
night	dobicott, *Ojibbeway*	daputo, *Galela*	jaukoba, *Vogul* (moon)	pidziga, *Yenisei*	tyngfouti, *Koriak*
(*darkness*,	dobikat, *Algonquin*	sophuto, *Tidore*	begh, *Tunguse* "	bicidin, "	yoru, *Japanese*
moon)	tippocat, *Narraganset*	matabut, *Ahtiago*	bjega, " "	bis, "	josari, "
	tpoku, *Delaware*	cappasay, *Pelew*	sara, *Mongol* "	pausemya, *Samoied*	atziroo, *Aino*
	topocq, *Mohican*	gubio, *Bolanghitam*	hold, *Magyar* "	paebi, "	kolkwa, *Kamtschatka*
	tpochku, *Minsi*	hubbi, *Sanguir*	kouli, *Esthonian* "	faemi, "	
	topochko, *Shawno*	pogaragana, *Teor*	tolys, *Permian, Siriantan* (moon)	pi, fi, fing, "	
	tipiscow, *Cree*	pai, *Gani* (moon)	idai, *Ostiak*	poinjaletok, *Yukagir* (evening)	
	pesede, *Abenaki*	potu, *Saparua*	keranlik, *Turk* (dark)	yirri, iri, *Samoied* (moon)	mimo, *Japanese* (dark)
	pekotok, *Menoment*	potu, *Cajeli*	kharangha, *Yakut* (dark)	kiniusha, *Yukagir* "	kurasing, *Loo Choo* (dark)
	piskak, *Delaware*	boto, *Wayapo, Massaratty*	ai, *Turk, Uigur* (moon)	omnel, "	mangets, *Japanese* (moon)
	pishkecaukh, *Micmac*	bohuwi, *Sula*	ooi, *Yakut* (moon)	omnitsch, " (dark)	gailgen, *Koriak* "
	pokonteauo, *Miami*	bokomo, *Gani*	tun, *Uigur*		geiligen, " "
		potuun, *Alfuros*	tuin, *Yakut*		tchngaloh, " "
		bungi, *Java*	dolboni, *Tunguse*		kounetson, *Aino* "
	nipahune, *Delaware* (moon)	fasina, *Sula* (moon)	golban, *Tunguse*		oostitchee, *Loo Choo* "
	nopauk, *Mohican* (moon)	bouan, *Tagala* (moon)	keesse, *Yakut* (evening)		maroo, *Loo Choo* "
		wuan, *Gah* (moon)	guejeh, *Turk*		yuru, " "
	nukon, *Massachusetts*	maugong, *Timbora* (moon)	koun, *Finn* (moon)		unujak, *Tchuktchi*
	skaynatsco, *Blackfoot* (dark)	sangau, *Baju*	sum, (*Mongol*)	nödi, *Samoied*	taukuk " (moon)
	caquay, *Blackfoot*	ahiahi, *Tahiti*	ku, kou, *Finn* (moon)	khi, kui, *Samoied* (moon)	tschatame, " "
	kisis, *Illinois*, &c. (moon)	osa, *Galela* (moon)	ku, kou, *Mordwin* (moon)	shui, kui, *Yenisei* "	tsuki, *Japanese* "
	kisathwa, *Shawno*, &c. (moon)		oj, *Magyar*	tui, " "	stchay, *Loo Choo* "
	lonaupoo keesho, *Mississagua*		jugun, *Finn*	ud, gigod, *Samoied*	dochsao, *Kamtschatka* (dark)
			haranguel, *Mongol* (dark)		
			moorak, *Tunguse* (evening)		
one	bojig, *Ojibbeway*	paoho, *Uea*	vaiko, *Mordwin*	irkon, *Yukagir*	sylunap, *Kamtschatka*
	poyak, *Cree*	wasa, *Batumerah*	bir, *Turk*		shnopf, *Tarakai*
	pajik, *Algonquin*	sawiji, *Java*	bir, *Yakut*		zinezf, *Yesso*
	beesick, *Penobscot*	soboto, *Bolanghitam*	auft, *Lapp*		sheeneap, *Insu*

	bechkon, *Etchemin*	nabi, *Amblaw*	oomun, *Tunguse*		
	pasuk, *Natick*	lopso, *Gani*	mukoun, *Tunguse*	chusem, *Yenisei*	
	neept, *Melicete*	parai, *Balad*		chusam, "	
	weembut, *Piankashaw*	sombaow, *Salibabo*		chuta, "	
	cotch, *Delaware*	hots, *Yengen*	otik, *Permian*	hucha, hauta, *Yenisei*	te, teetsee, *Japanese*
	cotto, *Sankikant*	sato, *Malay*	otik, *Sirianian*	hocha, *Yenisei*	itchee, *Loo Choo*
	quottie, *Shawno*	sadah, *Batta*	iits, *Esthonian*	khusei, "	iz, stozee, *Japanese*
	aquit, *New England*	sedi, *Bugis*	it, *Ostiak*		stitz, *Insu*
	ingoto, *Miami*	satu, *Sambawa*	nige, *Mongol*	om, *Samoied*	hodjun, *Corea*
	nquit, *Narraganset*	katim, *Mysol*	nego, *Buriat*	unem "	hotun, "
	negout, *Souriquois*	kotahai, *Easter*	xego, *Dzungarian*		kominis, *Kamtschatka*
	necootie, *Shawno*	atahai, *Otaheite*	nege, *Khalca*		
	nout, *Micmac*	nosiuni, *Massaratty*	negen, *Olots*		
		moi, *Galela*			
	nuko, *Shyenne*	nehi, *Manatolo*			
	su, *Blackfoot*	sa, *Malay, Java, Amboyna, Baju*, &c., &c., &c.			
	jih, *Blackfoot*	ji, *Malay*	ik, *Tcheremiss*		
		hia, *Sula*	egy, *Magyar*		
		hoo, *Tahiti*	yksi, *Finn*		
	chasu, *Arrapaho*	kusa, *Sanguir*			
		chas, *Lifu*			
		kayco, *Teor*			
	tookskum, *Blackfoot*	tatsaat, *Formosa*			
		tahi, *Marquesas*, &c., &c.			
		takura, *Serang*			
two	tabo, *Souriquois*	duwa, *Bugis*	gojer, *Mongol*	antachlon, *Yukagir*	tup, *Tarakai*
	tanbw, *Micmac*	dulava, *Manilla*	koir, *Buriat*	kydy, *Samoied*	zuzb, *Yesso*
	tarpoo, *Melicete*	dalava, *Tagala*	chojur, *Dzungarian*	syda, "	fupu, *Corea*
	neguth, *Shyenne*	sinuto, *Galela*	choor, *Khalka*	ynem, *Yenisei*	dupk, *Kamtschatka*
	nahtoka, *Blackfoot*	romodetti, *Tamati*	chojor, *Olots*	unem, "	ne, *Japanese*
	nij, *Ojibbeway*	nua, *Sava*		ince, "	nee, gnee, *Loo Choo*
	neesoh, *Mohican*	sua, *Mangaui*		una, "	ta, tatzee, *Japanese*
	nesoo, *Cree*	zua, *Flores*		inja, "	statzee, "
	nicha, *Delaware*	agua, *Tuham*	iki, *Turk*	kina, "	too, statz, *Insu*
	neshway, *Miami*	gahu, *Sula*	ikko, *Yakut*	hineang, "	mittanoo, *Kamtschatka*
	neesh, *Penobscot*		kaksi, *Finn*		
	nois, *Arrapaho*		kats, *Esthonian*		
	nees, *Montaug*		kok, *Tcheremiss*		
	neeso, *Massachusetts*		kavto, *Mordwin*		
	niss, *Abenaki*		kyk, *Permian, Sirianian*		
	nes, *Potawatomi*		kat, *Ostiak*		
	nysso, *Sankikant*		ket, *Magyar*		
	neeshwie, *Shawno*		djuhr, *Tunguse*		
	nesuog, *Natick*				

	ALGONQUIN.	MALAY-POLYNESIAN.	URAL-ALTAIC.	ASIATIC-HYPERBOREAN.	PENINSULAR.
three	nis, *New England*	nih, *Timbora*	uch, *Turk*	nagor, *Samoied*	san, *Japanese*
	noghlah, *Mohican*	sangi, *Galela*	ows, *Yakut*	tonga, *Yenisei*	sang, *Loo Choo*
	nacha, *Delaware*	ange, *Galela*	kolme, *Finn*	tjonga, "	sai, *Corea*
	nacha, *Sankikani*	ange, *Tidore*	kolm, *Esthonian*	donga, "	mee, meetsee, *Japanese*
	nothwie, *Shawno*	neti, *Paumotuan*	kum, *Tcheremiss*	dongeen, "	tshusquat, *Kamtschatka*
	nistoo, *Cree*	kunete, *Lifu*	kolmo, *Mordwin*	dogom, *Yenisei*	mitz, *Insu*
	gicht, *Souriquois*	gatil, *Sula*	kujim, *Permian, Sirianian*	lalon, *Yukagir*	liep, "
	sist, *Melicete*	tigu, *Malay*, &c.	chudem, *Ostiak*		repf, *Tarakai*
	seast, *Micmac*	othoy, *Pelew*	harom, *Magyar*		rezb, *Yesso*
	nash, *Abenaki*	veti, *Isle of Pines*	kolm, *Lapp*		raph, *Kamtschatka*
	nas, *Arrapaho*	kuu, *Uea*	elan, *Tunguse*		
	nish, *Narraganset*		ilanu, "		
	naho, *Shyenne*		churban, *Mongol*		
	naas, *Penobscot*		gurban, *Buriat*		
	nach, *Etchemin*		gurba, *Dzungarian*		
	nissin, *Ojibbeway*	hayen, *Yengen*	gurba, *Khalka*		
	noswoh, *Miami*		gurban, *Olots*		
	nisswi, *Nipissing*				
	nahhoka, *Blackfoot*				
	nishush, *Natick*				
	nishwoner, *Piankashaw*				
four	yehhoo, *Penobscot*	ahka, *Kissa*	durban, *Mongol*	shega, *Yenisei*	sy, *Japanese*
	yoh, *Narraganset*	ha, aha, *Sandwich, Marquesas*	derbyn, *Buriat*	shegiang, "	sheo, *Loo Choo*
	yaw, *Massachusetts*	hau, *Rotti, Easter*	dorbo, *Dzungarian*	chega, "	yoo, *Japanese*
		ahaa, *Otaheiti*	durba, *Khalka*	ziang, "	eeotsee, *Japanese*
		hah, *Sava*	dorbon, *Olots*	siam, "	yeatze, *Insu*
	yeano, *Arrapaho.*	oang, *Pelew*	digon, *Tunguse*	syjem, "	eenep, "
	neawe, *Shawno*	ampah, *Lampon*	degenu, "	shaja, "	tshascha, *Kamtschatka*
	navo, *Shyenne*	ampat, *Malay*, &c.	neljä, *Finn*	deite, *Samoied*	inezb, *Yesso*
	nasowo, *Blackfoot*	kopa, *Sanguir*	nolli, *Esthonian*	tade, "	inipf, *Tarakai*
	newo, *Delaware, Cree*	beu, *Isle of Pines*	nil, *Tcheremiss*	jelahlon, *Yukagir*	yhnap, *Kamtschatka*
	new, *Algonquin*	pa, *Celebes, Bouru*	nile, *Mordwin*		nai, *Corea*
	now, *Micmac*	fa, *Tonga*, &c.	njolj, *Permian, Sirianian*		
	naou, *Sheshtapoosh*	enhata, *Alfuros*	njeda, *Ostiak*		
	neo, *Nipissing*	ope, *Paumotuan*	negy, *Magyar*		
	niwin, *Ojibbewa*,	opak, *Bugis*	dirt, *Turk*		
	nayhoo, *Melicete*	maha, *Tahiti*	tirt, *Yakut*		
five	nan, *Micmac*	nim, *Caroline*	besh, *Turk*	chajem, *Yenisei*	koomdas, *Kamtschatka*
	nanan, *Ojibbeway*	nima, *Tonga*	bes, *Yakut*	kakjam, "	ahsik, "
	nanan, *Nipissing*	nima, *Wahat*	viisi, *Finn*	gagom, "	go, goo, *Loo Choo*
	niyanan, *Cree*	nim, *Yengen*	wiis, *Esthonian*	oheilang, "	go, *Japanese*
	noano, *Shyenne*	aeom, *Pelew*	vis, *Tcheremiss*	geijang, "	ittitsee, *Japanese*
	nesotoo, *Blackfoot*	matoha, *Galela*	väto, *Mordwin*	koga, "	idotzeo, "
	naisetow, "	neka, *Paumotuan*	vit, *Permian, Sirianian*	khala, "	itzeitzee, *Insu*

	naulon, *Delaware*	lima, *Malay*, &c., &c.	vet, *Ostiak*	sumulu, *Samoied*	asheak, "
	nelanum, *Cree*	limanu, *Bouton*	öt, *Magyar*	shumblia, "	tashu, *Corea*
	noallonwo, *Shawno*	enlima, *Alfuros*	wit, *Lapp*	totti, "	asheki, *Tarakai*
	noranum, *Cree*	oreema, *Otaheiti*	tona, tongou, *Tunguse*	ougaulon, *Yukagir*	ashikinipf, *Tarakai*
	yorthun, *Arrapaho*	romatoha, *Tamati*	tabun, *Mongol, Buriat*		ussikim, *Yesso*
	palenach, *Delaware*	panim, *Balad*	tabu, *Dzungarian, Khalka,*		assaraneeof, *Yesso*
	pohlenish, *Penobscot*	pulu, *Tagala*, &c. (ten)	*Olots*		
six	nahoh, *Blackfoot*	noh, *Amblaw*	alti, *Turk*	muktum, *Samoied*	mootsee, *Japanese*
	neyu, "	noi, *Teluti*	alta, *Yakut*	malghialon, *Yukagir*	nitzee, "
		nooh, *Saparua*	kunsi, *Finn*	ahjem, *Yenisei*	rok, "
		noo, *Lariki*	kuus, *Esthonian*	ages, "	rooko, *Loo Choo*
	nitahter, *Arrapaho*	nota, *Isle of Pines*	kut, *Tcheremiss*	agam, "	jishu, *Corea*
	nahsato, *Shyenne*		koto, *Mordwin*	aggiang, "	nitz, *Insu*
	negudaus, *Abenaki*		kvait, *Permian, Sirianian*	gelucha, "	ewan, "
	nacuttah, *Montang*		chut, *Ostiak*	kelucha, "	juwambi, *Tarakai*
	husagum, *Micmac*	gane, *Sula*	hat, *Magyar*	ogga, "	juiwanbe, *Yesso*
	asigum, "	kanum, *Sanguir*	kut, *Lapp*	geiluddgang, *Yenisei*	iwam, "
	negotaneo, *Penobscot*	butanga, *Galela*	kot, *Vogul*		kilkoas, *Kamtschatka*
	enkwitash, *Delaware*	nimwet, *Yengen*	dsirohu, *Mongol*		chguachu, "
	karmarchiu, *Melicete*	gurum, *Tuham*	ddjergon, *Buriat*		
		malong, *Pelow*	surga, *Dzungarian*		
	nigotwasswi, *Ojibbeway*		asurga, *Khalka*		
	nikotwasik, *Cree*		surgan, *Olots*		
	necootwathwee, *Shawno*		kilkok, *Tunguse*		
	guttach, *Delaware*		nunun, "		
seven	kitsic, *Blackfoot*	hitu, *Marquesas*	yedil, *Turk*	oujang, *Yenisei*	stchee, *Loo Choo*
	akitsecum, *Blackfoot*	aheitoo, *Otaheiti*	setu, *Yakut*	ohnem, "	siz, *Japanese*
	topakup, *Cree*	kapitu, *Sanguir*	seitsemän, *Finn*	ouse, "	nannatsee, *Japanese*
		gapitu, *Sula*	seitse, *Esthonian*	erham, "	arrawan, *Insu*
	tambaohoos, *Penobscot*	kumba, *Timbora*	sim, *Tcheremiss*	umya, "	aruwambi, *Tarakai*
		tumodi, *Tidore*	sisem, *Mordwin*	geiliniang, "	aruambi, *Yesso*
		tumidingi, *Galela*	sizim, *Permian, Sirianian*	kelina, "	aruwam, "
		tomdi, *Tamati*	tabet, *Ostiak*	kube, *Samoied*	jiku, *Corea*
	nisoto, *Shyenne*	enhit, *Alfuros*	het, *Magyar*	seigbo, "	aruachu, *Kamtschatka*
	neswawthwe, *Shawno*	witu, *Awaiya*	naddan, *Tunguse*	purohion, *Yukagir*	ittachtenu, "
	nijwasswi, *Ojibbeway*	petu, *Java*, &c.	etgatanok, *Tunguse*		
		nobo, *Isle of Pines*	dolochun, *Mongol*		
	nesoonsuk, *Cree*		dolon, *Buriat*		
	nichach, *Delaware*		dolo, *Dzungarian, Khalka*		
	nisorter, *Arrapaho*		dolon, *Olots*		
	eloohaykenuck, *Melicete*	luengemon, *Lifu*			
	aluginoo, *Micmac*	loiitfou, *Isle of Moses*			
		loalo, *Uea*			
		nim weluk, *Yengen*			
	keechegum, *Blackfoot*				

	Algonquin.	Malay-Polynesian.	Ural-Altaic.	Asiatic-Hyperborean.	Peninsular.
eight	alenanoa, *Cree*	veluano, *Bouton*	kahdexan, *Finn*	malgialachlon, *Yukagir*	tshokteun, *Kamtschatka*
	aumulchin, *Micmac*	onwol, *Alfuros*	kattesa, *Esthonian*	geiltangiang, *Yenisei*	duhpyhs, "
	hogomulchin, *Melicete*	oialou, *Isle of Moses*	kändäxe, *Tcheremiss*	chajem-dogom, "	toopish, *Insu*
		walou, *Malagasy*, &c.	kavsko, *Mordwin*	unem-boisem-chogem, *Yenisei*	yeatz, "
	narnesweum, *Blackfoot*	karna, *Salayer*	kökjamys, *Permian*, *Sirianian*	hun-basi-ang, *Yenisei*	tubishambi, *Tarakai*
	arenanoa, *Cree*	waru, *Amboyna*, &c.	nida, *Ostiak*	kattaga, "	zujemambi, *Yesso*
	ayenanew, "	koneho, *Timbora*	njolcz, *Magyar*	chetonga, "	zubsam, "
	nahnai-sweyeme, *Blackfoot*	nim-weyen, *Yengen*	kykiamis, *Permian*	kina-manchan, "	faz, *Japanese*
	nishwasswi, *Ojibbeway*	kun-engemen, *Lifu*	sekkez, *Turk*	kuydeite, *Samoied*	eeyatsee, *Japanese*
	saansuck, *Penobscot*	wan, *Caroline*	ogos, *Yakut*	syetade, "	iosee, "
	swassik, *Cree*	saya, *Kayan*	djapkull, *Tunguse*		jita, *Corea*
	chach, *Delaware*	gatahua, *Sula*	tshokotenok, *Tunguse*		fatchee, *Loo Choo*
	nghash, "	wagu, *Teluti*	naiman, *Mongol*		kwatchee, "
	nahnotó, *Shyenne*		najaman, *Buriat*		
	nahsorter, *Arrapaho*		naima, *Dzungarian*, *Khalka*		
	thwawsickthwe, *Shawno*		naiman, *Olots*		
nine	shack, *Cree*	signa, *Tuham*	dokkuz, *Turk*	togos, *Samoied*	jahao, *Corea*
	shangasswi, *Nipissing*	sanga, *Java*	tagos, *Yakut*	chajem-sysem, *Yenisei*	coo, *Loo Choo*
	caugaswi, *Algonquin*	skengemen, *Lifu*	tshakatomok, *Tunguse*	chusem-boisem-chagem, *Yenisei*	kon, *Japanese*
	jangwasswi, *Ojibbeway*	sin, *Mysol*	ijogjin, "	*chuta-jauos-cheijang*, "	*kokonitz*, *Japanese*
		sioanu, *Bouton*	jisun, *Mongol*	goddjibunagiang, "	kounitsee, "
	eokenardek, *Melicete*	lothack, *Uea*	jihun, *Buriat*	huchabunaga, "	lepish, *Insu*
	kekamitatat, *Cree*	metauda, *Formosa*	jesu, *Dzungarian*, *Khalka*	khusa-manchan, "	shinebishambi, *Tarakai*
	chawkuthwe, *Shawno*	gutusia, *Sula*	jesum, *Olots*	chunierki-ellendzshien, *Yukagir*	sinesambi, *Yesso*
	siautah, *Arrapaho*	etew, *P*[illegible]	yhdeksan, *Finn*		sinobsan, "
	soto, *Shyenne*	siyu, *T*[illegible]*ati*, &c.	iitesa, *Esthonian*		synahpyhs, *Kamtschatka*
		samba[illegible], *Sambawa*	endexe, *Tcheremiss*		tshaktanak, "
		sioh, *Timor*, *Rotti*, &c.	väikse, *Mordwin*		
	nolo, *Delaware*	sambilan, *Malay*, &c.	ökmys, *Permian*, *Sirianian*		
	nohleo, *Penobscot*	lali, *Timbora*	arjong, *Ostiak*; kilencz, *Magyar*		
ten	mahtoto, *Shyenne*	mackoth, *Pelew*	arban, *Mongol*, *Buriat*	kuniella, *Yukagir*	komtook, *Kamtschatka*
	mahtahtah, *Arrapaho*	manud, *Tuham*	*Khalka*, *Olots*	tchiuu, *Samoied*	upyhs, "
	midasswi, *Ojibbeway*	putusa, *Serang*	arba, *Dzungarian*	bet, "	wambi, *Tarakai*
	neetawthwee, *Shawno*	painduk, *Yengen*	tshomkotak, *Tunguse*]	chojum, *Yenisei*	wambe, *Yesso*
	mitaswi, *Nipissing*	fotusa, *Ahtiago*	djanu, "	kogom, "	fambe, "
	mitatat, *Cree*	hutusa, *Awaiya*	own, *Turk*	chogem, "	wanna, *Insu*
	tellin, *Delaware*	teran, *Matabello*	on, *Yakut*	hagiang, "	yoo, too, *Japanese*
	tillun, *Melicete*	saroni, *Timbora*	lava, *Uigur*	chaha, "	siou, "
	matala, *Penobscot*	nulu, *Manatoto*	kymmeven, *Finn*	haga, "	joo, dzoo, *Loo Choo*
	umtolen, *Micmac*	ongofooloo, *Tonga*, &c.	kümme, *Esthonian*	khoa, "	je, *Corea*
		nafula, *Samoa*, &c.	lu, *Tcheremiss*	chaijang, "	
	chitnorth, *Micmac*	nauru, *Raratonga*	kämen, *Mordwin*		
	kaipoo, *Blackfoot*	kapuroh, *Sanguir*	das, *Permian*, *Sirianian*		
	wimbut, *Delaware*	tobennete, *Uea*	jong, *Ostiak*		

		vuta, *Ahtiago*	tiz, *Magyar*		
		boto, *Cajeli*	lokke, *Lapp*; lu, *Vogul*		
hundred	mitana-mitina, *Cree*	hutuna, *Amboyna*, &c.	dsun, *Mongol*, *Buriat*	kysash, *Yenisei*	sing, *Loo Choo*
	mittausau-mittawnaw, *Ojibbeway*	hutun, *Ceram*, &c.	dsu, *Dzungarian*, *Khalka*	kyha, "	
		uton, *Mysol*, &c.	sulu, *Olots*	utamsa, "	
			nemadjo, *Tunguse*	tchius, *Samoied*	
				dsoon, "	

VOCABULARY II.

Comparison of Characteristic Forms in Algonquin, with the same in the Languages of Neighbouring Families.

	ALGONQUIN.	ATHABASCAN.	IROQUOIS.	DACOTAH.	CHOCTAW.
man	lenno, illinni	aille, tenalo, tchelaqui	lonque, lookque	hihna	
	renoes		ronkwee, raniha		
	ithini	dinnie, tino, tengi	etschinak	wicasta	hatak
	nah, inini	khanae, sikkanne	cuiha, hajinah	wincha	nockene
	ninaben			numohk	
	wessia			wahsheegae	
	tommawshow			ceeteka	chauheh
	mahtsee	enday, ndo	entequos	matse	
woman	wiwah, wowemow			wako, weah	
	newah		kanenwenh	mega, meha	
	abitase				tike, hoktie
	eskwa, ichque	iayquay, chequois	yonque		ohoyo, chauhiwauh
child	cnese, negusis	yazo	ixhaa	chincha	ushe
	awansis, owasis	trinyin	raxaah	wahcheesh	
	pappoos	sie, toju	woccanoune	hoksiyopa	pooskoos
	apilossah	quelaquis	kotonia	sookhomaha	vlla
	necovis	tenaiyusa			
boy	ianis, nekeesh	tinji, tenaiu	haksaah	ceneek	nokkene
	bawtoos	tsiah, tcho	raxha, laxha	hoksidang	choppootche
	quises	azay, syaseh	yung, chahinks	eeingyai	ushi
girl	danis	idazoo, oto	yaweetseutho	moyakatte	take
	mitanis	nitsit	ekrojehawak	wechincha	oshetik
	panum	lengai, keel		meha, mega	
	epidek	chi, zaa	yakenwaston	weetsheeahnah	villa tak
	squasese	syaseh, sekus	exha, kaxha		
head	wil, wilan	umitly	onoalagoue		
	wyer	se wolyer	otahra, anuwara	marshaa	ecau
	stikwan	astintah, hutzeetzin	skotan, scouta		isteka
	uppa, puhkuk	pitsa, betthie		pa, pahhih	eebuk

	ALGONQUIN.	ATHABASCAN.	IROQUOIS.	DACOTAH.	CHOCTAW.
head	dup, neetop	ethi, thie		antu	nishkubo
	menongi	sugha, aissagge	nontsi, ranontsi	naso	
mouth	madoon, indown	ta, edha	wachsagaint	ei, ea, ihah	iti
	nettee, meessey	chezhik, huzzay	chigue	pootay	
	marthe	kasatl	oosharunwa		
	netlee	salutte	wachsacarlunt		
tongue	weelauloo, wilano	lasom			soolish
	mitaluno	thoula, tsoola			soonlush
	nirnou	sheedare		rezi	istetolahswah
	tenanian	kanat	owanauchsuh	cozi	
	minau, neannan	soh, luzzy, chicha	ennasa	dezi	
	ootou	ethu, edthu	enachse	theysi	
tooth	nibit, mepit	goo, chagoh	onawy	i	noteh
	wipi, webit	howwah, howgo	onotchia	hi	noteeh
	veisike	sheego	honozzia	ei	
	nepitallah	sawyer, hurgo	onawira		
	tibbit	shti	otoatsch		
nose	yoch, chassie	so·tzee	oojyasa		
	gheen, chichkon	chintsih	onuhsah		
	wikiwon	witchess	aongya		
	keeton	hutchin, khointsus	kakondah		
	mikoot.	mintshesh		pahoo, pasu	
	peechten	neuzeh		pute	isteepooh
	chalik	kaljuatsch		apa	ebitchella
	ocrisis	schiutschish		buppa	
eye	miskichi	nackhay, nakhai			nishkin
	mate	ente		meishta	eenoskeen
	schinquay	ssnega	yochquiendoch	ista, ishta	
	kechekoue	konda, chindar	ohuchta	estume	
	nepiquigour	senourvoh	okahra	ite	
	owopspee	pindah	acoina	ister	
	seeseeko	schindah	kaka		
	wuskink	sleeda, sleenda			
ear	towakah	hutchah	ookahnay	naughta	tsechokolo
	wittawak	wickyah	ohontah	neetah	kutseo
	nootawee	szoga, tshigha	ohuchta	noge, nakoha	
	hyttrwack	ocho, zach	wauntah	nakpa	ocksebish
	chalksee	szulu			haklo
hand	oleechee, niligee	hollah, shlaa	shake		ilbeck
	nahck	inla, lah	kaschuchta	onka	iunkkee
	oniskan	skona	osnonsa	naue	istinkeh
	neninch	kajakaz	osnoongee	sake, shagai	
	peton	wislah		nape, nonpay	ibbak
	maharts	chinli, law	ahonressa		

foot	maemed kussie katah seet waseed nesit lelckistan	selur chekeh, kagasch schkatna stah eke, oca, cuh shko, seka jetly, skaltna	yoroesaw saghsigo ochsita sita, ochida oosootaw saseeko sheedau	silha; sih itsi the, tsi buschee	iyi yoyeh
black	kusketa suckgek skaynatseo mowesu mukkooto mandzey	klazin huldji tkhlsune dellzin tarzi	tetlucalas hontsi yorwetsoyuh tewhgarlaro	sapa sewi tpaza eokhpazek	isteelectoppixsee echatau loosah lusteeh
white	opee wape wabeek wompi	lakki, halukai delksay takaih itesina	kenrat kearagea wrahesta	ska sang ntaki	bota
red (blood)	squayo ahsain mik, mesquah mainkhe bahe, pockagun	delicouse, tutkhl tatsik, takakueto tell sko tah	quwentarogon youtkojunya hotkwensa cotnuh	wahsah hishi duta idi we	issish homma
bad	mattik muchisew monadud malatisew maratisew pahkaps	satklaka nizikwah tschoolta sleni koschijal	wahetka hetken yodaksea aksen yeghscrohea wahpateku	shiche kheeush ishia cheja kubbeek	okpulo
good	wulilliswi ouret meyoo mino mithoo onishishin aghseo owalsaw	thloucunni leyzong nrzih neeheosoo ouchon nazoon sutschon itait	ioyanere wegwest wastaitch	uohta tsaki shusu washtai itsicka	achukma chookoma heetla
great	kicho gitche messha ispisew misikiti innuya machkilk	eha, choh tchos, tcha nitsih wane mintshaghe nekau unshaw	kowa hons	hashkah tangka ictia honska	ishto chito
small	chuckie awuchin	tsoota	ostonha	oisting	

	ALGONQUIN.	ATHABASCAN.	IROQUOIS.	DACOTAH.	CHOCTAW.
small	chimasin	chautah		tonana	
	takoosew	astokwoo	diwatsa	ecat	
	enahcootsie	nacontza		cikadang	iskitini
	langtitti	tsul, nettsul			
	upises	ensoolo			
	pistakwin				
	pungo				
come	pacho	chatchoo	kajeo	kuya	vla
	pitassimous		kats	hiya	
	panatao	anyat	karo	hi	
	astamotch	yeudessay		u	
	ondjipi	andezei			
	tootoo	yuksozin-essal			
	wigun				
	omo	ano, orne			
go	acho	essay	iki	ya	ia
	machew, madji	eenio	aghdeandi		
	waipthai	antonger			
	elmyet	anahzontteo			
	kitootao				
eat	meehow	setso	higuekch		
	monnisi	ishshan	iraks		
	wisin	boha		duti	vpa
	mitishin	chesti		wota	impa
	kitow	utzits, shateo	ahadigo	utah	
	wawithene		dahontskahon	utahpe	humbiischa
	megelhet	keljkatj	yusyhoory	rooshtoosh	
drink	maynaan	chidetlch	uttanote		ishko
	minikwe	mljchny	akhnekira	hi	hishko
	minno		guehra	yatkang	
	banna			beedeehee	
	somate	esdan		smimmik	
	misseboguot			nebnatah	
give	makew		waghsaka	accujo	ema
	meenuh	besanesdi	cassar	ku, khu	
	mith	entar	kayahwe		
	eginemow	antschatte	wahetky		
	cummeinsh	chushitscha			
	melaw	hamiltu			
	ootookoot				
speak	kitoo	kanna	haguetaa	yaotangin	
	ewaw, apooyatz	tini	chawtonk	ide	
	pekiskwao			bidow	
	telawin	katlijach		ia	

	forootback	yaltuck	raton		
	itwao	yawsthee, yasti	atakea		
	animutag				
kill	nitage	tridhehlkai	kerios		numpuli
	enikke	uzcagha			
	nipahao	lesanesshi		kita	
	tahnetow	thla, thloa		kte	abi
	thaw	ziltir		ta	uhbe
day	kijik, kisik	kakech	gachquaw	cang	
	ogunnegat	cheengo, cajauo	andakagagua	ohjajo	neetak, nittah
	pecuneah, pesim	dzine, janes, tsin	wahnta	haunip	hushi, hashee
	ifpete	tschan, kan	ootaune	anpetu	
	nippauus	apach	onteka	ompah	
	wastawin	taosse, tsa	wende	thieshe	
	wasayow	sah, tchay	hiday	weehah	
	kilswa	tiljean, klut	kilanquaw	ahhiza	
	cristoque	drin, attri	garachquaw	menahkah	
	kisipol	katakyl	yoohooks	wee	
	wasalawin	shaitltiti	yorhuhuh	mapemidi	
	wasarawin	rseye	ennisera		neethleh
night	dobicott	sah, kacha	karakkwa	owee	
	pesedo	tata, tedho	heegtheh	aoui	opia
	piskak	shetsill	kelanquaw	estogr	
	nepauk	taltolla	kachqua	onhape	
	nukon	kleakut, khutli	autsunye	maku	
	skaynatsee	sulchatl	asonthen	hangyetu	nennak
	caquay, kisis	hkah	sonrek	oche	hashenecnak
	lenaupee keesho	tlakannoo	aghsont	htayetu	hushi

4

VOCABULARY III.

Comparison of Pronouns.

	ALGONQUIN.	MALAY-POLYNESIAN.
I	neya, *Cree*	naak, *Pelew*
Thou	keya, "	kow, *Pelew*; kowe, *Ponape*
	ki, *Delaware*; kee, *Shawno*	koe, *New Zealand*; coy, *Tonga*
	ki, *Ojibbeway*	koai, *Malay*
He	noh, *Natick*; neha, *Delaware*	na, "
	weya, *Cree*	iya, *Tagala, Malay*
	oo, *Shawno*	aia, *Tonga*
We	keyanow, *Cree*	cami, *Tagala*; kami, *Malay*
	kenawun, *Natick*	gimowooa, *Tonga*
	mow, *Micmac*	mow, *Tonga*
	kistahnon, *Blackfoot*	kita, *Ponape*; keeta, *Malay*
	neyunow, *Cree*	naic, *Malagasy*
you	keyuwow, *Cree*	koe-ee-oo, *Malay*
	kenuau, *Natick*	kamo, *Tagala*; kamu, *Malay*
	kinawa, *Ojibbeway*	gimooa, *Tonga*
they	nahoh, *Natick*	now, "
	winawa, *Ojibbeway*	ginowooa, *Tonga*

Prepositions and Adverbs.

before	amooya, *Cree*	mua, *Tahiti*; gi-mooa, *Tonga*
		dee-mooea, *Malay*
below	utamik, *Cree*	atas, "
	chupuses, *Cree*; tabassish, *Ojibbeway*	da-baoua, "
behind	ootak, "	tooa, *Tonga*
near	teik, *Algonquin*; cheke, *Cree*	dekat, *Malay*
at	kekek, *Cree*	ka, "
against, about concerning.	ooche, *Cree*	gi, *Tonga*

VOCABULARY OF MISCELLANEOUS TERMS.

Algonquin and Malay-Polynesian.

	ALGONQUIN.	MALAY-POLYNESIAN.
all	misewa, mamo, *Cree*	mau, *Tahiti*
alone	pikoo, *Cree*	bo, *Tonga*
ant	ayik, "	kakai, *Amblaw*; osea, *Celebes*
arrow	kanouins, anwi, *Algonquin*	gnahow, *Tonga*
	wepema, *Miami*	pana, *Malay, Java*
	utoos, attouche, *Cree*	dota, *Ombay*
ashes	pekootao, *Cree*; pingwi, *Ojibbeway*	aptai, *Bouru*; aftuha, *Sula*
		kapok, *Galela*
awake	pakoenao, *Cree*	peekeeis, *Pelew*: bangou, *Malay*
axe	togkunk, *Algonquin*	togi, *Tonga*
	koksakin, *Blackfoot*	kisseem, *Pelew*
	aguewet, *Ojibbeway*	ikiti, *Batamerah*
basket	wutupewut, *Cree*	tampat, *Malay*
to be	itow, *Cree*	ada, *Malay*
belly	wachtey, *Delaware*	wutan, *Java*; butah, *Baju*
	mutai, *Cree*	motni, *Mysol*
bone	oshkunne, *Shawno*	koknatea, *Amblaw*
boat, canoe	wuskiwoose, *Cree*	wog, *Gani*; vaka, *Mariannes, Tonga*
	oot, *Cree*	oti, *Tidore*
	missole, *Miami*	mallayac, *Pelew*
body	eeio, *Ottawa*; yoa, *Ojibbeway*	aoh, *Menado*; awah, *Java*
	iniwia, *Blackfoot*	inawallah, *Saparua*; nanau, *Amblaw*
bow	uchape, *Cree*	jobi-jobi, *Tidore*; djub, *Sula*
bread, food	meechim, "	macunnan, *Malay*
	ayukoonow, *Cree*	kännon, *Bissayan*
	pummeh, *Mohican*	fafanga, *Tonga*
breast	totosh, *Ojibbeway*	tetai, *Malay*; toot, *Pelew*
bird	penasew, *Cree*	namo-bangou, *Tidore*
	pethesew, "	pitek, *Java* (fowl)
	benasew, *Ojibbeway*; pinasy, *Algonquin*	manok, *Java*, &c.

	ALGONQUIN.	MALAY-POLYNESIAN.
brother	thetha, *Shawno*	taeae, *Tahiti*
	netahcan, *Mohican*	tuakana, *New Zealand*
	sayin, *Ottawa*	tehina, *Tonga*
	ounis, *Ojibbeway*	fonao, "
blue	kasqutch, *Cree*	kotteetow, *Pelew*
	chepatuk, "	ma-bida, *Menado*
break	pokoowayo, *Cree;* pikocko, *Algonquin*	fachi, *Tonga;* pata, *Malay*
bull	elapao, *Cree*	lomboo, *Malay*
blanket	ukoop, "	cafoo, *Tonga*
butterfly	kwakwapisew, *Cree*	kupukupu, *Malay;* kokop, *Teor*
brain	ootip, "	ooto, *Tonga;* outac, *Malay*
bring	pacheweyao, "	baoua, *Malay*
broom	wapuhikun, "	sappoo, "
brush	siniku tukuhikun, *Cree*	seecat, "
clothes	equichtit, *Delaware;* weyachikuna, *Cree*	caguee, *Malay;* kakahu, *New Zealand*
cold	teu, "	toetoe, *Tahiti*
	teki, *Abenaki;* tegake, *Micmac*	tijok, diguin, *Malay*
chew	misemao, mamakwamao, *Cree*	mamah, *Malay;* mamma, *Tonga*
climb	ukoosew, *Cree*	caca, *Tonga*
cloth	munitooakin, *Cree*	gnatoo, "
comb	sekoohoon, "	cissar, *Malay*
crooked	wakisew, "	bico, *Tonga*
deer	hipasto, *Blackfoot*	palow, *Baju*
die	nipew, *Cree*	pohi, *Tahiti*
dog	ayim, *Narraganset*	yem, *Mysol*
	anum, *Natick;* alınem, *Ojibbeway*	anjing, *Malay*
	ameeteh, *Blackfoot*	muntoa, *Bouton*
deceit	wuyusehewawin, *Cree*	wahahee, *Sandwich*
	kukuyawisew "	kaka, *Tonga*
division	puska, "	vahe, "
dream	powamewin, *Cree;* kebahwahnon, *Ojib.*	menimbee, *Malay*
dry	pasoo, *Cree*	pau, *Tahiti*
earth	pockki, *Delaware*	buchit, *Malay;* pihta, *Rejang*
end	iswapewyoo, kisepao, *Cree*	abio, *Malay;* hopea, *Tahiti*
face	sisseguk, *Abenaki*	hihika, *Liang*
	mikwakun, *Cree*	muka, *Malay;* uwaka, *Morella*
	keelingeh, *Miami*	lugi, *Sula*
father	och, *Delaware*	uah, *Baju*
	ootawemow, *Cree*	tamai, *Tonga*
	meetungus, *Penobscot;* nootha, *Shawno*	moduah, *Sandwich;* medua, *Tahiti*
	ninnah, *Blackfoot*	nama, *Wahai*
fear	koostachew, *Cree*	coquet, *Malay*
	nunechewin, "	manuvache, *Tonga*
flesh	wiauthee, *Shawno*	waouti, *Awaiya*
	wonunya, *Arrapaho*	wamut, *Mysol*
	ojoos, *Delaware*	gusi, *Sanguir;* isi, *Baju,* &c.
fish	gigo, *Ojibbeway*	jugo, *Salayer;* iko, *Tonga*
	kinoosas, *Cree*	kena, *Sula;* ikan, *Malay,* &c.
forehead	hakulu, *Pennsylvania*	alis, *Malay*
fatigue	alaskoosew, *Cree*	lessoo, *Malay*
feather	oopewai, "	bushook, *Pelew;* bulu, *Malay*
to fly	pimeyow, "	boona, *Tonga*
finger	yeyokichichan, "	kakowana, *Sula*
	kinoochichan, "	kaniuke, *Mysol*
forefinger	itoohikun, "	toohoo, *Tonga*
flower	wapikwune, "	bunga, *Malay;* kembang, *Java*
flee	tupusew, "	sweebuk, *Pelew*
light	masekao, "	mokamat, "
grass	muskoose, *Cree;* mijack, *Algonquin*	moochie, *Tonga*
grind	pinipooyao, *Cree*	tumboe, *Malay*
hair	lissis, *Ojibbeway*	low, *Tonga*
	milach, *Delaware*	uwoleihamo, *Awaiya*
	neleethe, *Shawno*	wultafun, *Teor*
		volundoha, *Malagasy*
	weehauknum, *Mohican*	wooko, *Bolanghitam*
heart	entahhee, *Miami*	yanton, *Malay*
	uteh, *Mohican*	ati, *Bugis*
heaven	heyring, *Shawno*	harani, *Sandwich*
hot	epekit, *Micmac;* kesipetai, *Passamaquoddy*	aputu, *Batumerah,* &c.
	kisisoo, *Cree*	sasahu, *Tidore*
house	opee, *Shawno*	abi, *Tonga*
	muyai, *Blackfoot*	umah, *Java*
hate	pukwatao, *Cree*	benkee, *Malay*
hard	muskowisew, "	maketihy, *Celebes,* &c.

	ALGONQUIN.	MALAY-POLYNESIAN.
iron	pewapisk, *Cree*	busi, *Malay*, &c.
if	kespin, *Cree*	capow, *Tonga*
insect	munichoos, *Cree*	monga-monga, *Tonga*
island	ministik, *Cree*; minnis, *Ojibbeway*	nusa, *Bouru*, *Amboyna*, &c.
journey	pupamatisewin, *Cree*	fononga, *Tonga*
kindle	kwakootao, *Cree*	cacaha, "
knife	mokoman, *Ojibbeway*	macouosim, *Alfuros*
	sapapistaeis, *Blackfoot*	pisau, *Malay*
lizard	oosikeyas, *Cree*	kihia, "
load (a canoe)	poosehao, "	fowagi, *Tonga*
louse	ikwa, "	okuta, *Bouton*
love	sakehao, "	souka, *Malay*
mat	anakan, *Ojibbeway*	junguto, *Galela*
morning	wapun, *Cree*	popongi, *Raratonga*
mosquito	sukimao, *Cree*	sugeti, *Bouru*; gumoma, *Galela*
mother	mikawe, "	mako, *Baju*
	niugah, *Miami*	inungi, *Sanguir*
	nana, *Potawatomi*	inana, *Bouton*
	niwa, *Shawno*	nafa, *Tonga*
mountain	wahchiwi, *Shawno*	vohits, *Malagasy*
mouse	apikooses, *Cree*	bokoti, *Bouton* (rat)
much	ayewak, "	yeepack, *Pelew*
neck	kwegan, *Algonquin*; ohkokin, *Blackfoot*	kaki, *New Zealand*
	oquiow, *Cree*	guya, *Tonga*
name	issenikasoowin, *Cree*	hingoa, *Tonga*
	weloowin, *Cree*	gnalan, *Tagala*
	weroowin, "	pouranama, *Malay*
navel	mitase, "	bito, *Tonga*
nail (finger)	okanj, *Algonquin*	kanuko, *Celebes*
	miskuse, *Cree*	kuku, *Malay*
nut	pukan, "	pooc, *Pelew*; beequee, *Malay*
odour	meyamao, "	namoo, *Tonga*
oil	memaye, *Micmac*	mineac, *Malay*
	peminnee, *Abenaki*; pime, *Cree*	fango, *Tonga*
open	pasketa, *Cree*	buca, *Malay*
pinch	chestipatao, *Cree*	tchoubat, *Malay*
pass	pasich, *Cree*	piko, *Malay*
partake (portion)	puke, "	baguee, *Malay*
paddle	upwoi, "	fohe, *Tonga*; pagayo, *Malay*
plenty	mistuhe, "	mataud, *Malay*
	mechatew, *Cree*	maka, *New Zealand*
prosperity	meyooayawin, *Cree*	mooona, *Tonga*
to place	ayao, "	y, "
plain	mitoone, "	tonoo, "
peel	petoopitao, "	fohifohi, "
quiet	kelamisew, "	lolongo, "
river	sibi, *Ojibbeway*	sawan, *Sanguir*; uve, *Bouton*
ring	uchunis, *Cree*	tchintchin, *Malay*
rise	wuniskow, *Cree*	bangou, "
rod	seskuhoon, "	seeca, "
rub	sisoonao, "	gosso, "
reckon	itayetum, "	ceton, "
remnant	pewipichekun, *Cree*	lebignan, "
road	mikana, *Ojibbeway*	neko, *Galela*
root	wutupe, *Cree*	tefito, *Tonga*
sit	oonupew, "	nofo, "
serpent	kenabeg, *Ojibbeway*	nife, *Amblaw*; pok, *Mysol*
skin	wusukai, *Cree*	pisi, *Menado*; usa, *Lariki*
	utai, "	kutai, *Saparua*
	wian, *Algonquin*	unin, *Wahai*
star	ahnungoon, *Ojibbeway*	kingkong, *Timbora*
	watawesu, *Abenaki*	fetoo, *Tonga*; tahwettu, *Tahiti*
	alangua, *Miami*	alammatana, *Batamerah*
	alank, *Ojibbeway*; alaqua, *Shawno*	lintang, *Java*; meleno, *Teluti*
	attack, *Cree*	abbthduk, *Pelew*
	anang, *Algonquin*	oona, *Awaiya*
stone	wudju, *Ojibbeway*	bahtu, *Bugis*
	penapse, *Abenaki*	papa, *Tahiti*
sword	simakun, *Cree*	songai, *Batta*
sing	nikumoo, "	migniaguee, *Malay*
smoke	ukwapatao, *Cree*	aeep, "
sleep	nebat, *Micmac*	moopat, *Pelew*
stink	weehakisew, *Cree*	boussouc, *Malay*
suck	soosoopemao, "	tioup, "

	Algonquin.	Malay-Polynesian.
sure	kachenahoo, *Cree*	songoo, *Malay*
swear	uspimoo, "	soumpan, "
sweep	wapuwao, "	sappou, "
spear	usimakun, "	sanoko, *Camarian*
	takuchikun, "	tuwaki, *Amblaw*
soft	munookow, "	musikomi, *Sanguir*
sour	sewisew, "	assam, *Malay*
salt	sewetakun, *Cree*; ciwitagun, *Algonquin*	simuto, *Bolanghitam*
soul	achak, *Cree*	aho, *Tahiti*
squint	utitapew, *Cree*	tepa, *Tonga*
strong	sepisew, "	fefeca, "
strike	ootamuwao, *Cree*	ta, toogi, *Tonga*
tree	abassi, *Abenaki*; apass, *Passamaquoddy*	pohoo, *Malay*; bougo, *Tonga*
to-morrow	wapuke, *Cree*	bass, *Malay*; bongi-bongi, *Tonga*
throw	pimoosinao, *Cree*	bomgeetee, *Pelew*
tail	oosoo, "	igoe, *Tonga*
thoughtful	mamitoonayetum, *Cree*	manatoo-natoo, *Tonga*
turtle	mikinak, "	pignoo, *Malay*
unlucky	malookoosew, "	malaia, *Tonga*
water	bi, *Delaware*; bij, *Pennsylvania*	boi, *Baju*; vai, *New Zealand*
	sipe, abo, *Ojibbeway*	pape, *Tahiti*; evi, *Easter*
	ohkeah, *Blackfoot*	akei, *Menado*
	orenpeoe, *Souriquois*	rano, *Malagasy*
wind	notin, *Algonquin*	matangin, *Tonga*
	awaunwee, *Miami*	anguin, *Malay*
well (adverb)	meyoo, *Cree*	behai, "
where	tanewa, "	deemana, *Malay*
workman	ootutooskao, *Cree*	toucan, "
write	ojibiige, *Ojibbeway*	papai, *Tahiti*
wing	ootutukoon, *Cree*	ihoti, *Amboyna*, &c.
work	aputisew, "	petchiol, *Mal.*; faatuba, *Tonga*
walk	ecoonne, *Blackfoot*	hahani, *Tahiti*
a well	walipayan, *Cree*	lepa, *Tonga*

CONTRIBUTIONS TO AMERICAN HELMINTHOLOGY.

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No. 1.

The observations recorded in the following pages were made for the most part during the months of September and October of the present year. Teaching duties have, however, prevented the completion of many of them; and it is only in consideration of the difficulty of procuring, during the winter, fresh material with which these might be supplemented, and of the fact that certain other interesting forms (which I hope shortly to describe to the Institute) have recently engaged my attention, that I publish these notes in their present fragmentary condition.

The work was undertaken with the desire of contributing towards a wider knowledge of the anatomy of Trematodes. In the attempt, however, to diagnose the forms that presented themselves for examination, it became apparent that in spite of the extensive contributions of Dr. Joseph Leidy, much work of a faunistic character remains to be done in this department on this continent.

The present paper has assumed in this way more of a systematic character than was originally intended; although there are, it is hoped, some points of interest to the general zoologist.

Certain important memoirs are not accessible to me here; owing to which there are, no doubt, misstatements or omissions which might otherwise have been rectified.

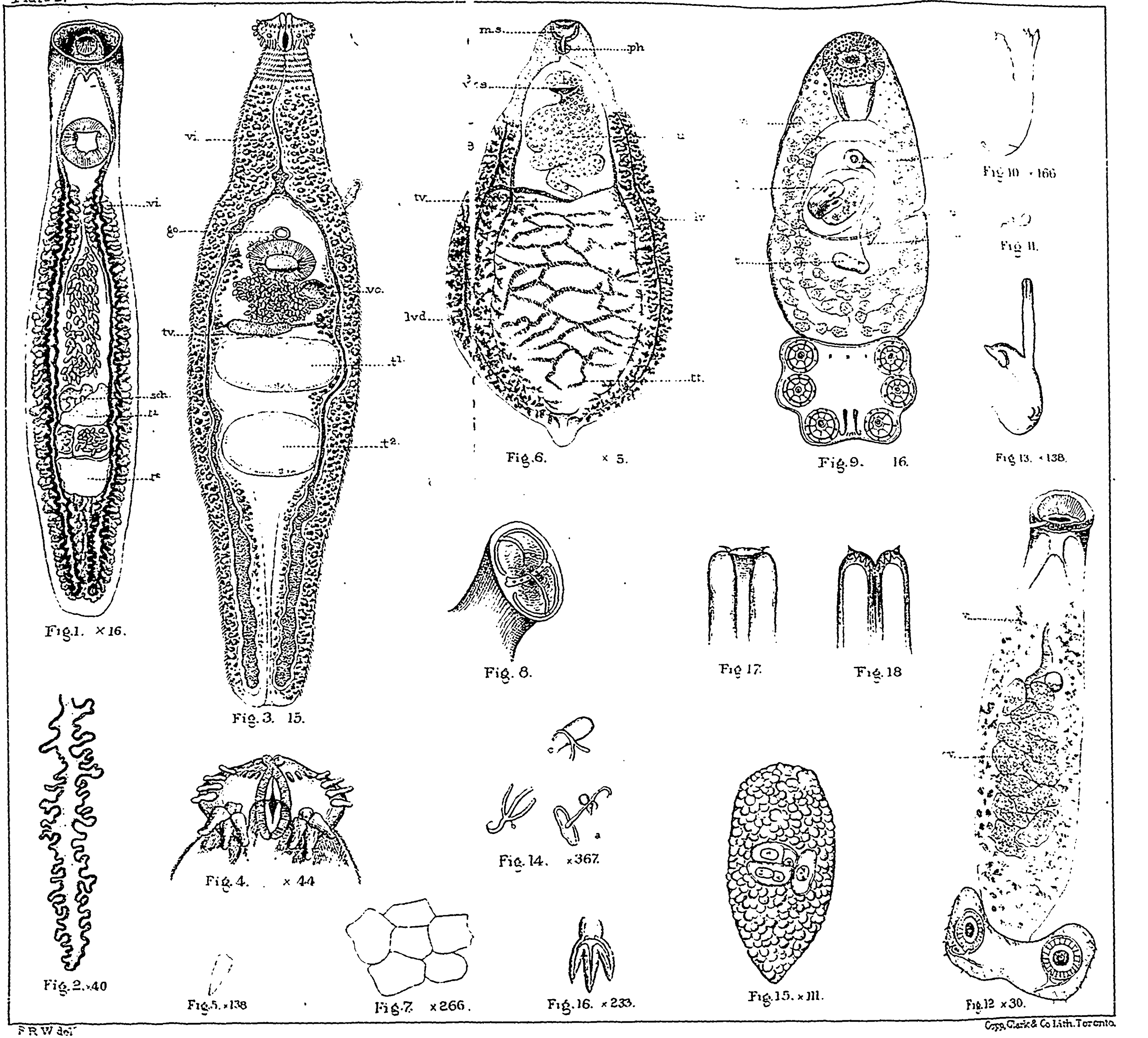
TREMATODES.

1st Sub-Order—Digenea. Van Ben.

1.—Distomum heterostomum. *Rud.*

I refer provisionally to this species certain worms which I have found on two occasions firmly adhering to the mucous membrane

Plate I.



F R W del.

Copp, Clark & Co Lith. Toronto.

of the mouth of the American Bittern (Botaurus minor, Gm.) at the sides of and below the tongue.

The following species, according to V. Linstow's excellent "Compendium," have been found in the cavity of the mouth or in the œsophagus of Ciconiæ:

1.	D. complantaum	œsoph	Ardea cinerea.
2.	D. heterostomum	sub lingua	A. purpurea.
3.	D. hians	œsoph	Cic. alba.
4.	D. dimorphum	"	A. cocoi.

These forms are closely related; indeed, Dujardin[1] regards the first two as identical with the third, and Diesing[2] seems to suggest that the first and fourth are also related. The separation by Diesing of D. hians from these congeners, on account of the relative size of the suckers, may possibly be grounded on a mistake. The anterior end of the worm which I possess resembles closely that of D. dimorphum (see Diesing's figure),[3] and it is more than probable that the prominent border which surrounds the mouth in these forms has been taken for the anterior sucker. This it seems to replace functionally in part in my specimens; for during life it undergoes rapid changes in shape, sometimes having a circular sometimes a triangular aperture, and plays an active part in the locomotion of the animal; while the anterior sucker is quite distinct, although small, and is immersed in the papilla which springs from the anterior depression. (See Fig. 1).

The following points in the description of D. heterostomum induce me to refer my specimens to it until a comparison can be made: the habitat, size, *two lateral lines*, form of anterior end of body, of neck and of ventral sucker, position of genital organs and apertures.

The details which follow are for the most part taken from dead specimens.

The form of the body is subject to much variation. Fig. 1 represents it at rest. Length, 6.85 mm.; greatest breadth, 1.5 mm. It may, however, lengthen into a much more linear form. The anterior sucker is 0.3 mm. in diameter, its aperture transversely elliptical. The pharynx has thin walls, is still smaller, and gives off the intestinal coeca immediately, which are very conspicuous from the deep brown pigment in their walls. They have the further peculiarity of

[1] Helminthes, p. 899. [2] System. Helm. I. 354.

[3] Neunzehn Arten Tremat. X. B. Denkschr. d. k. Akad. in Wien., Taf. III., 2 & 3.

being provided on each side, at any rate in the trunk, with short, sometimes branched, diverticula (Fig. 2), which, however, project much less in the most extended condition of the animal. This character seems to be shared by D. dimorphum,[4] and although present in many Polystomeæ (Epibdella, Diplozoon, Onchocotyle, &c.), is by no means *common* in Distomeæ.[5]

The ventral sucker is situated 0.8 mm. behind the anterior, and is 0.8 mm. in diameter. Its cavity is deep and gaping during life; frequently its orifice is circular from strong contraction of the radial fibres, usually *shield-shaped* or triangular.

The excretory system has a large caudal pore, and two much convoluted lateral stems, which run along the sides to the neck. During life I observed that the granules contained in these also circulated through the vacuolated parenchyma of the body, although they did not seem to enter the plexus of fine canals which could be seen immediately under the outermost investment. The parenchyma reminded me of that which I have myself observed, and which has been described by Fol and others, in the foot of embryonic Gastropods. This connection between water-vascular system and parenchyma spaces has been insisted on by Sedgwick Minot.[6]

I have not been able to follow satisfactorily all of the genital organs. The vitellogens (see Fig. 1) are in the form of racemose glands grouped round the intestinal coeca, and occupying the interval between these at the hinder end of the body. The testes (*t*) are two in number, and between them are the ovary, first convolutions of the oviduct, and a retort-shaped receptaculum seminis, from which I am inclined to believe a canal (vagina?) passes upwards towards the back, although I have failed to detect this in my preserved specimens. Towards the right side of the anterior testis is a structure whose function I have not been able to determine. It is possibly the thickened end of the oviduct at its junction with the uterus; at any rate the thickened tube projects into the bottom of the thin walled uterus, and is subject to a regular and slow evagination of the anterior part of its inner surface, recalling the gradual eversion of the peristome in a Vorticella. This is followed by a rapid retrac-

4 Diesing's fig., loc. cit.

5 Schmarda, Zoologie, attributes this character to D. cygnoides and clavigerum of the Frog; Pagenstecher's figures (Trematodenlarven und Trematoden) do not corroborate this.

6 On Distomum crassicolle. Mem. Bost. Soc. N. H., Vol. III., p. 5.

tion. It may be similar to the "Schluck-œffnung" observed by Vogt in certain marine Trematodes.[7]

The genital orifice, as in D. dimorphum, is situated behind the ventral sucker about 1 mm. No cirrus was detected. The oval eggs have a thickish yellow shell, with a lid at the narrow end, and measure 0.099 mm. by 0.066 mm.

2.—Distomum asperum, *n. sp.*

One of the two examples of Botaurus minor above referred to yielded ten specimens of a Distome occupying two varicose dilatations of the bile-duct, recalling the swollen bile-ducts described by Cobbold[8] in a Porpoise. The worms proved to belong to Dujardin's sub-genus Echinostoma; and I at first believed that they might be D. ferox, Zeder, first detected by Goeze in dilated intestinal follicles of Ardea stellaris. I was more inclined to do so from discrepancies in the various descriptions of this form.[9] Certain peculiarities, however, seem to me to mark it off from that species, of which it is undoubtedly a near relative, and I accordingly propose the specific name "asperum" for my specimens.

> Description (Figs. 3, 4, 5).—Body yellowish white, 8.19 mm. long, 1.8 mm. broad in middle, *tapering gradually to each end;* the head and *anterior part of neck narrower* than tail; covered *entirely* with *persistent* spines 0.054 mm. long, somewhat sparse posteriorly; head reniform, with a coronet of 27 *obtusely-pointed* spines, four of which on each side of a median ventral notch are larger (0.155—0.16 mm.) than the others (0.117 mm.), and *radiate from nearly a common point of origin;* anterior sucker terminal, with projecting circular lip 0.14 mm. in diam.; ventral large (0.75 mm.), situated *at junction of anterior and middle thirds of body.* Vitelligenous glands chiefly in neck, but accompanying intestinal coeca to posterior end.

The orbicular neck of D. ferox, its deciduous spines only present anteriorly, the position of its ventral sucker, and the constriction of the body there, together with the arrangement of the coronal spines, seem to distinguish it effectually from D. asperum.[10] The genital

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[7] Zeit. f. Wiss. Zool., B. XXX., Suppl., p. 307, f.

[8] Jour. Linn. Soc. XIII., p. 39.

[9] For lit. *see* Dies. Syst I., p. 387; Molin. Denkschr. d. k. Akad in Wien XIX., p. 210; Olsson, Kongl. Svensk. Vetensk. Akad. Handlingar. XIV., p. 22. I have not access to Van Beneden's paper, "Sur la cicogne blanche et ses parasites." Bull. Acad. Belg. XXV.

[10] Cf. Fig. 4 with Olsson's Fig. 50 loc. cit.; also V. Linstow's descr. Trosch. Archiv., 1873, p 106, and Dujardin's.

organs answer well to Olsson's description of D. ferox; the eggs, however, measure 0.096 mm. × 0.069 mm., while the following are measurements given for D. ferox:

0.092 – 0.102 mm. × .049 mm. (Dujardin).
0.06 mm. × 0.04 mm. (Olsson).

The penis, exserted in all my specimens, is smooth, and measures about 2 mm. in length.

The pharynx is pistilliform; the intestine bifurcates 2.08 mm. from the anterior end, and is very easily distinguishable from its dark brown contents (probably broken down epithelium and blood corpuscles).

3.—Distomum reticulatum, *n. sp.*

The Assistant Curator of the University Museum, while preparing a specimen of the Belted Kingfisher (Ceryle alcyon, Boie) in April, found two Trematode worms "on the surface of the lung," which present in many respects a remarkable resemblance to D. hepaticum, L. I believe them to be hitherto undescribed, and I propose for them the specific name "reticulatum," referring to the beautiful network formed by the branching and anastomosing testicular tubes shining through the translucent testicular area.

Description (Fig. 6).—Body *ovate*, flat, or slightly concave ventrally, separated by a constriction and by a *large and projecting* acetabulum from the *upturned* neck. Total length, 14 mm.; greatest breadth, 8 mm. Entirely covered with recurved *rounded 0.025 mm. long* spines, which are closer and smaller on anterior part of neck. Anterior sucker bowl-shaped, 0.9 mm. wide. Acetabulum 1.3 mm. diameter, orifice circular. Pharynx oval, thick-walled, 0.48 mm. wide. Intestinal coeca *unbranched* (?). Bifurcation shortly behind pharynx. Genital orifice immediately in front of acetabulum. Penis (?). Uterine gyri overlying and extending behind the acetabulum. Testes, in the form of branched tubes, occupying a translucent *oval* area, with black borders *narrower posteriorly*, formed by the vitelligenous glands, which are disposed in a racemose manner round a dorsal and a ventral longitudinal stem on each side. Eggs average 0.11 mm. × 0.065 mm.

The above description contains most of the points which can be observed by studying this worm entire by the aid of a compressorium. Probably slicing will give better results as to the disposition of the genital apparatus and intestinal coeca. The ease with which the intestine can be made out in D. hepaticum depends entirely on the dark contents: the bifurcation was here observed from the dorsal surface, but the branches were empty. The longitudinal muscular fibres are strongly developed on the ventral surface, and the ventral surface of the neck has two sets of oblique decussating fibres, as in D. hepaticum.[11] The transverse vitello-duct can be easily seen with the naked eye. The right half is longer than the left, and the common duct, leading obliquely upwards (towards an Ootype ?), is narrower than either.

4.—DISTOMUM VARIEGATUM. *Rud.*

In looking for Polystomum-eggs from a specimen of Rana halecina, Kalm, in the way recommended by Zeller,[12] I found that a worm had been voided by the frog, which turned out to be D. variegatum, Rud. It had been partly macerated from exposure to the water; the acetabulum was consequently even more than ordinarily difficult to make out, and the characteristic coloration was destroyed. The application of picrocarminate, however, is particularly successful in rendering distinct the different organs in Trematodes, and probably more so in such a case as this from the previous bleaching.[13]

The intestinal coeca were entirely destitute of contents, and their epithelial lining (average individual cells of which [Fig. 7] measured superficially 0.03 mm. × 0.021 mm.) was well seen.

The left lung of the same animal yielded only one well-coloured example of the worm.

My examples agree well with Pagenstecher's description and measurements,[14] except that the ventral sucker was easily discoverable in the fresh worm, and that the testes, three in number, which seemed to be composed of flask-shaped cells empty of their contents, and with the neck of the flasks converging to the vas deferens, could hardly be called small. The vitelligenous glands, as Blanchard has already figured,[15] are in the form of six or seven scattered racemose clumps on each side, with a connecting longitudinal stem.

[11] Leuck. Mensch. Par., I., 537.

[12] Zeit. fur. wiss. Zool. XXVII., p. 255, f. n.

[13] After writing the above, I notice that the use of picrocarminate has been already recommended by Dr. G. Duchamp (Journal de Micrographie, July, 1878).

[14] Trematodenlarven und Trematoden, p. 41.

[15] Ann. des Sci. Nat. 3 S. VIII., Pl. 13, f. 1.

5.—DISTOMUM GRACILE. *Diesing.*
CLINOSTOMUM GRACILE. *Leidy.*

This worm was first described by Dr. Leidy,[16] who regarded it as generically different from Distomum. He records it from the intestines of a Pike, and from cysts in the gills, fins and muscles of Pomotis vulgaris (auritus), Günther. I have found the same worm in cysts on the branchiostegal membrane and anterior fins of Perca flavescens, Cuv. This species appears to me to belong to the same group as D. heterostomum and D. dimorphum, from the structure of the anterior end, and of the ventral sucker. In a specimen of 6.45 mm. in length, with a greatest breadth of 1.8 mm. across, the mouth sucker measures 0.338 mm. across, and the prominent border which surrounds it 0.975 mm. The large ventral sucker (0.91 mm.) is situated in the middle of a constriction dividing the neck from the body, and has a triangular aperture. Its cavity is lessened by three triangular tongues, which project into it so as nearly to meet each other. The anterior of these points with its apex backwards; all are formed chiefly of radial fibres, and they must undoubtedly increase the efficiency of the sucking apparatus very considerably.

The species of Distomum which have been found included in cysts are either fully mature (D. agamos, V. Linst.,[17] D. Okenii, Köll., D. crassicolle, R. [Pontallié]), or have only one part of the sexual apparatus ripe (D. hystrix., Dujard., the testes[18]), or are finally quite immature. In the last category fall D. annuligerum, Nordm., D. diffusocalciferum, Gastaldi, D. dimorphum, Diesing, and, as I believe, D. gracile. No mention of generative organs is made in Leidy's description, and I have failed to detect any trace of such. The Sunfish and Perch can consequently hardly be regarded as the definitive hosts of this worm. Probably the sexually mature worm is to be sought for in the intestine of some larger fish (Pike?) or piscivorous bird. In the latter case, the relationship between the immature and mature form would resemble the two forms of D. dimorphum described by Diesing.

The intestinal coeca are large, and extend nearly to the posterior end; the contents are yellowish-brown, and include some lozenge-shaped concretions.

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[16] Proc. Ac. Sci. Phil. VIII., p. 45.
[17] Trosch. Arch. XXXVIII., B. I., p. 1, f.
[18] Olsson, Lund's Univers. Årsskr. IV., p. 52.

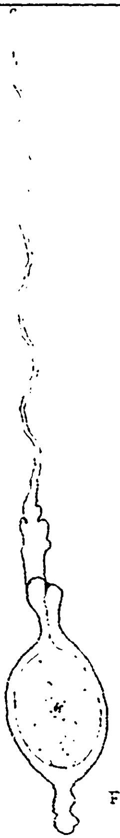

Fig. [illegible]

Fig. [illegible]

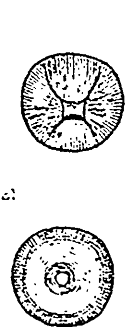

Fig. [illegible]

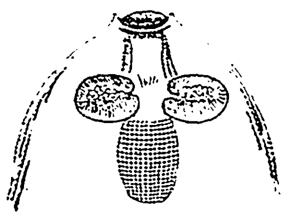

Fig. 2[illegible]

R.F.W. del.t [illegible] Clarke & Co. Lith Toronto

The water-vascular system has a wide median stem, which continues from the caudal pore half way to the ventral sucker, giving off in its course lateral branches, which communicate with the finer canals of the system. One of my specimens, which had been preserved in alcohol, was placed in a diluted carmine solution resembling Beale's, but the fluid, instead of staining the tissues to any extent, entered the water-vascular stem and injected the subcuticular meshwork, resulting in a beautiful preparation resembling the actual injections from which Blanchard's figures of the water-vascular system in various Trematodes are taken.[19] Rounded calcareous corpuscles occurred in great numbers in the median stem and its primary branches; these seem to be especially abundant in immature Trematodes.

On the ventral surface behind the acetabulum were several series of dark granular spots—perhaps the optical expression of cutaneous glands.

2nd Sub-Order—Monogenea. Van Ben.

1.—Octobothrium sagittatum. *F.-S. Leuck.*
Placoplectanum sagittatum. *Diesing.*

I possess several specimens of a worm from the gills of one of our fresh water fishes here, probably Catostomus teres, Le S., which were, unfortunately, preserved without any label, and as to the habitat of which I am consequently uncertain.

A comparison of Fig. 19, Pl. II., with Leuckart's figure of Octobothrium sagittatum,[20] will show the great similarity between the appearance of the worms. I cannot reconcile certain points in his description with what I have ascertained from these specimens; but I propose to refer to these provisionally under this heading until I have access to a more satisfactory description of the worm living on the gills of the European brook trout, and until I secure fresh specimens of the form taken here.

The body is arrow-shaped, 6 mm. in length, with a greatest breadth of 1.5 mm. The body is separated by a marked constriction from the caudal disc, which is notched posteriorly, and has four suckers on each side of its ventral face.

The structure of these suckers is at variance with Leuckart's description. It is with great difficulty that one can succeed in getting a satisfactory view of the chitinous framework, under a cover glass,

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[19] Loc. cit., Pls. IX. and X.
[20] *Zoolog. Bruchstücke, III., Taf. V.*

without distorting some part of it. The only way to obtain a correct view of the structure of the suckers, is to examine them in the first place with incident light before they have been subjected to pressure. I believe that Fig. 8 conveys a correct interpretation of the disposition of the parts of the framework.

The suckers have short muscular pedicels and an oval aperture, the long axis of which is directed transversely to the caudal disc, and which has a nearly continuous chitinous ring. This ring is interrupted by hinges at four points in its course, viz., the middle points of the outer and inner borders, from each of which a hook arches over the aperture of the sucker, and the middle points of the anterior and posterior borders, where it meets with a mesial piece which traverses the concave floor of the sucker. I have never been able to establish the continuity of this with the anterior border of the ring, and am inclined to believe that they do not meet.

The aperture of the sucker may be narrowed so as only to leave a chink between its approximated anterior and posterior borders. This is effected by the outer and inner hinges, and the appearance of the framework is changed by the greater curvature thus given to the mesial piece, and by the free hooks being pressed backwards toward the posterior border. I believe that Leuckart's figure is drawn from the framework in this position; in which case it is possible to identify the pieces shown in both figures.

The aperture of the sucker may also be narrowed in a direction at right angles to the above, in which case the hinges from which the free hooks project become more apparent. This seems to agree better with Olsson's figures (loc. cit.) of the suckers in various species of Octobothrium.

The mouth-suckers are somewhat peculiarly formed, the muscular tissue being interrupted at the inner margin of each (Fig. 20, Pl. II.).

The intestinal coeca are invested throughout by a thick layer of vitelligenous glands, forming two dark-coloured stripes in the body, on each side of and between which a somewhat more translucent area is to be seen.

The abundance and opacity of these glands render the examination of the genital organs difficult; the following points were, however, made out.

The only genital orifice detected is situated 0.78 mm. from the anterior end. It is a circular sucker of 0.135 mm. diameter, which, when viewed superficially, shows radial fibres and an irregular quadrangular orifice; but when the glass is pushed deeper, shows a doubly contoured ring 0.0135 mm. diameter, surrounded by circular fibres. (Fig. 21.) The ovary is somewhat bilobed, the ovarian eggs are polygonal from mutual pressure, and measure 0.009 mm. The fully formed egg differs much from Leuckart's figure, and approaches those described by Olsson for various species of Octobothrium. Its oval body measures 0.195 mm. in length, while the whole egg is 1.04 mm. long. (Fig. 22.)

The testis lies behind the ovary, and its vas deferens, surrounded by strong circular fibres, is continued forwards near the dorsal surface of the body. It probably opens by the same aperture as the oviduct; at any rate, I have not been able to detect any trace of a second genital aperture.

2.—Polystomum oblongum, *n. sp.*

In September I had the opportunity of dissecting a single specimen of the Musk Turtle (Aromochelys [Sternothaerus] odoratus, Gray): the only parasites obtained from it were four examples of an undescribed species of Polystomum found in the urinary bladder. No Helminths, as far as I am aware, have been hitherto obtained from this organ in Chelonia; the fact, however, that P. ocellatum is described from the cavity of the mouth in two Old World Turtles, suggested to me that I had perhaps in these a bladder stage of that worm, and that the two known species of Polystomum had in this way a precisely parallel history.[21] A closer examination and comparison with the characters of the two described species, showed that the worms presented peculiarities of specific value. I hope shortly to have the opportunity of examining the other turtles (Chrysemys picta, Chelydra serpentina) which are common in this neighbourhood, and have no doubt that Polystomes will be found in the oral cavity as well. An examination of the urinary bladder of Emys Europaea might not be without results in this respect.

Description (Figs. 9, 10. 11).—Body oblong, mouth on the *ventral* surface of the *rounded* anterior end. Pharynx bowl-shaped. Intestinal coeca *without anastomoses or branches.* Generative outlets *in front of the line* of the lateral vaginæ. Cirrus-coronet of *sixteen alternately small and large sabre-shaped pieces. Viviparous.* Length up to 2.5 mm., breadth to 1.5 mm. Egg, greenish, 0.235 mm. × 0.195 mm. Larva ocellate 0.5 mm. in length.

[21] For life-history of P. integerrimum, v. Zeller. Zeit. wiss. Zool. XXVII., p. 238 f.

The general outline of the body is somewhat oblong when the worm is at rest; in motion, however, its form is capable of considerable variation, and it is especially then that the constriction corresponding to the position of Zeller's "Seitenwülste" is noticeable. The caudal lamina is somewhat narrower than the greatest width of the body, and is shorter than it is broad. The body narrows considerably at its junction with the caudal lamina.

The hooks and suckers are disposed very much as in P. integerrimum. The suckers (0.2 mm. in diameter) seem to project rather more than in that species, and their prominent rim bears a series of rounded apertures similar to those spoken of above in describing the suckers of Octobothrium sagittatum. The smaller hooks (Fig. 11) measure 0.015 mm. in length. The six anterior of these are situated in pairs between the two anterior suckers. They have a knobbed attached end, with an arm (longer than represented in the figure) projecting at right angles not far from the middle of the hook. The four posterior (situated between the larger hooks) are capable of more independent action than the others. This was evident when the worm endeavoured to free itself from the piece of thin glass by which it was covered. The two large hooks measure 0.15 mm., and have a proportionately deeper notch than those of P. integerrimum.[22]

No eye-spots were observed in the adult worm. The longitudinal system of muscular fibres seemed to be most developed.

The mouth is transversely oval, and is surrounded by a well-marked sucker, in which radial and vertical fibres preponderate. It leads immediately into a bowl-shaped pharynx, the walls of which possess merely weak circular fibres, and from this the simple intestinal coeca arch backwards directly. The coeca of all the observed specimens were empty.

Only the convoluted lateral stems of the water-vascular system were observed near the anterior end.

The lobes of the vitellogen are more scattered than in P. integerrimum, and do not extend into the caudal lamina. The transverse duct seemed to pass inwards dorsally from the intestinal coeca; but I have been unable to determine the relationship of the internal generative organs, partly from the fact that my specimens were taken from the turtle the day after it was killed, and consequently had very little vitality.

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[22] Cf. Zeller, loc. cit., Taf. XVII. p. 12.

The testis is a solid gland situated in the posterior third of the body. The course of the vas deferens is shown in the figure. No internal vas deferens was observed. The male outlet lies immediately behind the bifurcation of the intestine, and is armed with sixteen alternately large and small hooks, which differ considerably in form from those of P. integerrimum. The free end of each piece is sharply curved; the attached end is shaped like a cross, the transverse piece of which is longer on one side than the other. The longer pieces measure 0.02 mm., and the shorter ones 0.015 mm. Whether there is any connection between the attached ends, I am unable to say.

The comparative transparency of the body would render the examination of the internal organs of this species of Polystomum particularly easy. I failed, however, to satisfy myself as to their disposition, from the cause noted above.

As in P. integerrimum, there are two lateral cushions, in this case each situated in a depression, which communicate with canals (vaginæ) leading towards the middle of the body. The inner ends of these I could not follow. A third canal, originating from an oval body with brown contents (shell-gland ?), situated on the left side of the middle line (*ov*, Fig. 9), likewise was observed to take the same direction. The ovary (not represented in the figure) is situated in front of the testis on the right side of the body. The short oviduct terminates in a wide uterus, in which only a single egg can be accommodated at one time. The egg-shell is somewhat thin, is destitute of the short stump present in that of P. integerrimum, but has a rather large operculum.

In each of the two most active specimens of the worm which I secured, a Gyrodactylus-like larva, similar to that of P. integerrimum, and with eye-spots disposed in the same fashion, had already escaped from the shell, and was moving actively within the uterine chamber.[23] The motions seemed to depend entirely on the muscles and the hooks of the caudal disc. This had a rounded outline, except posteriorly, where there was a square projection bearing the four posterior small hooks. The disc measured 0.114 mm. across, and the twelve anterior

[23] According to Zeller (loc. cit., p. 269, note), "die Eier bei den jüngsten fortpflanzungsfähigen Harnblasenpolystomen durchmachen ihre Entwickelung noch innerhalb des Eierleiters." I am not sure whether to conclude from this that, as in the present instance, larva and egg-shell are extruded separately from the uterus. I am inclined to believe, however, taking into consideration the size and advanced state of development of the larva, the absence of cilia, and the thinness of the egg-shell, that this viviparous method is the normal in P. oblongum.

small hooks were disposed at regular intervals on the margin of the rounded part of the disc. There was no trace of suckers. The small hooks had already attained their definitive size and form; the two large ones, on the other hand, situated considerably further in from the margin than in the adult, measured only 0.024 mm. instead of 0.15 mm. This difference in length is owing to the shortness of the immersed portion, in which, however, the notch is already formed.

It will be seen that in respect of the state of development of the large caudal hooks, this larva differs considerably from that of P. integerrimum. It is also larger, measuring 0.5 mm. in length, instead of 0.3 mm.

SPHYRANURA OSLERI, *nov. gen. et spec.*

I have lately received from my friend Professor Osler, of Montreal, several specimens of a worm taken from the gills and cavity of the mouth of our common Lake-Lizard (Necturus [Menobranchus] lateralis, Raf.) These had been preserved for eight years in Goadby's fluid, and proved comparatively useless for further examination, having become quite opaque and black in colour. From some specimens, in a good state of preservation, mounted by Dr. Osler for microscopical examination, and also from his notes and sketches made on observation of the fresh specimens, I am able to communicate the following. The only specimen of Necturus which I have had the opportunity of examining since receiving these did not yield any of the worms.

According to Diesing's conspectus (Revision der Myzhelminthen), the worms ought to fall into his genus Diplectanum. I have not access to Wagener's later descriptions of the two species of this genus. It is evident, however, from a study of Van Beneden's[24] and Vogt's[25] figures and descriptions of D. æquans, that this form cannot be referred to Diplectanum. It resembles Polystomum, and differs from Dactylogyrus and Diplectanum in the following points: (1) The size and shape of the egg; (2) the structure of the suckers; (3) the disposition and number of the caudal hooks. It differs from Polystomum in the general form, the number of suckers, and the structure of the

[24] Rech. sur les Trematt. marins, p. 122, Pl. XIII.
[25] Zeit für wiss. Zool., Suppl. XXX., Taf. XIV. 2, XVI. 1.

genital apparatus, and I propose for its reception the generic name "Sphyranura," with the following characters:

> Body depressed, somewhat elongate, expanded posteriorly into a caudal lamina, *considerably wider* than the body, bearing *two* immersed acetabula, two large hooks behind these, and sixteen small hooks (seven along each side of the lamina, and one in the centre of each acetabulum). Mouth ventral anterior, somewhat funnel-shaped, intestine with two branches anastomosing posteriorly. Excretory pore between the acetabula, *two contractile bladders anteriorly.* Oviparous. Parasitic on the gills and in the mouth of perennibranchiate Amphibia.

The specific characters in the allied genera are derived chiefly from the size, the caudal and genital armature, and the size and shape of the eggs. I accordingly note the following as characteristic of this species, which I propose to associate with the name of Dr. Osler as S. Osleri, *n. sp.* (Figs. 12, 13, 14.)

> Body 2.6 mm. in length by 0.7 mm. in breadth, narrowed at each end, especially where it joins the caudal lamina, which measures 1 mm. across, and about 0.45 mm. in length. Large hooks 0.2 mm. long. Oviduct occupying the interval between the intestinal coeca, with numerous eggs; uterus with single mature egg, oval, with brownish-yellow shell, 0.364 mm. × 0.247 mm.

I am not aware that any monogeneous Trematode, with the exception of Polystomum integerrimum, has been hitherto found in any amphibian; and this seems to be restricted to the tailless forms. A careful examination of the gills, mouth-cavity, and urinary bladder of both perennibranchiate and caducibranchiate Urodela would probably yield interesting results with regard to this family of Trematodes.

I regard the form under consideration as of great interest in view of the frequently asserted[26] relationship between Dactylogyrus and Gyrodactylus on the one hand, and Polystomum on the other, and I propose to recur to this after detailing the facts which I have been able to elucidate with the material at my disposal.

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[26] Von Siebold, Untersuchungen über Gyrodactylus. Van Beneden, Animal Parasites, Eng. Ed., p. 261. Willemoes-Suhm, Zeit. f. wiss. Zool. XXI. I have not seen this paper. The following is from Hofmann und Schwalbe's Jahresberichte fur 1872, p. 274: "Hat Zeller den Lebenslauf der Thiere vorzüglich aufgeklärt so gebührt Willemoes-Suhm die Priorität der Publicirung der Beschreibung der Larve, sowie die Andeutung, dass die Aehnlichkeit derselben mit einem *Gyrodactylus* eine phylogenetische Entwickelung von *Polystomum* und *Gyrodactylus* aus einer Stammform wahrscheinlich mache."

The measurements on Fig. 12 are taken from a specimen in which the eggs are nearly ripe. The worm somewhat resembles a hammer in shape, the body forming the shaft of the hammer and the tail-piece the head. This resemblance is greater in the hardly-mature specimens, where the oviduct is not dilated with eggs, and the body consequently more linear in outline.

The caudal lamina is considerably wider than the body. It is longest at each side, and somewhat shorter in the middle through the presence of a posterior notch, which may become considerably deeper, dividing the disc into two very well marked halves when the large caudal hooks are in vigorous action, owing to the course of the muscular bands which are attached especially to the innermost forks of these. The suckers resemble in all respects those of Polystomum; the prominent rims do not present the rounded apertures which I have noticed above in P. oblongum. The diameter of the suckers is 0.27 mm. The large hooks (Fig. 13) differ in form from those of Polystomum or of any species of Dactylogyrus; and, in fact, except for the impair trabecula present in the latter genus, the hooks of some forms of Dactylogyrus and of Polystomum resemble each other more closely than they do those under consideration. The attached end of the hook is divided into two pieces: one—the longer—a thin, flat, somewhat linear splint in the continuation of the axis of the rounded body of the hook; the other, thicker, shorter and rounder, standing at an angle of 45° from that axis, with two prominences for muscular attachment. I observe that the splint-like portion is bent in some specimens; this is perhaps due to pressure in mounting. The free portion of the hook, just in front of the bend, bears two little curved teeth, one rising from the surface of the other, which probably assist in securing the attachment of the animal. Similar teeth seem to be present on the hooks of Dactylogyrus monenteron, Wagener.[27]

I have not been able to elucidate very successfully the structure of the smaller hooks. I have only attempted to indicate their position in Fig. 12. Even their number remains somewhat doubtful; only in one small specimen have I succeeded in making out sixteen. They are much less easy to observe in the larger worms; perhaps their functional importance diminishes with age, as I am inclined to believe of the corresponding structures in Polystomum. Especially those lying behind the large hooks seem to be important in the small

27 Beiträge z. Entwick. d. Eingeweidewürme, Pl. XIII., Fig. 8.

worms, as I find in two specimens the substance of the lamina projecting beyond the level of the rest with the base of the hook lodged in it.

Of the marginal hooks, most seem to have a trifurcate base, as represented in Fig. 14 (*b*); in others (*a* and *c*), there would seem to be a chitinous ring at the point of attachment similar to those noticed in the large hooks of Dactylogyrus by Wagener and V. Linstow.[28] The hooks situated in the centre of the suckers (*a*) appear to be slightly different from the others, additional chitinous rings of smaller size being present. The hooks measure about 0.025 mm. in length.

The mouth is situated in the middle of a somewhat funnel-shaped sucker upon the ventral surface of the head. From Dr. Osler's sketch I make out that the pharynx is situated shortly behind the mouth, and that the intestinal coeca diverge immediately from this to arch into each other (as in some forms of Monostomum) in the posterior fourth of the body.

The following is extracted from Dr. Osler's notes:

"The water-vascular system is well developed, beginning as a ramification of vessels about the anterior disc, and uniting to form two vessels, which run the whole length of the body, joining below, and opening somewhere between the posterior discs. Cilia are to be distinctly seen in the water-vascular system, especially at the junction of the tubes below. At the upper third of the body, on a level with the generative orifice, are seen on each side curious pulsating organs, which are undoubtedly connected with the water-vascular system, the pulsation occurring about once every minute and a half."

From the sketch accompanying this, these contractile bladders would seem to resemble in form, position and relative size, those represented in Epibdella Hippoglossi, by Van Beneden.[29]

The lobes of the vitellogen occupy the sides of the body, but do not extend into the caudal lamina, nor further forward than the generative aperture.

This is situated immediately behind the bifurcation of the intestine. I have only been able to determine its position from the cirrus-coronet in the mounted specimens. Dr. Osler, however, saw the female aperture quite close to this, leading into a "narrow, slightly-curved vagina." This I have represented in Fig. 13; it is probably the unexpanded uterus.

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[28] V. Linstow, Trosch. Archiv., 1878. These seem also to be indicated in Zeller's figure, loc. cit., Taf. XVII., Fig. 3.

[29] Mémoire sur les Vers Intestinaux, Pl. II., Fig. 2.

The structure of the cirrus-coronet is difficult to ascertain on account of the semi-opacity of my mounted specimens. The pieces do not seem to be more than eight in number; they converge anteriorly where they are narrow and pointed; posteriorly they are wider, with somewhat arrow-head shaped ends, which fit into the terminal bulbous portion of the vas deferens. I have been unable to follow the rest of this tube, or to find any trace of the testes.

Sphyranura resembles P. oblongum and the precocious gill-cavity stage of P. integerrimum, in possessing only one complete shell-invested egg in the uterus at one time. This is very large (*v. supra*) in relation to the size of the worm, being considerably larger than the eggs of either P. integerrimum or P. oblongum. It consequently forms a noticeable feature in the worms possessing it, and is readily detectable with the naked eye. Numerous other eggs may be seen in the oviduct formed of the ovarian ova with the investing foodyolk-balls, and by mutual compression assuming various forms. What I suppose to be the ovary is represented in the figure to the right hand of the base of the muscular tube. I cannot find any trace of shell-gland, transverse vitello-duct, or of a vagina. All of these would undoubtedly be easily seen in fresh or well preserved specimens.

I regard the genera Gyrodactylus, Dactylogyrus, Sphyranura and Polystomum, as forming a very natural assemblage. All probably live on the blood of their hosts, being found in positions where there is a more or less close superficial vascular plexus; all possess a caudal disc armed with fourteen to sixteen small and two (rarely more) large hooks, which enable the fish-parasites to secure themselves firmly to the gill-filaments of their hosts. Those which possess suckers formed around the smaller hooks are found attached to smoother surfaces (mucous membrane of mouth and urinary bladder), where the small hooks alone would have little purchase; even these forms, however, pass through a suckerless stage in which they inhabit the anterior respiratory part of the intestinal tract.[30] The resemblance of the Polystomum-larva to Gyrodactylus is very striking, so that if any phylogenetic speculations may be made from the observation of the ontogeny of an animal, the assumption is surely justi-

[30] It must be remembered that the mucous membrane covering the hyoid arches of many Chelonia has still a high respiratory significance. *Vide* Agassiz: Contrib. Nat. Hist., U. S. Vol. I., Pt. ii., pp. 271–284.

fied that Polystomum is descended from a Gyrodactylus-like ancestral form. The suckers of Polystomum are not developed simultaneously, and Sphyranura is a transition form, where the formation of these is restricted to one pair.

The consideration of the probable relationships of the hosts of these forms lends additional authority to such a conclusion. If the piscine ancestors of Amphibia had Gyrodactylus-like gill-parasites, these would probably be transmitted to their descendants, and we should not be surprised that among the oldest representatives of these, two (the Frog-larva and Necturus) should possess such. The texture of the gills in Necturus might account for the change in the caudal armature. The loss of the gills in the Frog is necessarily accompanied by a change of habitaculum on the part of the parasite; and it is not surprising that the emigrating worms should have prospered so well in a locality where so many favourable conditions obtain as in the urinary bladder of the same host. That some Chelonia are the only reptiles in which parasites belonging to the same series have been found is probably to be accounted for by their aquatic habits.

Dactylogyrus may be regarded as a divergent form marked by its peculiar genital armature, the shape of the eggs, and the arrangement of the caudal hooks. In all of these points the three other genera approach each other more closely, and as Gyrodactylus is evidently nearer the stem-form than the others, all might be received into Van Beneden's family "Gyrodactylida."[31]

CESTODES.

TAENIA DISPAR. *Goeze.*

I have to record another habitaculum for this worm. The specimen of Rana halecina above referred to (p. 6), expelled several ripe proglottides which seem to be much smaller than usual, as will be seen from the measurements given below. In the intestine of the frog were found several chains about an inch and a half in length, and also many scolices and immature chains of different lengths. Many more worms in the two latter conditions were also found in the body cavity between the viscera; whether these become mature in this position I am unable to say—they certainly frequently occur here.

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[31] Recherches sur les Trematodes marins, Van Ben. and Hesse, p. 121.

The head does not measure more than 0.5 mm. across in any of my preserved specimens, nor in fact does any part of the chain. In life it is very variable in form, and bears a distinct unarmed rostellum, which is frequently completed retracted, so as to escape notice, but acts much like a fifth sucker. This is merely indicated in Van Beneden's figure,[32] and its existence is negatived in Diesing's and Dujardin's descriptions.

The only ripe proglottides observed were mostly of the form represented in Fig. 15, and measured 0.4 × 0.16 mm. Instead of containing a series of capsules in pairs with their contained embryos, two or three capsules at most were observed, with six or seven embryos altogether. These measured 0.027 × 0.018 mm.

NEMATODES.

ASCARIS ADUNCA. *Rud.*

A statement occurred in the "American Naturalist" in the course of last year, as to the prevalence of an Ascaris in the intestine of the American Shad—Alosa sapidissima, Storer. This was probably A. adunca, R. I have several specimens taken in last winter from Portland fish, which undoubtedly belong to this species.

The only other reference to a round worm from the American Shad of which I am aware is by Dr. Leidy, who records[33] Agamonema capsularia (?), Diesing, as free in the intestines. This, in spite of the "undivided lip," is probably the young of A. adunca, the "obtusely conical, minutely mucronate tail," arguing for this. Molin[34] describes "Nematoideum Alausæ" also with mucronate tail, but with a four-papillate mouth from the European Shad, but considers that the absence of lips forbids its reference to A. adunca. The metamorphoses of the mouth-parts in Ascaris are still insufficiently known, but what has been already established[35] does not exclude the possibility of both of the above larval forms belonging to A. adunca.

FILARIA TRIAENUCHA, *n. sp.*

A single female specimen of a worm belonging to the genus Filaria was found in the upper part of the proventriculus of each of the

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[32] Mém. sur les Vers Intest., Pl. XXII., Fig. 4.
[33] Proc. Ac. Sci. Phil., VIII., p. 55.
[34] Sitz. d. k. Akad. Wien., XXXVIII., p. 31.
[35] Schneider Monog. der Nemat., p. 294.

Bitterns above referred to, along with a single male of Ascaris microcephala, Rud. (?) in one of these; and although closely related to two species (F. laticeps, R., and F. tridentata, V. Linstow[36]) which have been described from Falco lagopus on the one hand, and from Colymbus arcticus and Larus ridibundus on the other, it does not appear to resemble any of the numerous Filariæ described from Ciconiæ, except perhaps F. alata.

I hope I may shortly have an opportunity of examining the disposition of the præ- and post- anal papillæ in the male, a character of essential systematic value in this genus; in the meantime, however, I record the following points which seem to distinguish it from the above mentioned forms:

> Densely striated. Length 10 mm.; greatest breadth, 0.43 mm. A cervical fascia or frill, the tops of the lateral loops of which are 0.18 mm. from the anterior end, and which extends 0.405 mm. backwards on the neck. The root of the cervical papilla (or trifurcate spine) is 0.06 mm. from the end of the frill. The trident measures from the root to the end of the median fork 0.06 mm. The eggs measure 0.027 mm. × 0.018 mm. The tail is terminated by a short rounded conical projection.

A comparison of Fig. 16 with the figures of Schneider[37] and V. Linstow, will show how it differs from the similar structures represented there, the teeth of the trident being much longer and narrower in proportion to the body. The uterus was packed full of eggs, so that its walls were extended in every direction, occupying almost the whole of the body cavity.

ANCYRACANTHUS CYSTIDICOLA (Schn.) *R.*

I find this worm very commonly present in considerable numbers in the swim-bladder of Salmo siscowet, Ag. The males are, however, usually about twice (19–22 mm.) the length recorded by Schneider, while the females measure 30–33 mm. The two teeth (Fig. 17) which are doubtfully ascribed to the head by Schneider are quite evident in my specimens, and are continuous with two longitudinal ridges in the œsophagus. It is somewhat difficult, on account of the coiled up tail, to get a satisfactory view of the papillæ in the male, but there seemed to be five pairs of these behind the anus. The eggs measure 0.04 × 0.02 mm.

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[36] Trosch. Archiv., 1877, pp. 10 and 175.
[37] Loc. cit., Taf. VI., Fig. 3.

ANCYRACANTHUS SERRATUS, *n. sp.*

A single female specimen of a worm closely allied to the above was obtained from the auricle of the heart of Coregonus albus, Le S. It only measures 11 mm., and differs from A. cystidicola in the mouth-armature. Instead of having only the two teeth of that species, there are a series of smaller ones disposed, as represented in Fig. 18, round the anterior end. The eggs in this specimen were not mature, but the genital organs were observed to be arranged as in the above species. The structure of the œsophagus is sufficient to place the worm in this genus, and I propose provisionally for it the specific name "serratus."

TORONTO, December, 1878.

EXPLANATION OF THE FIGURES.

PLATE I.

FIG. 1.—Distomum heterostomum, Rud. (?); *vi*, vitellogen; *sch*, "schluck-œffnung;" *t*, testes.

FIG. 2.—End of an intestinal coecum of the same.

FIG. 3.—D. asperum, *n. sp.*; *ga*, genital aperture; *vo*, the ovary; *tv*, transverse vitello-duct.

FIG. 4.—Head of same; the characteristic disposition of the hooks is best represented on the right side.

FIG. 5—An isolated body-spine of the same.

FIG. 6.—D. reticulatum, *n. sp.*; the ventral sucker (*vs*) is flattened; *u*, the uterus; *lv*, the ventral; *lvd*, the dorsal longitudinal vitello-duct; *tt*, the testicular tubes.

FIG. 7.—Surface view of intestinal epithelium of D. variegatum, Rud.

FIG. 8.—Caudal sucker of Octobothrium sagittatum, F. S. Leuck. (?)

FIG. 9.—Polystomum oblongum, *n. sp.*; *l*, larva; *ck*, cirrus-coronet; *va*, vaginae; *ov*, shell-gland (?).

FIG. 10.—Large caudal hook of the same.

FIG. 11.—Small caudal hook of the same.

FIG. 12.—Sphyranura Osleri, *n. sp.*; *ov*, eggs.

13.—Large caudal hook of same.

. 14.—Small caudal hook of same.

FIG. 15.—Proglottis of Taenia dispar, Goeze.

FIG. 16.—Cervical papilla of Filaria triaenucha, *n. sp.*

FIG. 17.—Head of Ancyracanthus cystidicola, Schn.

FIG. 18.—Head of A. serratus, *n. sp.*

PLATE II.

FIG. 19.—Octobothrium sagittatum, F. S. Leuck. (?); *ga*, genital aperture; *o*, a mature ovum; *ov*, the ovary; *vd*, vas deferens.

FIG. 20.—Anterior end of same to show shape of mouth, anterior suckers and pharynx.

FIG. 21.—Genital sucker of same; *a*, superficial; *b*, deeper view.

FIG. 22.—Mature ovum.

SYLVA CRITICA
CANADENSIUM.

1—6,

BY THE REV. JOHN McCAUL, LL.D.,
President of University College, Toronto.

1. In Cicero, *Phil.* II., c. xxxi., are the following words, of which I have never seen any interpretation that I believe to be correct:

"O hominem nequam! quid enim aliud dicam? magis proprie nihil possum dicere."

The ordinary acceptation of *nihil possum dicere* is, "I can give no name *magis proprie* than *nequam.*" I am inclined to think that it should be—"I can call thee *magis proprie* 'thou nothing.'" Cicero, when he said *nequam*, had not reached the limit of revilement, for he might have said *nequissimum.* I would translate the whole passage thus: "O good for nothing man! for what else am I to call thee? Yes! I can give thee a name more peculiarly thy own—'thou nothing.'" It is remarkable that we have in Horace (*Sat.* II., vii., 100) these words—*nequam* and *nil*—in juxtaposition, in a similar sense:

> Nequam *et cessator Davus; at ipse*
> *Subtilis veterum judex et callidus audis:*
> Nil *ego, si ducor libo fumante.*

We find other examples of this use of the word *nil* (or the equivalent *nihil*) in Cicero—*e. gr.*, *Epist. Famil.* vii. 27, *te* nihil *esse cognosceres*, and in *Divin. Verr.* 14, nihil *fueris* and 15, nihil *est, nihil potest.* Similarly *οὐδὲν* is used in Greek, *e. gr.*, Eurip., *Orest.* 718) *ὦ πλὴν γυναικὸς οὕνεκα στρατηλατεῖν Τἄλλ' οὐδέν, κ. τ. λ.*

2. In the *Ephemeris Epigraphica*, 1877, Vol. III., pp. 113–155, are the *Additamenta* by Prof. Hübner to the Inscriptions of Britain as given by him in the 7th volume of the "*Corpus Inscriptionum Latinarum.*" They have been chiefly supplied by Mr. W. Thompson Watkin. Among the remarks given there is the following: "Ad n. 906. In C. A. latere custodem armorum Buechelerus coniecit probabiliter. Titulus igitur ita legendus videtur esse: *d(is) M(anibus,*

Gemelli c(ustodis) a(rmorum) Fl(avius) Hilario s(ecundus) h(eres) f(aciendum) c(uravit).

The stone is figured in *Lapidarium Septentrionale*, n. 446. It is expanded thus, and the following remarks are given:

"DM	Diis Manibus
GEMELLI · C · A ·	Gemelli carissimo amico (?)
FL · HILARIO · S · H · FC ·	Flavius Hilario secundus heres faciendum curavit.

"This inscription has been variously expanded. For the reading here given the editor is indebted to Professor Henzen, who in a private communication says: 'Second heirs occur very frequently in military inscriptions; and though our inscription does not belong to a soldier, it must have belonged to a person attached to the camp. Therefore I have little doubt about my explanation.' The only remaining difficulty belonging to the inscription is the expansion of C. A. at the end of the second line. Professor Hübner thinks that the letters 'indicate a military charge.' Dr. McCaul proposes to read the line '*Gemelli custodis armorum.*'"

In the *Canadian Journal*, Vol. XII., p. 122 (to which the learned editor of the *Lapidarium Septentrionale* refers), the following are the terms of the article on this inscription, in the Review of Dr. Bruce's Roman Wall, 3rd Edition:

'In consequence of the incorrect representations of the inscription that have hitherto been given, the last two letters of the word *Gemellica* being separated from the rest, and a full stop after each, great has been the perplexity of those who have attempted to read it, and various the interpretations that have been given of it. Gemellica, it must be confessed, is a name which we have not previously met with. *Diis Manibus. Gemellica Flavio Hilario sepulchrum hoc fieri curavit.* To the divine manes. Gemellica to Flavius Hilarius caused this sepulchre to be erected.'

"If the reading *Gemellica* be assumed as correct, I would read the inscription thus: '*Diis Manibus. Gemellica. Flavius Hilario secundus heres faciendum curavit.*' *Gemellica* may be in the nominative, or may stand for *Gemellicæ*. *Hilario* is a name that occurs more frequently than *Hilarius*, and *secundus heres* is not uncommon. See Orelli, nn. 3416, 3481. The head, however, which is carved below the inscription seems to be rather that of a man with a beard, than of a woman with a head-dress. Hence I would suggest, instead of *Gemellica*, GEMELLI · C · A., *i.e.*, *Gemelli custodis armorum;* and this I regard as the most probable rendering."

It appears, then, that the interpretation of C. A. was originally given in the *Canadian Journal* in 1868.

3. The remark immediately following this in the *Ephemeris Epigraphica*, 1877, is: "Ad n. 914. V. 6 ad Solvam Norici oppidum rettulit Buechelerus in censura, recte puto. Itaque solvendum *Mar(ti) Coc(idio) m(ilites) leg(ionis)* II *Aug(ustæ) c(enturia) Sanctiana c(enturia) Secundini d(omo) Sol(venses)* e. q. s.

The stone is figured in the *Lapidarium Septentrionale.* It is expanded thus, and the following remarks are given:

"MARTI COC M
LEG · II AVG
> SANCTIANA
> SECVNDINI
D · SOL · SVB CV
RA · ÆLIANI C (?)
CVRA · OPPIVS
FELIX OPTIO
Marti Cocidio milites
legionis secundæ Augustæ
Centuria Sanctiana
centuria Secundini
Deo (?) Solverunt (?) sub cu
ra Æliani centurionis (?)
curavit Oppius
Felix optio

"The inscription presents some difficulties. The meaning seems to be this—the altar was dedicated to Mars Cocidius; the dedicators were some soldiers belonging to two centuries of the second legion, the century Sanctiana, and the century of Secundinus; the party being at the time under the command of the centurion Ælianus; Oppius Felix, the *optio,* took charge of its erection.

"The editor has in vain sought for some authority for the expansion of the letters D · SOL · in the fifth line. None is to be found. The Rev. John Hodgson reads *de solo;* such an expression is often used as to a building, but is inapplicable to an altar. Professor Hübner suggests, though very doubtfully, *dato solo.* Mr. Clayton proposes *deo* or *deis solverunt.*"

The letters D · SOL, doubtless, present very considerable difficulty. I have never met with them before. Various expansions have suggested themselves to my mind, the best of which I regard the following:—D[evoti] SOL[i]. With this view we may compare the inscription in Lersch, *C. Museum,* n. 14, Bonn, or Steiner, *Cod. Inscrip. Rom. Danubii et Rheni,* n. 1268:

IN · H · D · D · PRO
SALVTE · IMP · SEVERI
ALEXANDIRI · AVG · DEO
APOLLINI · DYS · PRO · LV · S
OLQ · DE · MILITES · LEG ·
XXX · V · V · P · F · SVB · CVRA
AGENT · T · F · APRI
COMMODIAN · c · q · s ·

i. e., In honorem domus Divinæ, pro salute Imperatoris Severi Alexandri Augusti, Deo Apollini, Dis propitiis Lunæ Solique devoti milites *legionis tricesimæ Ulpiæ Victricis, sub cura agentium Titi Flavi Apri Commodiani.*

4. In the *Ephemeris Epigraphica,* 1877, Vol. III., pp. 132, 133, the following account is given of two inscriptions, on which I offered some observations in the *Canadian Journal,* Vol. XIV., p. 544:

"Legendum igitur Victoriæ Augg. Alfeno Senecion[e] co(n) s(ulari) felix ala [prima] As(turum). *Senecioni* pro casu sexto fortasse positum est barbare. Manifestum est, alam ipsam felicem dictam lapidem dedicavisse (ut infra in n. 100 hujus additamenti); sed quid M et PRA litteræ significent, quæ iam non possunt coniungi cum reliquis, ignoro; nisi fuit M(arciano) pra(efecto). Expectamus cognomina alæ imperatoria, veluti *Antoninianæ.* Ceterum in altero textus exemplo omnino desunt. Observa Genios, non Victorias, in lateribus. Hæc mecum communicavit W. Th. Watkin.

In the *Journal of the Archæological Institute,* 1878, Vol. XXXIV., p. 144, Mr. W. Thomson Watkin writes thus, having given an account of the copy of the inscription in the Ashmolean Museum:

"In any case the correct reading of the stone is established, showing that the word *Felix,* instead of being a proper name, is used in the same sense as in the inscription lately found at *Cilurnum.*"

The inscription lately found at Cilurnum is thus given by Hübner, in n. 160 of the *Additamenta:*

(S)ALVIS AVGG
(F)ELIX · ALA · $\overline{\text{II}}$ · ASTVR
A
VIRTVS
AVGG ·

Bruce lapid. append., p. 472, n. 943, qui annotat alteram G in vocabulo AVGG utroque loco eradi cæptam esse. Idem accidit vocabulo [Antoninian]a. Brucius non sine probabilitate propter titulum, n. 585, in quo Antoninianæ cognomen item erasum est, cogitavit de Elagabalo et Alexandro Augustis. Alam II. Asturum Cilurni in castris fuisse ad quintum usque sæculum notum est.

The stone is figured in t. . *Lapidarium Septentrionale,* n. 943, and the following expansions and remarks are there given:

"Salvis Augustis
felix ala secunda Asturum
Antoniniana (?)
Virtus
Augustorum."

"The inscription is different from any that we have previously met with. The evident meaning of it is, 'So long as the Emperors are safe the second ala of Asturians will be happy.' A reference to the inscription, n. 121, leads us to suppose that the Emperors to whom this flattering compliment was paid were Elagabalus and Severus Alexander. Very soon after this inscription was carved

Elagabalus was slain by the infuriated soldiery at Rome, and the second ala of Asturians, at Cilurnum, sympathizing with them, erased, though not entirely, the second G at the end of the first line, and that at the end of the inscription (VIRTVS AVGG) in the hands of the standard-bearer, as well as the whole of the third line of the principal inscription, which was probably an epithet which the ala had been permitted to assume, by favour of the unfortunate Emperor when he was a popular idol."

I now su join the remarks which appeared in the *Journal* in 1873:

"The inscription, given by Orelli,* n. 864, confirms Dr. Bruce's view of the meaning:—ΣΑΛΒΩ ΚΩΜΜΟΔΩ ΦΗΛΙΣ ΦΑΥΣΤΕΙΝΑ, *i. e.*, *Salvo Commodo felix Faustina*, but his reference of AVGG to Elagabalus and Severus Alexander is certainly incorrect. So far as we are aware, there is no example of the application of the term *Augusti* to those two Emperors. Nor is there any evidence that they were united under that name. To us it seems highly probable that the two Augusti were Caracalla and Geta, that the date is A.D. 211, after the death of Severus, and that the second G was erased after the murder of Geta, in A.D. 212. But the most interesting result of this discovery is, that the inscription throws light on another which unfortunately is lost. It is given from Horsley, in the *Lapidarium Septentrionale*, n. 27, and in *Britanno-Roman Inscriptions*, p. 133:

"VICTORIAE
* * GGALFE
N S SENECIO
N COS FELIX
ALA I ASTO
[RV]M PRA

"Of the true reading of the main part of the inscription there can be but little doubt. It is—*Victoriæ Augustorum Alfenus Senecio Vir Clarissimus Consularis Felix Ala prima Astorum.* ALA has been regarded as standing for ALAE, the letters RVM as the final three of *Astorum* for *Asturum*, and PRA as the first three of *Præfectus*. Thus *Felix* was regarded as Præfect of the first Ala of Asturians. With others we have accepted this view, but it has always appeared strange to us that *Felix* had neither *prænomen* nor *nomen*. Now it seems most probable that *Felix* is used as it is in n. 943, and Baxter's reading, ALFENO SENECIONE, is not so unlikely. What the letters at the side were that were crowded out can scarcely be conjectured with probability; they may have been something like *Curam Agente*, or *Curante Præfecto.*" †

I believe the AVGG of the two inscriptions to be the same—*Severus* and *Caracalla* (or *Caracalla* and *Geta*)—and that the date of these inscriptions was A.D. 209—before Geta was declared Augustus, on the news reaching the army in Britain, that although the expedition into

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* See also Eckhel, viii. 11.

† There is a strange mistake relative to this Præfect in Dr. Bruce's General Index to the *Lapidarium Septentrionale:* "Alfenius Senicio, Prefect of the Ala Prima Asturum, 31; his titles on other inscriptions, 31."

Caledonia was attended with great difficulties, yet the Emperors were safe—or A.D. 211.

5. In the *Ephemeris Epigraphica*, 1877, Vol. III., pp. 161–163 and 203, 204, there are *Additamenta* to Prof. Mommsen's article on *Tesseræ Gladiatoriæ*, in Vol. I. of the *Corpus Inscriptionum Latinarum*. From these it appears that there are now* known to exist six examples of the word *spectavit* in full, viz.:

(1) DIOCLES
VECILI
SPECTAVIT
A · D · V · K · FEBR.

(2) PHILOMVSVS PERELI
SPECTAVIT

(3) PROTEMVS FALERI
SPECTAVIT
N · S.

(4) GENTI · PACONI · T · S .
SPECTAVIT

(5) MENOPIL · ABI · L · S ·
SPECTAVIT
C · VAL · M · HER.

(6) PAMPHIL · SOCIORW
SPECTAVIT

i.e., (1) *Diocles, Vecili* (*servus*), *spectavit, a*(*nte*) *d*(*iem*) *q*(*uintum*) *K*(*alendas*) *F*(*ebruarias*). (2) *Philomusus Pereli* (*servus*), *spectavit.* (3) *Protemus Faleri* (*servus*), *spectavit, N*(*onis*) *S*(*extilibus*) *or S*(*eptembribus*). (4) *Genti*(*us*) *Paconi T*(iti) *S*(ervus), *spectavit.* (5) *Menopil*(us) *Abi L*(ucii) *S*(ervus) *spectavit C*(aio) *Val*(erio) *M*(arco) *Her*(ennio) (*Consulibus*) *i.e.*, A.V.C. 661 = 92 B.C. (6) *Pamphil*(*us*) *Sociorum* (*servus*) *spectavit.* In 1863, the most ancient then known was of the date 85 B.C. The only real difficulty is in SP, which has been expanded by *spectatus*, *spectator* or *spectavit*, to which we should now, perhaps, add *spectat*, or we may regard *spectat* as an abbreviation of *spectator*—*spectator* [*fuit*] being believed to be = *spectavit.* In the volume of the *Canadian Journal* for that year, there is an article by me on the subject. From that article I subjoin extracts, as I cannot but regard the suggestion given there as more probable than any other explanation that I have seen, even including that offered by Prof. Mommsen, and stated at the close of the article in the *Ephemeris Epigraphica*, Vol. III., p. 163:

"In mentem venit Momseno (mihique visum est probari posse) gladiatores rude donatos fortasse transiisse ex arena in carcerem, spectandique ius adeptos esse ibi, ubi antea spectabantur. Eius iuris initium memoriæ tradi potuit veluti honesta missio quædam in tesseris gladiatoriis. Horatii versus sane non obstat huic opinioni."

* In 1863 there were only two (doubtful) specimens of *tesseræ* giving the word *spectavit.*

The extracts from my article are:

"The sense in which this expansion (*spectatus*) was generally* understood, was, that the gladiator to whom the *tessera* was given was 'tried,' 'approved,' and allowed to retire on the specified day of the month in the year indicated by the specified consuls. In support of this interpretation the well-known verses were cited:

> 'Spectatum *satis, et donatum jam rude quæris*
> *Mæcenas, iterum antiquo me includere ludo.*'

Morcelli, *De Stilo*, i. p. 412, suggested, instead of *spectatus*, *spectavit*,† on the authority of an inscription given by Tomasini and Fabretti, in which that word appeared on a *tessera*, *in extenso*, *scil.* PILOMVSVS · PERELI · SPECTAVIT. The sense in which he understood the word, was, 'was a spectator,' 'took his seat amongst the citizens and looked on. He believed that these *tesseræ* were given to gladiators who had received not only the *rudis*, but liberty, and that they entitled those who had received them to sit amongst the citizens. The inscriptions would thus be regarded as stating the date of the first occasion on which such gladiators availed themselves of the privilege conferred by the presentation of the *tesseræ*. Another expansion, *spectaculum*, has been proposed by Gori, *Inscrip.* i. 74, but I am unable to conjecture in what sense‡ he understood it. Morcelli, who notices this expansion, dismisses the reading with the expressive phrase—*quod miror*. . . . We may now assume that the first two syllables of the word are SPECTAT, on the authority of the following inscription, on an unquestionably genuine *tessera*, published for the first time by Mommsen,‖ p. 201:

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* Thus Reinesius, *Syntag.* p. 372, remarks: "*Fulvius Ursinus putabat significari videri, quo anno seu consulatu, mense ac die gladiator spectatus, diu multumque in arte versatus, rude sit ac tessera eburnea donatus, quibus solutum se palæstræ atque arenæ legibus athletam ostenderet.*" Amati, *Giornale Arcad.* 1826, explains *spectatus* thus: "*Le picciole taglie quadrilatere di avorio or di osso erano visibili documenti di morte pe ressi gladiatori ad altri recata, e almeno di sanguinosa vittoria ottenuta con atterrar l'avversario.*" Tomasini, *De tesseris*, makes the astonishing statement: "*Erat autem rudis tessera quædam eburnea, cui nomen gladiatoris ætate emeriti inscribebatur quam qui accipiebat, is ab omni pugnandi necessitate eximebatur.*" It is scarcely necessary to remark relative to this view, that there is no authority for the notion that the *rudis* was a *tessera*.

† Ursatus, *De Notis Romanorum*, remarks: "SP. Spectatus, *Pignorius, qui*, De Servis, *scribit hanc notam quæ doctos viros hucusque torsit, nihil aliud 'Significare, quam, spectavit, ut detur intellige. ...nductos fuisse aliquos, veluti ab e...tore, gladiatores insignes, rude olim donatos, spectandi gratia, non pugnandi.*'" Pitiscus, *Lexicon*, in *tessera*, Facciolati, *Lexicon*, in *Specto*, and Orelli, n. 2561, adopt the view of Morcelli. Henzen, n. 6162, seems to pre er *spectatus*. Zell, *Delectus*, p. 60, reads *spectandus*.

‡ Muratori, *Nov. Thes.* p. DCXI. n. 2, explains SP. as meaning that the person named informed the people that he had given or intended giving a *spectaculum*.

‖ The account of this is so interesting that I give the words: "*Sero reperi in libro ms. Lanthelmi Romieu Arelatensis scripto a.* 1574, *servatoque hodie Lugduni Bat. inter Voss Germ Gall. Q.* 1. *Legitur ibi f.* 88 *sic:* Ores ie commence icy à fere mention des Epitaphes d'Arles—— et en premier lieu ie veux reciter l'escrit memorable, qui se list clairement en une piece d'ivoire ou plustot de corne de cerf, que i'ay, qui a esté nouvellement trouvée icy a *la poincte* au bord du Rosne, la quelle est si menue et estroicte, qu'elle n' est pas plus longue, ne plus large, que la moytie du petit doigt de ma main, etant percée à l'un des bouts: ou est faite mention de Ciceron, et de Caius Antonius."

MENSE · FEBR · M · TVL · C · ANT · COS · ANCHIAL · SIRTI · L · S · SPECTAT · NVM.

From this it appears that of the two expansions *spectatus* is the more probable; but even it is not satisfactory, and Mommsen with good reason calls it in question. He objects that the words of Horace by no means prove that *spectatus* was the proper or ordinary term for expressing the fact that a gladiator had fought.* *Pugnavit*, he believes, would be much more clear and suitable than *spectatus est*. He also notices the inconsistency of the days named on the *tesseræ* with the days which we know were fixed for the *ludi gladiatorii* at Rome, viz., a.d. xiii. xii. xi. x. k. Apr. To these objections I would add, that there is no notice, so far as I am aware, in any ancient author, of *tesseræ gladiatoriæ*.† The designation is a modern invention, accepted and used by those archæologists who read SP as *spectatus*, with reference to gladiators. . . . When I first examined the inscriptions on the *tesseræ consulares*, I had seen only those containing the names of slaves, and was inclined to conjecture that they might have been given to persons of that class as testimonials of approved character. Thus Terence, *Adelphi*, v. 6, 5, *is mihi profecto est servos* spectatus *satis*. On re-examination of the subject two or three years ago, I found the names of freemen also; and observing the frequent mention of the Calends, Nones and Ides, I was led to think that the *tesseræ* were in some way connected with money. Hence I conjectured that the word was SPECTATOR, in the sense "examiner of money;" and now, perceiving that this conjecture derives support from SPECTAT · NVM · (*i. e.*, as I read it, *spectator numorum* or *numularius*)‡ in the recently published Arles inscription, I submit this reading as more probable than any of which I am aware.

"Of the use of *specto* and its derivatives in this sense, the following passage affords sufficient evidence: *Ex omni pecunia certis nominibus deductiones fieri solebant, primum pro* spectatione, &c. Cicero, *Verr.* v. 78; *Cape hoc, sis. Quin das? Numi sexcenti heic erunt Probi, numerati; fac sit mulier libera, Atque huc continuo adduce. Jam faxo heic erit. Non, hercle, quoi nunc hoc dem* spectandum, *scio.* Plautus, *Persæ*, iii. 3; *Quum me ipsum noris. quam elegans*

* The sense in which the word was understood by the greater number of those who received it, conveyed more than this, as I have elsewhere stated. Mommsen's objection, however, as to the application of *spectatus* to gladiators is valid in whatever sense the term was taken. Indeed I do not recollect any passage in a Latin author, besides that cited from Horace, in which *spectatus* is used with a reference, direct or indirect, to gladiators.

† This designation is used by Maffei, Fabretti, Orsato, Marini, &c. And yet the phrase is, as I have remarked, unsanctioned by ancient authority. There is no passage with which I am acquainted that mentions any such object as a *tessera* given as a reward, unless the words *tabulam illico misit* in Suetonius, *Claudius*, c. 21, be taken in this sense, as Morcelli interprets them. His explanation, however, is, in my judgment, very unsatisfactory. He seems to have forgotten the statement in Dio Cassius, lx. 13, relative to the usage of Claudius at these shows: *κήρυξι μὲν ἐλάχιστα ἐχρῆτο, τὰ δὲ δὴ πλείω ἐς σανίδας γράφων ἐδήλου*; *i. e.*, *Præconibus rarissime usus est ac pleraque* tabulis inscripta *significavit*.

‡ The *numularii* did more than tell whether coin was good or base. They seem to have been like our money brokers. Their occupation and position were below those of *argentarii*. In the Theodosian Code, xvi. 4, 5, *sevri* and *numularii* are classed together.

formarum spectator *siem.* Terence, *Eunuch*, iii. 6, on which Donatus remarks: '*Spectator, probator, ut pecuniæ* spectatores *dicuntur;*' *Adcipe: heic sunt quinque argenti lectæ numeratæ minæ.* Plautus, *Pseudol*, iv. 7, 50; *Lectum'st: conveniet numerus quantum debui.* Terence, *Phormio*, i. 2, 3, on which Donatus remarks: 'Spectatione *lectum est;*' *Veri speciem calles, ne qua subærato mendosum tinniat auro?* Persius, v. 105, on which Kœnig remarks: '*Sumptum hoc ab illo hominum genere, quorum erat* probare numos, *quique* spectatores *vel docimastæ vocabantur.*' In later times, the provers of gold were called *spectatores*, as we know from Symmachus, *Epist.* iv. 56: *Nullo jam provincialis auri incremento trutinam* Spectator *inclinat.* In none of our English works on archæology is there any explanation of either of these terms—*spectatio* or *spectator*—but the necessity for employing persons skilled in distinguishing base from good coin, and the origin of this *spectatio*, are well pointed out in an article by Dr. Schmitz, on *Moneta*, in Smith's 'Dictionary of Greek and Roman Antiquities:'

"'As long as the Republic herself used pure silver and gold, bad money does not seem to have been coined by any one; but when, in 90 B.C., the tribune Livius Drusus suggested the expediency of mixing the silver which was to be coined with one-eighth of copper, a *temptation* to forgery was given to the people, and it appears henceforth to have occurred frequently. As early as the year 86 B.C. forgery of money was carried on to such an extent that no one was sure whether the money he possessed was genuine or false, and the prætor M. Marius Gratidianus saw the necessity of interfering. (Cic. *De Off.* iii. 20) He is said to have discovered a *means* of testing money and of distinguishing the good from the bad denarii. (Plin. *H. N.* xxxiii. 46.) In what this means consisted is not clear; but some method of examining silver coins must have been known to the Romans long before this time. (Liv. xxxii. 2).'

"Dr. Schmitz's interpretation of the passage in Pliny's Natural History seems to me very doubtful. The words are—'*Miscuit denario triumvir Antonius ferrum. Miscentur æra falsæ monetæ. Alii e pondere subtrahunt, quum sit justum lxxxiv e libris signari. Igitur ars facta denarios probare, tam jucunda lege plebi, ut Mario Gratidiano vicatim totas statuas dicaverit.*' *Ars facta denarios probare* do not appear to me to signify 'a means of testing money and of distinguishing the good from the bad denarii was discovered,' for that cannot have been done *lege*, 'by a law;' but rather 'the testing of denarii was made an art, became a recognized occupation,' *i. e.*, the law of Gratidianus provided for the appointment or recognition of a certain class, whose business it was to distinguish good and base denarii. . . . . .

"It seems not improbable, then, that these *tesseræ* were carried, or, it may be, hung round the neck, by those who acted as *spectatores*, as badges indicative of their occupation, and that the inscription showed that they were authorized to act as such, having been approved on the stated days, or in the stated months. Thus the frequency of the occurrence of the Calends, Nones and Ides seems to be satisfactorily accounted for; for these were, as is well known, the settling days, the principal times for money transactions. But a question presents itself—which may also be asked if we accept the old reading *spectatus* with reference to gladiators—why the days are stated on those *tesseræ* which were found at or near the city, whilst the three examples of the month alone are on those found in other places, viz., Parma, Modena and Arles? Mommsen is of opinion that perhaps we should take in these instances the month as used for the Calends of the month—'*fortasse intelligendæ sunt ipsæ kalendæ in tesseris his nescio quo* *modo præcipuæ.'* Another explanation of this distinction may be given by supposing that these badges or certificates were issued in Rome on any day of the month on which they were applied for, especially the Calends, Nones and Ides, being those on which the services of the *spectatores* would be most required; whilst in the country parts they were issued only once in the month, the day for such issue not being fixed, but left to the discretion of the issuing officers.

"Still another view may be taken, that these *tesseræ* indicated the time, not from which the persons holding them might act as *spectatores*, but for or during which they were empowered to discharge that duty—in the city for a specified day—in the country for a specified month."

6. About a year ago I was asked to explain an inscription that was stated to have been found on a stone in Syria. It was "ANN · XII · P · C." I suggested that there was a letter left out between P · C., and that the letter was *V.*, *i.e.*, I read the inscription "*Ann(o) Duodecimo post urbem conditam*," and gave as instances Gruter, 113, 2, and Orelli, 3694, 3697. It appears, however, that the reading, *Anno duodecimo post Christum*, was preferred. In this article I propose examining the subject, so that there may be no reason for doubt. If the reading which was preferred be correct, I am compelled to infer that the inscription was spurious, for the era—A.D., *anno Domini*, P.C., *post Christum*, or A.C., *ante Christum*—was introduced by the monk, *Dionysius Exiguus*, in the sixth century after the birth of our Lord—some say in 525, others in 527, and others again in 532. Dionysius placed the Nativity in A.V.C. 753, and recommended the substitution of this mode of computation for the others that were then used, specially for the era of Diocletian. The following extract from "Hales' Chronology" may be useful:

"Unfortunately for ancient chronology, there was no one fixed or universally established era. Different countries reckoned by different eras, whose number is embarrassing, and their commencements not always easily to be adjusted or reconciled to each other; and it was not until A.D. 532 that the Christian Era was invented by *Dionysius Exiguus*, a Scythian by birth, and a Roman abbot, who flourished in the reign of Justinian.

"The motive which led him to introduce it, and the time of its introduction, are best explained by himself, in a letter to Petronius, a bishop:

"'Because St. Cyril began the first year of his cycle [of 95 years] from the 153rd of Diocletian, and ended the last in the 247th; we, beginning from the next year, the 248th, of that same tyrant, rather than prince, were unwilling to connect with our cycles the memory of an impious [prince] and persecutor; but chose rather to antedate the times of the years, from the incarnation of our Lord Jesus Christ, to the end that the commencement of our hope might be better known to us, and that the cause of man's restoration, namely, our Redeemer's passion, might appear with clearer evidence.'

"The era of Diocletian, which was chiefly used at that time, began with his reign, A.D. 284; and therefore the new era of the incarnation, A.D. 284+248 =A.D. 532. Strauchius, and other chronologers, I know not upon what grounds, date it A.D. 527, five years earlier.

"How justly Dionysius abhorred Diocletian's memory, may appear from Eusebius, who relates, that in the first year of his reign, when Diodorus the bishop was celebrating the holy communion with many other Christians in a cave, they were all immured in the earth, and buried alive! Hence, his era was otherwise called the Era of the Martyrs; and not from the tenth, last and bloodiest of the Christian persecutions by the Roman emperors, in the 19th year of his reign.

"Dionysius began his era with the year of our Lord's incarnation and nativity, in U.C. 753, of the Varronian Computation, or the 45th of the Julian Era. And at an earlier period, Panodorus, an Egyptian monk, who flourished under the Emperor Arcadius, A.D. 395, had dated the incarnation in the same year.

"But by some mistake, or misconception of his meaning, Bede, who lived in the next century after Dionysius, adopted his year of the Nativity, U.C. 753, yet began the Vulgar Era, which he first introduced, the year after, and made it commence Jan. 1, U.C. 754, which was an alteration for the worse, as making the Christian Era recede a year further from the true year of the Nativity."

As the foregoing extract sufficiently explains the motive that influenced Dionysius, and the manner in which he introduced the new mode of computation, it remains for me to discuss the date of the Nativity, so as to indicate the errors of the date of the Vulgar Christian Era.

The date of our Lord's birth includes the year, the month, and the day. We shall first consider the year, and then proceed to the month and the day. First, it is evident that our Lord's birth-day must have preceded the death of Herod, for we are told by St. Matthew that the return from Egypt took place "when Herod was dead." If, then, we can find out the year of Herod's death, we may be sure that, as "Jesus was born in the days of Herod the King," the year of the birth of Jesus Christ must have been before that. From Josephus, *Antiq.* xvii. 8, § 1, it appears that Herod died, having reigned thirty-four years from the murder of Antigonus, and thirty-seven years from the date of his appointment as king. The latter event (on the same authority, *Antiq.* xiv. 14, § 5,) was in the consulship of *Domitius Calvinus* and *Asinius Pollio*. Now we know that they were consuls in A.U.C. 714. But we also know (Josephus, *Antiq.* xiv. 16, § 4,) that the death of Antigonus took place in the consulship of *Vipsanius Agrippa* and *Caninius Gallus*, *i.e.*, in A.U.C. 717; and further, there is evidence that proves that in the calculations of time by Josephus, he counts from the Jewish month, *Nisan* to *Nisan*, and that he reckons the portion of a year, either at the beginning or at the end, as one complete year. Hence it follows that the birth of Christ preceded the date of 754 A.U.C., which is the Vulgar Christian Era, by at least four years, for the death of Herod should be placed in 750 A.U.C. But we can ascertain not merely the year but the month of Herod's death, for it was between an eclipse of the Moon (March 13th), and (Josephus, *Antiq.* xvii. 6, 4,) shortly before the feast of the Passover, so that it was in the month of March. The year of our Lord's birth must then have preceded March, B.C. 4. But from St. Matthew ii. 16, it appears that the year of the birth of our Lord should be placed about two years or under before the death of Herod, or, if we accept the inclusive method of counting years, between one year and five or six months before that event. This will give us B.C. 5 or 6. But there are other data from which calculations of the year of the Nativity have been made, viz.: (*b*) the appearance of the star; (*c*) the census by Augustus; (*d*) the age at the baptism; (*e*) the date of the first Passover after the baptism; (*f*) the succession of the courses of the priests. Of these it is sufficient here to observe that there is not one of them that yields a certain result.

As I have now proved that the date of the Nativity, commonly received since the time of *Dionysius Exiguus*, is inaccurate, I shall subjoin a precis, from "Hales' Chronology," of the different dates that have been accepted:

EPOCHS OF THE NATIVITY.	U.C.	B.C.
Tillemont, Mann, Priestly	747	7
Kepler, Capellus, Dodwell, Pagi	748	6
Chrysostom, Petavius, Prideaux, Playfair, Hales	749	5
Sulpitius Severus, Usher	750	4
Irenæus, Tertullian, Clemens Alex., Eusebius, Syncellus, Baronius, Calvisius, Vossius	751	3
Epiphanius, Jerom, Orosius, Bede, Salian, Sigonius, Scaliger	752	2
Chronicon Alexand., Dionysius, Luther, Labbæus	753	1
		A.D.
Herwart	754	1
Paul of Middleburgh	755	2
Lydiat	756	3

[Clinton adopts 5 B.C. as the year of the Nativity.]

At present, in the West, December 25th is regarded as the day set apart for the commemoration of the birth of Christ, but for the first three hundred years it was celebrated on the day of the Epiphany From the authorities cited by Gieseler, i., p. 292, it appears that it was first appointed by Julius, Bishop of Rome, A.D. 337–352. See Mommsen, *Corpus Inscriptionum Latinarum,* Vol. I., p. 410, who cites the words of *scriptor Syrus* (apud Assemannum bibl. Oriente, V. II., p. 164): "*Causa ob quam mutarunt patres solemnitatem die 6 Jan.* [*i. e.,* Epiphaniæ die] *et ad diem 25 Decembris transtulerunt, hæc fuit: solemne erat Ethnicis hoc ipso 25 Decembris die natalicia solis celebrare, in quibus accenderunt lumina festivitatis causa. Horum sollemnium et festivitatum etiam Christiani participes erant. Cum ergo animadverterent doctores ad hoc festum propendere Christianos, consilio inito statuerunt hoc die vera natalicia esse celebranda, die vero 6 Jan. festum Epiphaniorum. Hic itaque una cum hoc instituto ad diem usque sextum invaluit mos ignium accendendorum.*"

In the *Fasti Philocali,* the day VIII · K · IAN · (*i.e.* Dec. 25) is marked $\overline{\text{N}}$ · INVICTI · $\overline{\text{CM}}$ · XXX *i.e.,* N(atalis) invicti; c(ircenses) m(issus) xxx. *Invictus* is a common epithet of Mithras, or Sol, of whom, it is well known, Constantine the Great (Emperor from 306 to 327 A.D.) was a worshipper.

7—15,

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7. Plato, *Philebus,* 30 B. πᾶσαν καὶ παντοίαν σοφίαν ἐπικαλεῖσθαι.

The passage in which these words occur presents many difficulties, owing partly to the want of sequence in the grammatical structure of the sentences, partly to the obscurity of meaning. Professor Jowett somewhat freely renders, or rather paraphrases, this passage as follows: "For surely we cannot imagine that of the four classes, the finite, the infinite, the composition of the two, and the cause or fourth class, which enters into all things, giving to our bodies souls, and the art of self-management, and of healing disease, and operating in other ways to heal and organize; we cannot, I say, imagine that this last should *have all the attributes of wisdom,* and that whereas the elements exist, both in the entire heaven and *in great provinces of the heaven,* only fairer and purer, this should not also in that higher sphere have designed the noblest and fairest of natures?" The *italics* are mine. In this rendering, which appears to present the opinions expressed in the notes of the commentators, there are several points to which I would direct attention. In the first place, it seems somewhat awkward that ἐπικαλεῖσθαι should be given a passive meaning (*appellari*), while μεμηχανῆσθαι, which is co-ordinate with it, is taken as active (*effecisse*). In the next place, I cannot help feeling that, thus taken, the sentence ἐν μὲν τοῖς παρ' ἡμῖν κ. τ. λ., is but a poor antithesis to ἐν τούτοις δὲ κ. τ. λ. I think that it should be translated somewhat in the following manner: "And operating in other ways to heal and organize, *summons to its aid every varied device of science.*" This would give ἐπικαλεῖσθαι its more usual meaning of "*calling in as helper, &c.*" Again, if the words κατὰ μεγάλα μέρη are to be rendered "in great provinces *of the heaven*" (τοῦ οὐρανοῦ being understood), we are told that the elements exist *both* in the *entire* heaven *and* in great provinces of the heaven. Such pleonasms are certainly idiomatic among the Greeks; but, one would think, should not be unnecessarily attributed to them. It would seem more in accordance with the context to render κατὰ μεγάλα μέρη "*in large quantities,*" *i.e.*, these elements not only exist in the entire heaven but also in great abundance there. They are moreover as superior in quality as in quantity to ours.

8. *Ibid.*, 42 C. τούτων τοίνυν ἑξῆς ὀψόμεθα, ἐὰν τῇδε ἀπαντῶμεν, ἡδονὰς καὶ λύπας ψευδεῖς ἔτι μᾶλλον ἢ ταύτας φαινομένας τε καὶ οὔσας ἐν τοῖς ζώοις.

Commentators usually put a comma after ἀπαντῶμεν, to avoid making the accusative ἡδονάς depend upon it, and supply a dative after ἀπαντῶμεν. Stallbaum, however, shows that there is no need for resorting to this artifice, as there are numerous examples of similar verbs with an accusative instead of the dative. But it has occurred to me that this passage is susceptible of a very different explanation. From a comparison with a passage immediately preceding this (41 B), where Socrates says, "Let us stand up, then, like wrestlers to this new argument," I am inclined to think that here, too, we have one of those metaphors from the training school, which one not unfrequently meets with in the dialogues of Plato (cp. *Phileb.* 13 D, and Stallbaum's note on that passage). Instead, then, of rendering this passage, with Professor Jowett, "Next let us see whether in another direction we may not find pleasures and pains existing and appearing in living beings, which are still more false than these," I would render, "Next, then, we shall see, *if we join issue in this way*, pleasures and pains," &c. The surprised and indignant ποίας δὴ καὶ πῶς λέγεις; with which the defender of pleasure greets this home thrust, shows that the dialogue has not yet reached that easy didactic stage at which any suggestion unfavourable to his client will be suffered to pass unquestioned.

9. Sophocles, *Ajax*, v. 416. τοῦτό τις φρονῶν ἴστω.

These words are generally supposed to be equivalent to "*hoc sciat qui sapit*," "Let him who is wise know this." In this case, they serve as a cue to the spectators. In order to see *their* force, it is necessary to bear in mind the stage at which they are uttered. Ajax has just recovered consciousness, and, after an outburst of despair, in which, like Shakespeare's Duchess of Gloster (*Henry VI.*, pt. ii., act iv., sc. iv.), he declares that henceforth "dark shall be *his* light and night *his* day," and accuses all nature of being in league with his foes—"long has it kept him about Troy, where he has won nothing but dishonour, but no longer shall it keep him in life"—he exclaims, τοῦτό τις φρονῶν ἴστω—"This let me while in my right mind resolve." As I take it, Ajax fears that he may again relapse into frenzy, and work yet more "sorrow for his friends and laughter for his foes;" he will therefore make up his mind, while yet free from madness, to die. With regard to this interpretation, I would observe that φρονῶν is repeatedly used with this signification in the *Ajax*, *e. g.*, vv. 82 and 342; and τις is often used, like our "one," not only for the second and third, but also for the first person (cp. v. 245 of this play), especially where there is a hint of something unpleasant which is likely to happen to the person indicated—as, for instance, in the ludicrous scene between Dionysus and Xanthias, in the *Frogs* of Aristophanes (vv. 606, 628 and 664).

10. Cicero, *De Legibus*, II. xxv. 62. "Gaudeo nostra iura ad naturam accommodari maiorumque sapientia admodum delector; sed re[cedo] quiro, ut ceteri sumptus, sic etiam sepulchrorum modum. MARCUS. Recte requiris."

In this passage, which I have given according to Vahlen's text (as being that which adheres most closely to the MSS.), the chief difficulty lies in the words *sed recedo quiro*, which are said to be thus given in those MSS. which are generally considered to be of highest authority. Vahlen's remedy would appear to be the least violent of those proposed; he would read *sed requiro*. Halm, Klotz, and Feldhügel, assign to Marcus those words which follow *delector*. Thus they read: "MARCUS. *Sed credo, Quinte, ut c. s., sic etiam s. m. recte requiri.*" Either of these readings fails to account for the presence of several letters in the MSS. The following reading appears to me to be free from objection on this score: *delector; sed recte, credo, requiro . . . . modum.* M. *Recte requiris.* With regard to the emendation here proposed, it is necessary to remark that *recte credo* would degenerate into *recedo* through one of the most frequent sources of corruption in MSS., viz., the confusion of the letters *t* and *c*; it would be superfluous to adduce examples of this well known fact. Another step in this progress of error would be the omission, almost regular in MSS., of recurrent letters, which would account for the disappearance of *ct* and *e*; and, finally, the letter *r* being indicated, rather than written, by a dash, would readily escape notice. Thus the word *progressa*, which immediately follows, is said to be given as *pcessa* or *processa* in the best MSS.

11. *Ibid.*, II. xxv. 63. Here Vahlen gives the reading of the best MSS. as "*Nam et Athenis iam* illo mores *a Cecrope, ut aiunt, permansit hoc ius terra humandi.*" He proposes *nam et Athenis, (nostis) iam illos mores, &c.* The reading given in the text of Nobbe, Klotz, and Halm—*nam et Athenis ille mos a Cecrope, &c.*—is said to be found as an interlinear correction of the MSS. Halm, however, in a foot note, speaks of the passage as a *locus nondum sanatus*. A statement which Madvig makes in his *Adversaria* (Vol. I., p. 40), that the words *mores* and *maiores* are occasionally interchanged in MSS., suggested what I conjecture to have been the original reading, namely: *Nam et Athenis iam illo a Cecrope, maiores ut aiunt, &c.* "For at Athens too, even from the time of the famous Cecrops, as the ancients say, &c." The confusion of *maiores* with *mores* would lead naturally to this transposition of the words. The age of Cecrops would appear to have passed into a proverbial expression for the remotest antiquity, the words *ut aiunt* being regularly used in quoting a proverb.

12. Virgil, *Georgics*, B. III., v. 348.

"Omnia secum
Armentarius Afer agit, tectumque Laremque
Armaque Amyclæumque canem Cressamque pharetram:
Non secus ac patriis acer Romanus in armis
Injusto sub fasce viam quum carpit, et hosti
Ante expectatum positis stat in agmine castris."

On this passage Conington remarks that "Keightley seems right in saying that *in agmine* ought to have been strictly *in acie*. There may be some rhetorical point in the catachresis to show the rapidity with which the line of march is exchanged for line of battle." I think that it is possible to give *agmine* its proper meaning, without assuming any catachresis. The heavy burden of stakes under which the Roman soldier is described, in the preceding line, as toiling along, would enable him, as Conington says, to exchange with rapidity the line of march for line of battle. As I take it, the idea conveyed is, *that an enemy* surprises the Romans while on the march; instantly each man plants his stakes, and, to the amazement of the enemy, there is a stockade to storm instead of a column with unprotected flanks. This may be brought out, I think, without difficulty, by laying stress on *agmine*. I would render thus: "Not otherwise than when the brave Roman in the arms of his fathers, beneath an unequal burden wends his way, and unexpectedly, with pitched camp confronts the foe, *though on the march*." Perhaps, however, it is better to make *hosti* depend upon *expectatum;* in which case the force of *et* will be more apparent; thus, "when, beneath an unequal burden, he wends his way; *and suddenly*, all unexpected by the foe, stands with pitched camp *though on the march*."

13. Juvenal, *Satire* XIII., v. 197.

> "Poena autem vehemens ac multo saevior illis,
> Quas et *Cædicius* gravis invenit aut Rhadamanthus,
> Nocte dieque suum gestare in pectore testem."

Who the Cædicius here mentioned was, the commentators are unable to discover. The scholiast, as usual, makes a guess, and gravely states that Cædicius was either a cruel judge, or something else, in the reign of Nero. It strikes me that the name is one coined from the verb *cædo*, in which case it would be pretty nearly equivalent to "strike-'em." Thus it would do duty either for the "Jack Ketch" of the day, or for the cruel Draco of antiquity.

14. Propertius, V. ix. 5.

> "Qua *Velabra* suo stagnabant flumine, quaque
> Nauta per urbanas velificabat aquas."

We have here one of those amusing attempts at derivation, in which the ancients were fond of indulging. Mr. Paley has the following note on this passage: "*Velabra*.—The low part of the city called the Velabrum is here derived from *vela*, on the theory that it was once, like the place called λίμναι, at Athens, stagnant water. See on V., 2, 8. Varro, L.L., V., § 43–44: 'Olim paludibus mons (Aventinus) erat ab reliquis disclusus, itaque ex urbe advehebantur ratibus, quoius vestigia, quod ea, qua tum vehebantur, etiam nunc dicitur Velabrum.'—'Velabrum a vehendo. Velaturam facere etiam nunc dicuntur, qui id mercede faciunt.'"

There seems to be no doubt, from the above and similar passages (*e. g.*, Ovid, *F.*, VI., 505), that the Velabrum was originally a marshy spot. It has occurred to me that a more satisfactory derivation than either of those given above, would be to suppose it connected, by the medium of the digamma, with the Greek ἕλος, "a marsh;" and if, as philologists suppose, the Latin *vallis* is of cognate origin with ἕλος, this example would greatly add to the probability of the derivation which I propose. With regard to the termination of *Velabrum*, possibly, as in *volutabrum*, it is a mere suffix; possibly, as in *candelabrum*, the termination, *brum*, retains the meaning of the root *BHAR* (found in φέρω, *fero*, &c.), "bear," with which it is generally supposed to be connected. In this case, *Velabrum* would be, "The ferry of the marsh;" and the old derivation from *veho* would not be so far wrong after all.

15. *Luscinia.* This word is variously derived in the Lexica:

(1) *luscus* and *cano*, "the bird singing at night."
(2) *lux* and *cano*, "the bird singing at dawn."
(3) λύω and *cano*, "the liquid songstress."

Of these derivations the first is commonly rejected, on the ground that *luscus* and *cano* would properly signify "the one-eyed songstress;" the second, because the bird does not sing merely at daybreak but all the night long, and frequently in the daytime too.

With regard to the third, which has been received with more favour, I would object that, in almost every passage where the nightingale is mentioned by the ancients, it is not the sweetness but the sadness of her song which appears to have impressed them. Why did this bird redouble her plaints during the night, when other birds of song were still and silent? The myth of Philomela, Procne, and Tereus (Ovid, *Metam.* VI. 424 foll.) furnished an answer to this question. Everywhere the nightingale, whether called Procne, Philomela, or ἀηδών, is used as a symbol of ceaseless mourning. Sophocles speaks of her as the frantic mourner, whose unending plaint of "Itys ever Itys," best accords with the melancholy fancy of the forlorn

Electra. *Ἀλλ' ἐμέ γ' ἁ στονόεσσ' ἄραρεν φρένας, Ἃ Ἴτυν, αἰὲν Ἴτυν ὀλοφύρεται, ὄρνις ἀτυζομένα.* (Sophocles, *Electra*, v. 147.)

Æschylus (*Agamemnon*, vv. 1110 foll.) puts similar language into the mouth of the Chorus with regard to Cassandra's dirge. The name Itys is, of course, an onomatopœia. It is superfluous to multiply examples; a few of the more striking ones will serve our purpose. In addition to those mentioned above, we may take Homer, *Odyssey*, B. XIX., v. 522; Catullus, Ode LXV., v. 14; Virgil, *Georgics*, B. IV., v. 514.

In all these passages it is the *infelix avis*, the "hapless bird," which is present to their thoughts. From these considerations I have been tempted to propose *δυς* and *cano* as a probable derivation. *Dus* is the prefix which we find in the compounds *δυσηχής*, *δύσθροος* and other words, with the notion of "hard, bad, unlucky, &c." The letters *d* and *l* are, as is well known, interchangeable, cp. *e.g.* *δάκρυμα* and *lacruma* "a tear." Thus *luscinia* would be the "plaintive songstress."

EULER'S EQUATIONS OF MOTION.

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1. A rigid body fixed at O has at time t rotations $\omega_1\ \omega_2\ \omega_3$ round the principal axes OA, OB, OC: to determine the changes per unit time in these rotations.

The positions OA', OB', OC' of the axes at time $t + \delta t$ will be known from the displacements in time δt, due to these rotations, of the points $A\ (\omega_1, \mathrm{o}, \mathrm{o})$, $B(\mathrm{o}, \omega_2, \mathrm{o})$, $C(\mathrm{o}, \mathrm{o}, \omega_3)$. The components of these displacements in the directions OA, OB, OC, respectively, are evidently

$$\begin{array}{cccl} \mathrm{o}, & \omega_1\omega_3\delta t, & -\omega_1\omega_2\delta t, & \text{for } A; \\ -\omega_2\omega_3\delta t, & \mathrm{o}, & \omega_1\omega_2\delta t, & \text{for } B; \\ \omega_3\omega_2\delta t, & -\omega_3\omega_1\delta t, & \mathrm{o}, & \text{for } C. \end{array}$$

The component rotations at time $t + \delta t$ are $\omega_1 + \frac{d\omega_1}{dt}\cdot\delta t$, &c., which may be represented by OA', OB', OC'. The changes of the rotations in time δt are therefore AA', BB', CC'. Resolving these changes into the components (AF, FP, PA'), (BG, GQ, QB'), (CH, HR, RC'), in the directions of the axes at time t, we get (observing that FP, PA' are the displacements in time δt of the point $F\ (\omega_1 + \frac{d\omega_1}{dt}\delta t, \mathrm{o}, \mathrm{o})$, &c., and neglecting infinitesimals above the first order) the following as the resultant changes in time δt:

$$AF + GQ + HR = \left(\frac{d\omega_1}{dt} - \omega_2\omega_3 + \omega_3\omega_2\right)\delta t = \frac{d\omega_1}{dt}\delta t \text{ along } OA;$$

$$FP + BG + RC' = \left(\omega_1\omega_3 + \frac{d\omega_2}{dt} - \omega_3\omega_1\right)\delta t = \frac{d\omega_2}{dt}\delta t \text{ along } OB;$$

$$PA' + QB' + CH = \left(-\omega_1\omega_2 + \omega_2\omega_1 - \frac{d\omega_3}{dt}\right)\delta t = \frac{d\omega_3}{dt}\delta t \text{ along } OC.$$

The changes per unit time are therefore $\frac{d\omega_1}{dt}$, $\frac{d\omega_2}{dt}$, $\frac{d\omega_3}{dt}$, in the directions OA, OB, OC, respectively.

2. To determine the component changes of the body's moment of momentum.

At time t the components of the moment of momentum are $A\omega_1$, $B\omega_2$, $C\omega_3$ in the directions of the principal axes, where A, B, C denote the principal moments of inertia. At time $t+\delta t$ the components are $A\left(\omega_1+\frac{d\omega_1}{dt}\delta t\right)$, &c., in the directions OA', OB', OC'. Employing the figure in a new sense, the former components may be represented by OA, OB, OC, and the latter by OA', OB', OC'. The changes of the moment of momentum in time δt are therefore AA', BB', CC'. Resolving these changes into their components parallel to the axes at time t we get, as in the former case, (observing that FP, PA' are now the displacements in time δt of the point F $\left(A\omega_1+A\frac{d\omega_1}{dt}\delta t, \text{o}, \text{o}\right)$, &c.), the following as the resultant changes of the moment of momentum in time δt:

$$\left(A\frac{d\omega_1}{dt}-B\omega_2\omega_3+C\omega_3\omega_2\right)\delta t \text{ along } OA;$$

$$\left(A\omega_1\omega_3+B\frac{d\omega_2}{dt}-C\omega_3\omega_1\right)\delta t \text{ along } OB;$$

$$\left(-A\omega_1\omega_2+B\omega_2\omega_1+C\frac{d\omega_3}{dt}\right)\delta t \text{ along } OC.$$

The changes per unit time are therefore $A\frac{d\omega_1}{dt}-(B-C)\,\omega_2\omega_3$, &c., in the directions OA, OB, OC, respectively.

NOVEMBER 21st, 1878.

TIME-RECKONING.

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I propose to direct the attention of the Institute to some points connected with the reckoning of time. I shall refer to the minor inconveniences which in all parts of the world are daily experienced. I shall likewise point out what strike me as the more serious difficulties arising from our present notation, and which the progressive character of the age is gradually developing. The importance of determining some means by which these inconveniences may be overcome, cannot fail to be admitted by all who recognize the presence of the difficulties of which I speak.

The subject, by its character, cannot be limited in its bearing to Canada, or indeed to any country. It is one which affects in different degrees every locality and individual on the face of the earth; and it is of particular importance to all countries in which civilization is making rapid strides, and of which the geographical features resemble those of Canada and the United States.

I propose to consider the subject under the following aspects:

1st. The difficulties which arise from the present mode of reckoning time, owing to the extension of telegraph and steam communications by land and water.

2nd. The natural and conventional divisions of time.

3rd. The systems of reckoning time, ancient and modern.

4th. The necessity of meeting the defects caused by present usages, and the useful results which would be obtained from a uniform non-local system.

5th. The practicability of securing all the advantages attainable from uniformity, without seriously interfering with existing local customs.

The division of the day into two halves, each containing 12 hours, and each numbered from 1 to 12, is a fertile source of error and inconvenience.

Travellers who have had occasion to consult railway *guides* and steamboat time-tables, will be familiar with the inconvenience resulting from this cause; none know better by experience how much the divisions *ante meridian* and *post meridian* have baffled their inquiries, and how often these arbitrary divisions have led to mistakes. Were it necessary, innumerable instances could be given. The evil however is one so familiar that it has come to be looked upon as unavoidable, and is, as a matter of course, silently endured.

The halving of the day has doubtless long been in use, but beyond its claim to antiquity, is a custom that confers not a single benefit, and is marked by nothing to recommend it.

Another more serious difficulty, forced on the attention by the science of the century, is mainly due to the agency of electricity, employed as a means of telegraphy; and to steam applied to locomotives. These extraordinary sister agencies having revolutionized the relations of distance and time, having bridged space, and drawn into closer affinity portions of the earth's surface previously separated by long and, in some cases, inaccessible distances.

Let us take the case of a traveller in North America. He lands at Halifax in Nova Scotia, and starts by a railway to Chicago through the eastern portions of Canada. His route is over the Intercolonial, the Grand Trunk, and other lines. He stops at St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton and Detroit. At the beginning of the journey he sets his watch by Halifax time. As he reaches each place in succession, he finds a considerable variation in the clocks by which the trains are run, and he discovers that at no two places is the same time used. Between Halifax and Chicago he finds the railways observing no less than seven different standards of time. If the traveller remains at any one of the cities referred to, he must alter his watch to avoid inconvenience, and perhaps not a few disappointments and annoyances to himself and others. If, however, he should not alter his watch, he would discover on reaching Chicago that it was an hour and thirty-five minutes faster than the clocks and watches in that city.

If his journey be made by one of the routes through the United States, the variation in time and its inconveniences will not be less.

If he extends his journey west of Chicago, travelling from place to place until he reaches San Francisco, he will meet continual change, and finally discover a loss in time of nearly four hours (3h. 56m.). Between the extreme points there are many standards of time, each city or place of importance generally being governed by its own meridian. Hence the discrepancies which perplex the traveller in moving from place to place.

On the continent of Europe, and indeed wherever lines of communication extend between points differing to any considerable extent in longitude, the same difficulty is experienced. On a journey from Paris to Vienna or to St. Petersburg, the standard time employed by the railways changes frequently, and the extreme difference in time between the first and last city is nearly two hours. As railways and telegraphs are extended in Russia, the inconveniences will become of serious importance in that country. Within the limits of Russia in Europe and Asia, the extreme variations of time is about twelve hours.

Suppose we take the case of a person travelling from London to India. He starts with Greenwich time, but he scarcely leaves the shores of England, when he finds his watch no longer right. Paris time is used for the journey, until that of Rome becomes the standard. At Brindisi there is another change. Up the Mediterranean, ships' time is used. At Alexandria, Egyptian time is the standard. At Suez, ships' time is resumed, and continues, with daily changes, until India is reached. Arriving at Bombay, the traveller will find two standards employed, local time and railway time, the latter being that of Madras. If he has not altered his watch since he left England, he will find it some five hours slow. Should he continue his journey to China, it will have fallen eight hours behind.

In the United Kingdom the difficulties due to longitude are only felt in a modified form. The greater island, embracing England and Scotland, is comparatively limited in width; one standard of time is therefore used. It is only in respect to the sister island, Ireland, that the difference in longitude calls for a difference in time. In the whole United Kingdom, consequently, there are practically only two standards, viz., Greenwich time and Irish time, the difference being twenty-five minutes. No one, therefore, whose experience has been confined to the United Kingdom, can form an adequate idea of the extent of the inconvenience arising from the causes alluded to, where geographical circumstances render necessary the use of a multiplicity of standards.

The railway system is the principal agent in the developing of the difficulties referred to, and the still further extension of steam communications in great continental lines is forcing the subject on public attention. Canada supplies a good illustration of what is occurring. The railways built and projected will extend from the eastern coast of Newfoundland on the Atlantic, to the western coast of British Columbia on the Pacific, embracing about seventy-five degrees of longitude. Every Canadian city has its own time. Innumerable settlements are now being formed throughout the country ultimately to be traversed by railways; and in a few years, scores of populous towns and cities will spring up in the now uninhabited territories between the two oceans. Each of these places will have its own local time; and the difference between the clocks at the two extremes of Canada will be fully five hours. The difficulties which will ultimately arise from this state of things are apparent. They are already in some degree felt, they are year by year increasing, and will at no distant day become seriously inconvenient. This is the case not in Canada alone, but all the world over.

Again, there is a difficulty with regard to the determination of not only the precise hour, but even the day, of any occurrence under our present system of reckoning.

Persons who inhabit different sections of the earth, differ from each other in their reckoning of the day. At one place it is noon, at another it is midnight; at a third it is sunrise, at a fourth it is sunset. In consequence we have the elements of confusion, which involve in some cases the mistake of a whole day.

People even living in the same meridian may differ a day in their usual reckoning of time, according as the countries they inhabit have been colonized from the one side or the other of the globe. There are instances in the Pacific Ocean where islands almost adjacent reckon by different days of the month and week; a circumstance calculated to produce much confusion when intercourse becomes frequent.

In Alaska the days of the week and month were one day in advance of those in the adjacent colony of British Columbia, indeed of the whole of America. On the advent of citizens of the United States a few years ago, when that territory was transferred by Russia, the Saturday was found to be the Sunday of the old residents. For ordinary business purposes a change became necessary, and a dispensation was granted in 1871 by the dignitaries of the Greek Church in Russia, authorizing their missionaries and adherents in Alaska to celebrate Sunday a day later, or on Monday, according to the old reckoning.

The reverse has been met in another quarter of the globe. The Philippine Islands, lying between Australia and Asia, and about 100 degrees of longitude to the west of Alaska, were discovered in 1521 by the illustrious Magellan in his memorable first circumnavigation of the globe. That navigator followed the sun in his path around the world. Legáspi succeeded him and took possession of these important Islands in the name of Philip II., king of Spain. The Philippine Islands extend for a thousand miles from north to south, they embrace Manilla, one of the oldest cities of the Indies, and they contain a population of 5,000,000. They were colonized, as well as discovered, by Spaniards coming from the east; and as a consequence the reckoning of the inhabitants has for more than three centuries remained a day behind the day in British India and the neighbouring countries in Asia.

Travellers who arrive at New Zealand or the Australian colonies, by the San Francisco route, meet the same difference, owing to the fact that the countries in the South Pacific were colonized from the west. The day of the week and of the month carried from San Francisco, never agrees with the day and date reckoned by the inhabitants at the destination of the steamer.

All travellers who have made the voyage between America and Asia have experienced the difficulty in reckoning referred to. Those who have proceeded westward have lost, while those who have travelled eastward have gained a day. In Mrs. Brassey's "Around the World in the Yacht 'Sunbeam,'" this experience is recorded. The journal of that lady passes from Wednesday, January 10th, directly to Friday, January 12th—Thursday, January 11th, having no existence with the travellers.

In sailing across the Pacific from west to east, one day has to be repeated before landing on the American coast. If, for example, the correction be made on Wednesday, 1st July, there will be two Wednesdays in the one week, and two days of the month dated July 1st.

A journey round the world is now an everyday undertaking, and is accomplished with comparative ease. Suppose two travellers set out from a given place, one going eastwardly, the other westwardly. A singular circumstance will result when they both return to the common starting point, and the reason is obvious. One man will arrive, according to his reckoning, say on Tuesday, 31st December, when in fact at that locality it is Wednesday, January 1st. The other traveller, assuming that he has kept accurately a daily journal, will enter in his diary on precisely the same day, Thursday, January 2nd. This consequence has been brought out by Edgar Allan Poe, in his amusing story of "Three Sundays in one Week," but it no longer can be held to be an imaginary contingency, since steam communication by land and water is now affording extraordinary facilities for making the tour of the globe.

To illustrate the difficulty more particularly. First, let us select points in four quarters of the globe, each about ninety degrees apart—say in Japan, Arabia, Newfoundland and Alaska. If we assume it to be Sunday midnight at the first mentioned place, it must be noon at the opposite point, Newfoundland, but on what day is it noon? Arabia being to the west of Japan, the local time there will be 6 p.m. on Sunday; and Alaska, lying to the east of Japan, the time there will be 6 a.m. on Monday. Again, when the clock indicates 6 p.m. on Sunday in Arabia, it must be Sunday noon at a point ninety degrees further west, or at Newfoundland; when it is 6 a.m. on Monday at Alaska, it must be noon on Monday ninety degrees further east, also at Newfoundland. Thus, by tracing local time east and west from a given point to its antipodes, the clock on the one hand becomes twelve hours slower, on the other hand twelve hours faster. In the case in point, while it is midnight on Sunday in Japan, at precisely the same moment it is noon at Newfoundland on two distinct days, viz., on Sunday and on Monday.

Secondly, let us trace local time only in one direction around the earth. The day does not begin everywhere at the same moment. Its commencement travels from east to west with the sun, as the earth revolves in the opposite direction, and it takes an entire revolution of the globe on its axis for the day everywhere to be entered on. Immediately on the completion of one revolution the inception of any one day ends, and at this moment the end of the day begins; and the globe must make another complete revolution before the end of the day entirely finishes. The globe must in fact make two entire revolutions before any one week day runs out, consequently each and every day of the week runs over 48 hours; and, taking the whole globe into account, two civil days always co-exist. The first 24 hours of one day co-exist with the last 24 hours of its predecessor, while the remaining 24 hours co-exist with the first 24 hours of the day which follows.

It is difficult to accept the fact that any one day lasts more than 24 hours; but it can be demonstrated that it is the case. Let us place together several maps of the world on Mercator's "Projection," so as to represent, in consecutive order, each part of the earth's surface as it passes the sun during several diurnal revolutions. (*See Plate*).

AA^1, A^1A^2, and A^2A^3, are intended to represent each a complete map of the world. Within each of these limits every place on the earth's surface is brought under the sun during a daily revolution.

The vertical lines E I N R V represent meridians, for the sake of simplicity selected 60° degrees apart, and the stars or dots at their intersection denote the beginning and end of a day on each of the six meridians. As the earth revolves, the sun passes successively the meridians of those localities, with an interval of four hours elapsing between each.

Let us assume it to be 12 o'clock midnight on Thursday at meridian A. At that moment and at that place Friday begins and runs for 24 hours, or on the diagram from A to A^1.

Four hours later Friday begins on meridian E, and runs four hours on the second map, or into the 2nd revolution of the earth. Four hours still later Friday begins on meridian I and runs eight on the second map or into the 2nd revolution. This goes on from spot to spot, until at last the commencement of Friday reaches the last meridian, and at that point Friday runs entirely across the second map to A^2. Thus Friday begins at A, runs during two complete revolutions of the earth, as shown on the map from A to A^2.

The diagram will thus illustrate the duration of every day in the week, and it becomes obvious, when we take a general view of the whole globe on any given day, say Saturday, that day begins in the middle of Friday and does not end until the middle of Sunday. Friday, on the other hand, beginning in the middle of Thursday, runs into the middle of Saturday, while Sunday commences at the moment Friday ends. To state the case differently: the same moment of absolute time which is part of Saturday in one place, is equally part of Friday and of Sunday in some other places east and west.

It is a preconceived idea with many that there is a simultaneous Sunday over the earth, and that Christians in every meridian keep the Lord's day at one and the same time. Facts, however, establish that this is a mistake. From its first commencement to its final ending, the Sunday extends over 48 hours. Indeed, if we take into account the remarkable circumstance mentioned with regard to Alaska and the Philippine Islands, Sunday has been discovered to run over some 55 hours. The same may be said of any day in the week; and as a consequence we have, taking the whole globe into view, Saturday and Monday running over the intervening Sunday to overlap each other about seven hours. We have in fact as a constant occurrence, portions of three consecutive days co-existent.

From the fact that not only are the hours of the day different in every meridian, but that different days are constantly in progress on the face of the globe, it is a difficult matter under our present system of reckoning to assign relatively the hour and day when events take place. We may learn of an occurrence, and the time assigned will be correct in the meridian of the locality. Everywhere else it will be inaccurate. Indeed, if the fact of the occurrence be transmitted over the world by telegraph, it may, in some places, be recorded on different days.* If the incident occurs at the close of a month, or a year, it may actually take place in two different months, or two distinct years.

Under our present system it is quite possible for two events to take place several hours apart, the first and older occurring in the new year in one locality; the second, although the more recent in absolute time, falling, in another locality, within the old year. The same may be said of events that occur during the period which elapses when one century merges into another. In one part of the globe the same event may transpire in the nineteenth century, while in another it falls within the twentieth century.

These explanations set forth the inconveniences and the ambiguity inseparable from the ordinary mode of reckoning. The system, besides being unscientific and inconvenient, must, as time rolls on, inevitably lead to countless mistakes. In fact, unless the geographical

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* TIME AND THE TELEGRAPH.—A message dated Simla, 1.55 A.M. Wednesday, was received in London at 11.47 P.M. on Tuesday. As the clerk said, with pardonable confusion, "Why, this message was sent off to-morrow."—*Times.*

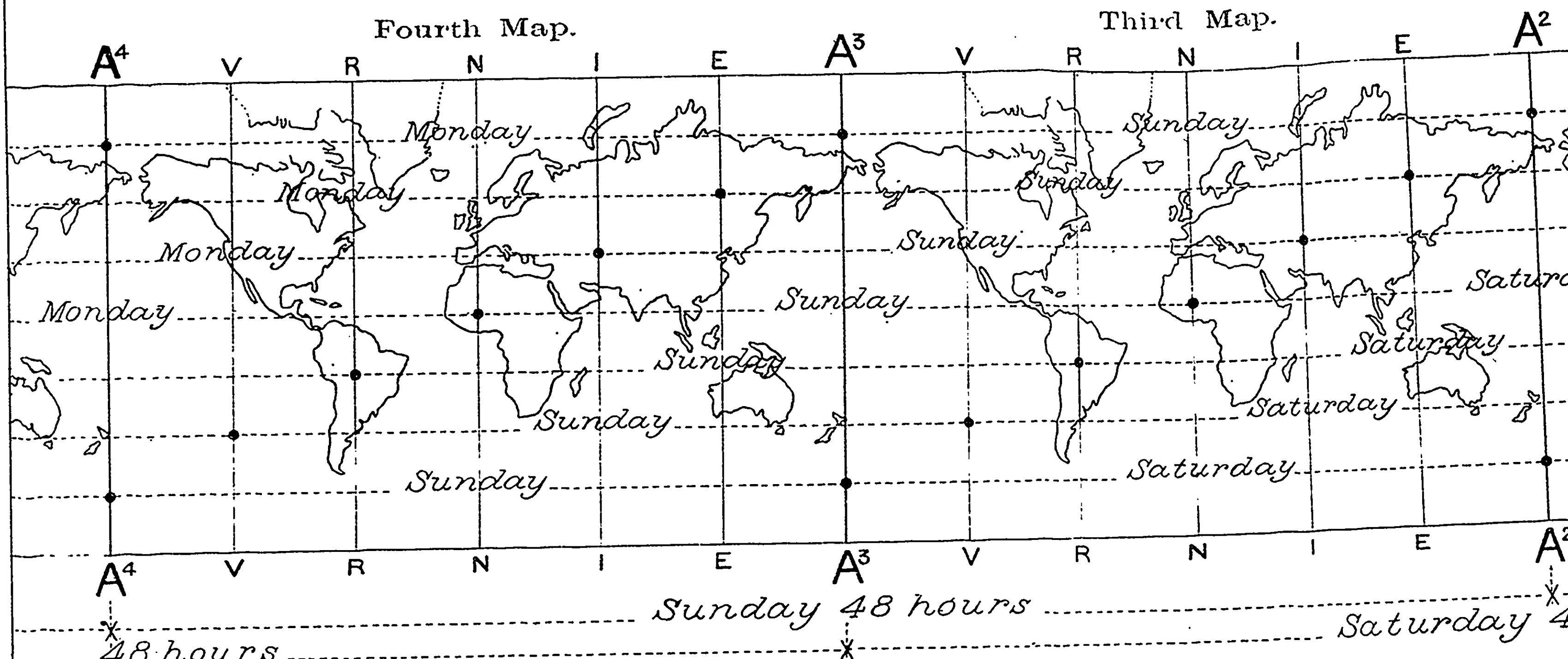
DIAGRA

TO ILLUSTRATE THE PROGR

— OF THE —

DAYS OF THE

Around the



GRAM
PROGRESS AND DURATION
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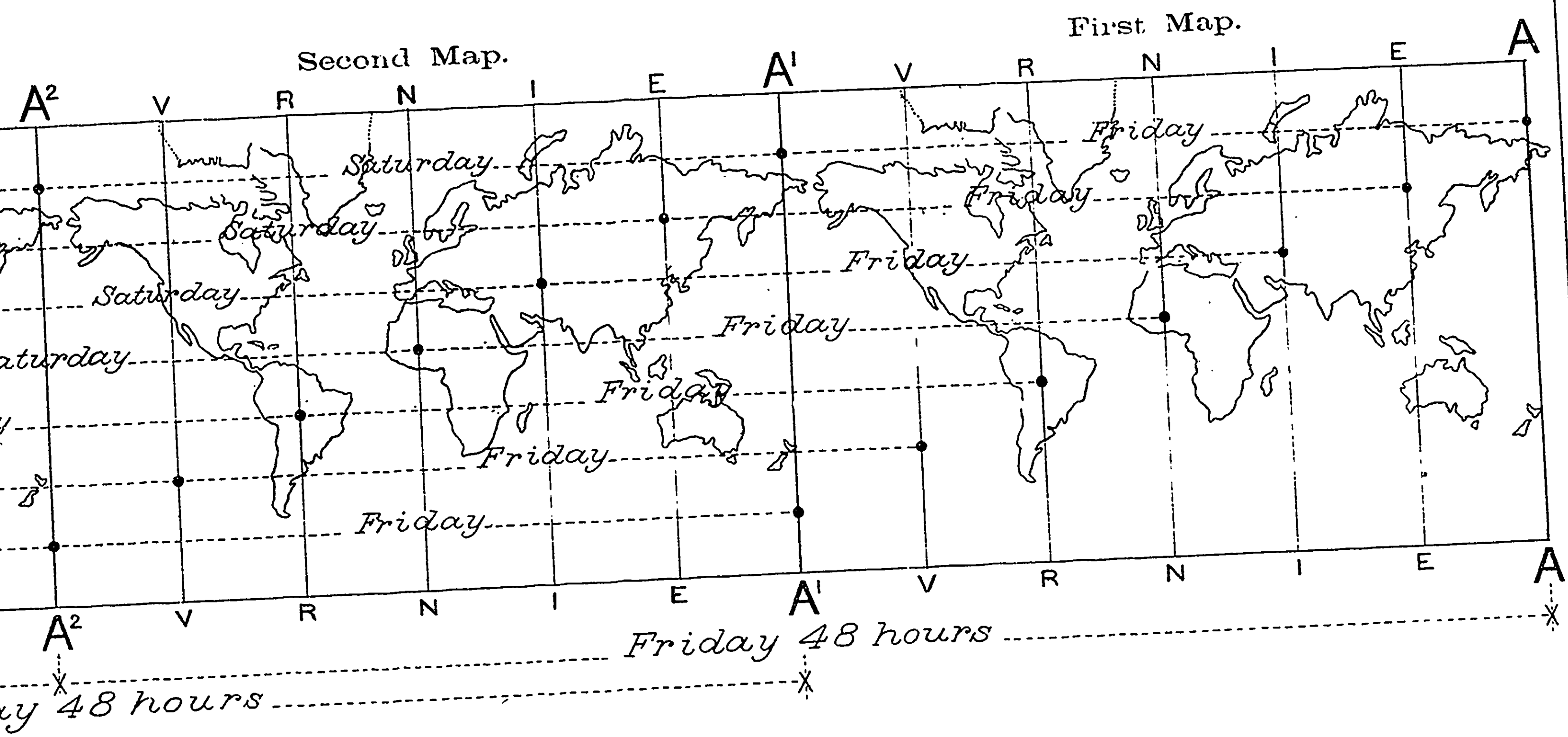


PHOTO LITH BY THE BURLAND DESBARATS LITH CO MONTREAL

position be specified as an important element of the date, there can be no absolute certainty with regard to time, as we at present note it in ordinary civil affairs.

The day is a purely local phenomenon. It begins and ends at every spot on the circumference of the globe at different instants in absolute time. From its very nature, there are as many different local days as there are points differing in longitude; and in order to make any comparison of the dates of different countries with each other, it is necessary, as in astronomical calculations, to make additions or deductions for the longitude of the places of observation. It need scarcely be argued that this process must become an exceedingly troublesome matter in the ordinary business of the world, especially when rapid and frequent intercourse between remote sections becomes general.

I need not further refer to the objections urged against the modes of keeping time, handed down to us from bygone centuries. It is clear from all experience that the customs which we still cling to, are indifferently adapted to the circumstances of the age, and that some better means of reckoning and verifying dates will soon be, if they are not already, urgently demanded.

A remedy for the evils to which your attention is directed may not generally be felt to be a pressing necessity; but the problem is obviously of no limited importance to the generation which is to succeed us, and it is not now too soon to seek for its solution. The minor inconveniences alluded to may be overcome in independent localities, as necessity dictates some arbitrary compromise; but if each country spontaneously adopted its own remedy, a want of uniformity of system, it is to be feared, will result, and increase the confusion.

The major difficulties to which I have referred are more general in their character, and in seeking for a remedy, uniformity of system is held to be of first importance, and consequently the broadest cosmopolitan view should be taken.

It is to be feared that no immediate solution to the problem may be possible; but a general inquiry into the science of chronometry may suggest means by which the difficulties may in some degree be met.

NATURAL AND ARTIFICIAL DIVISIONS OF TIME.

Time is determined in nature by the motions of the heavenly bodies. The great natural divisions are three in number: the year, the lunar month, and the day. All other divisions of time, as the civil month, the week, the hour, the minute, and the second, although long in general use, are arbitrary, conventional and artificial.

The employment of the lunar month for reckoning time is not general, although some nations, such as the Turks, Jews and Chinese, have preferred a lunar chronology. In China the age of the moon and the day of the month are identical.

The period measured by the diurnal movement of the earth on its own axis constituted the first space of time reckoned by the human race, and is undoubtedly the most important to man in all stages of civilization. It involves the most familiar phenomena of light and darkness, and embraces the constantly recurring periods of wakefulness and sleep, of activity and rest.

A day is the shortest measure of time afforded by nature. It is denoted by the revolution of the earth, and although the motion of the earth is uniform, we have three kinds of natural days all varying in length—the solar, lunar, and sidereal.

A solar day is the period occupied by a single revolution of the earth on its axis in relation to the sun.

A lunar day is the interval of time occupied by a revolution of the earth on its axis in relation to the moon.

A sidereal day is the period required for a complete revolution of the earth on its axis in relation to any one fixed star.

Of these three natural days, the sidereal day is the only one uniform in length. The lunar day, on account of the irregular and complicated motion of the moon in the heavens, is never employed as a measure of time. The solar day is variable in length on account of the ellipticity of the earth's orbit. Solar time is that shown by a sun-dial.

Although the sidereal day is uniform in length, inasmuch as it has no relation to the daily return of light and darkness, it is not employed for civil purposes. The commencement of the sidereal day is constantly changing throughout the year; at one period it comes at midnight, at another period at high noon.

It has been found convenient, therefore, to establish an artificial day, uniform in length, designated the mean solar day.

The mean solar day, as its name implies, is the average length of all the natural solar days in a year, and is the time intended to be indicated by ordinary clocks and watches.

The natural solar day is at one season of the year 14 minutes 32 seconds shorter, and at another 16 minutes 17 seconds longer than the mean. Thus the extreme variation is half an hour and 49 seconds.

The earth revolves in its orbit in about 365¼ days. To avoid fractions of days, it has been found convenient to establish three years in succession of 365 days, and each fourth year 366 days. The latter are designated leap years.

While an ordinary solar year has but 365 days, it has 366 sidereal days.

A solar day, therefore, exceeds the length of a sidereal by about $\frac{1}{365}$th part of a day, or nearly four minutes (3 minutes 55.9094 seconds).

The mean solar day, according as it is employed for civil or astronomical purposes, is designated the civil day, or the astronomical day. The former begins and ends at midnight; the latter commences and ends at noon. The astronomical day is understood to commence twelve hours before the civil day, but its date does not appear until its completion, twelve hours after the corresponding civil date. The two dates, therefore, coincide only during the later half of the civil and the earlier half of the astronomical day.

ANCIENT AND MODERN RECKONING OF TIME.

It has been stated that all shorter periods of time than a day are conventional and arbitrary, there being no measure less than a day denoted by nature. The only exception is the interval marked by the rising and setting of the sun; a period of time varying with the latitude and changing from day to day with the seasons.

The sub-division of the day into parts has prevailed from the remotest ages; though different nations have not agreed, either with respect to the epoch of its commencement, the number of the subdivisions, or the distribution of the several parts.

The division of the day with which we are most familiar is that which separates the whole space of time occupied by a diurnal revolution of the earth into two equal parts; one part extending from midnight to noon, the other part from noon to midnight. These half days are sub-divided into twelve portions or hours, and these again into minutes and seconds.

Astronomers do not divide the day into two sets of twelve hours. The astronomical day, extending from noon to noon, is reckoned by hours running from one to twenty-four.

In China and some other parts of the world, no half days are used. The Italians, the Bohemians and the Poles have a division of the day into twenty-four parts, numbered from the first to the twenty-fourth, from one o'clock to twenty-four o'clock. The Chinese divide the day into twelve parts, each being equal to two hours of our time; these they again divide into eight parts, thus sub-dividing the whole day into ninety-six equal parts. The Chinese astronomers, according to some authorities, divide the day into 100 parts, and each of these into 100 minutes, so that the whole contains 10,000 minutes. The inhabitants of Malabar have divided the day into six parts, each of these again into 60 parts. The ancient Tartars, Indians and Persians divided the day into eight parts, they had also a division of sixty parts.

In Japan there are four principal points of division—at noon, midnight, sunset and sunrise, dividing the natural day into four variable parts. These four parts are divided each into three equal portions, together making twelve hours. Each hour is again divided into twelve parts, thus making in all one hundred and forty-four subdivisions of the day. The six hours between sunrise and sunset differ in length, day by day, from the six hours between sunset and sunrise. During the summer the hours of the day are much longer than those of the night, and shorter, on the contrary, in the winter.

The division of that portion of the day during which the sun is above the horizon, into parts, belongs to the remotest ages of antiquity. The division of the other portion, which embraces the period of darkness, is of more recent date. It was not introduced at Rome until the time of the Punic Wars.

In early times the only divisions recognized were sunrise and sunset. Afterwards the division of the interval of daylight into two parts was made to denote mid-day. For many ages the Romans took no public notice of any point in the diurnal revolution of the earth, excepting mid-day. The precise time was manifested when the line of the sun's shadow fell along the forum in a particular direction, and the fact was duly announced by sound of trumpet.

Before mechanical means were adopted for the division of the day, only the vague, natural divisions of forenoon, afternoon, morning, evening and night could be used. Mention is made of the erection of the first sun dial at Rome by Papirius Cursor, 293 B.C., and the division of time into hours. The employment of sun dials led to a singular consequence, the number of hours were made constant between sunrise and sunset, and instead of being equal in length, the hour varied with the length of daylight. Whatever the moments of sunrise and sunset, the interval of light was divided into 12 parts. If the sun rose at 4 a.m. and set at 8 p.m., according to our notation, each hour would be equal in length to 80 of our minutes. Old habits are so strong that this constantly varying system was adhered to long after mechanical time-keepers were introduced, and attempts were made to regulate clocks to tell the unequal hours. Like the Romans, the Greeks divided the intervals of light between sunrise and sunset, whatever its length, into 12 equal parts, subject to change from day to day. The custom of making the hours variable is still followed by some eastern nations.

The system of dividing the day by the rising and setting of the sun makes the hours indefinite periods, as they continuously change with the seasons. Except at the equinoxes, the hours of the night and day can never be of equal length. Near the equator the variations are least; they increase with every degree of latitude until the arctic and antarctic circles are reached, within which a maximum is attained. Even in the latitude of Rome, the length of the hours of daylight and darkness under this system have an extreme difference of 75 minutes. In Spitzbergen the sun sets about the beginning of November, and remains below the horizon for more than three months. It does not set for an equal period after the middle of May.

Sun dials had two great defects, they were unserviceable at night and during cloudy weather. The clepsydra or water clock was accordingly introduced at Rome about 158 B.C., by Scipio Nasica Corculum. It measured time by allowing water to escape through an orifice in a vessel, as sand flows through a modern sand glass. Subsequently some sort of toothed-wheel work was applied to the clepsydra by Ctesibius (A. D. 120). Diurnal and nocturnal time was measured in this or some other rude manner for many centuries. Besides sun dials, gnomons and clepsydræ, all of which appear to have been known to the Egyptians, Indians, Chaldeans, Babylonians and Persians long before their Introduction at Rome, mention is made of a contrivance by which a mechanical figure dropped a stone into a brazen basin every hour, producing a loud sound which for a great distance announced the divisions of time. King Alfred employed as a time-keeper six wax candles, each 12 inches long. Three inches burned in about an hour, and thus the six candles lasted 24 hours, each being lighted in succession by an attendant. The system of measuring time by the burning of candles was subsequently used in monasteries. About the time of the eleventh century clocks moved by weights and wheels were first introduced. The pendulum clock was invented in the 17th century.

The Babylonians, Persians, Indians, Syrians, Greeks and other ancient nations, began their day at sunrise, and had divisions corresponding to morning, forenoon, mid-day, afternoon, evening and night. The Jews had four divisions, viz., evening, morning, noon and midnight, the two first being much longer than noon and midnight. The civil day of the Jews began at sunrise, their sacred day at sunset. The latter mode was followed by the Athenians and ancient Gauls.

The ancient, like the modern, Arabians began their day at noon.

The Chaldean astronomers divided the day into sixty parts; like the modern Chinese, they also had a division of the day into twelve hours.

The ancient Egyptians (probably B.C. 1000) divided the day equally into day and night, and again sub-divided each half into twelve hours, numbered from 1 to 12; the night with them commenced six hours before and terminated six hours after midnight; the day began six hours before noon and lasted twelve hours, or until six hours after noon. It is probable that the Egyptians had different modes of computing the day in different provinces. According to Pliny, they reckoned it from one midnight to another. The astronomers of Cathay and the East Indies reckoned it in the same manner. The Mohammedans from one twilight to another.

The day is reckoned to begin in China before midnight, the first hour extending from 11 p.m. to 1 a.m. of our mode of reckoning. The Jews, Turks, Austrians and others, with some of the Italians, have begun their day at sunset. The Arabians begin their day at noon, and in this respect they resemble the astronomers and navigators of modern nations. In Japan it has been customary to adhere to the practice of the ancient Babylonians in beginning their day at sunrise.

The above are some of the customs, gleaned from history, which have prevailed at various times in different countries with respect to the day and its sub-division. To these may be added the custom practised at sea by navigators. Mariners of different nations have had different customs, but the most common practice on shipboard is to divide the 24 hours into six equal portions called "watches," and these again into eight equal parts known as "bells," and numbered from 1 to 8. Thus, the whole day is sub-divided into 48 equal parts. The period of time called a "watch" is four hours in length, the reckoning being as follows:

From noon to 4 p.m., the afternoon watch.
" 4 p.m. to 8 p.m., the dog watches (from 4 to 6 being the first dog watch; from 6 to 8 being the second dog watch).
" 8 p.m. to midnight, the first (night) watch.
" midnight to 4 a.m., the middle (or second night) watcu.
" 4 a.m. to 8 a.m., the morning watch.
" 8 a.m., to noon, the forenoon watch.

This division into watches has a remarkable similarity to the practice followed by the Jews before the captivity. They divided the night into three watches, the first lasting till midnight, the middle watch lasting till cock-crow, the morning watch lasting until sunrise.

From what has been set forth, it would appear that the subdivisions of the day have not been less varied than the computations of the day itself. Man has reckoned the day to begin at sunrise, at sunset, at noon, at midnight, at twilight, at one hour before midnight, at six hours before midnight, and at six hours before noon. He has divided it in a great variety of ways, viz.: *First*, ir two, four, twelve, twenty-four and one hundred and forty-four unequal parts; *second*, into two, four, six, eight, twelve, twenty-four, forty-eight, sixty, ninety-six and into one hundred equal parts, without including the small sub-divisions of minutes and seconds. The common practice at present with most civilized nations is to divide the day into two series of twelve hours each, a custom which corresponds very closely with that followed by the ancient Egyptians long before the Christian era. Thus, while we have made extraordinary advances in all the arts and sciences, and in their application to everyday life, we find ourselves clinging to a conventional and inconvenient mode of computing time; one not materially different from that practised by the Egyptians perhaps thirty centuries ago—a custom which answered every purpose when the world was young and its inhabited portion of narrow limit, but now indefensible in theory and inconvenient in practice.

The Chinese system would, without a doubt, suit the requirements of this age much better than that which we now follow. The halving of the day is one source of difficulty which ought not to exist, and it would be an important step to imitate the custom of computing time which is followed by that old oriental civilization. The adoption of the Chinese system, by which half days would be thrown out of use, would not, however, obviate the other very serious objections which have been raised. To overcome at once all the difficulties is the problem which presents itself for solution.

A SCHEME OF UNIFORM TIME-RECKONING.

It has been stated that the period occupied by a diurnal revolution of the earth, is the shortest measure of time which we find in nature. As a consequence, *man* is left to reckon and sub-divide this measure in the way best calculated to promote his own convenience. There can be no doubt whatever that all smaller divisions, except that produced by the rising and setting of the sun, must be artificial and arbitrary.

When the decimal system was adopted by the French, it was proposed to divide the day into ten and a hundred parts; a scheme which would probably be the best at this age of the world, had the whole system of horology to be established *de novo*. In view of generally prevailing customs, however, it will doubtless be felt that any attempt to introduce the decimal division of the day would be unwise; that it would be futile to propose a change which could only succeed by seriously interfering with the present notations.

The progress of the world may indeed before long demand a radical change in our chronometry; but the present method of computing time in the more civilized parts of the earth is so interwoven with every day life, that it cannot in the meantime be disregarded. It will be evident that the consideration of any change should be based on the full recognition of established customs. Instead of attempting to uproot and supersede the present system, it is considered that any new scheme to meet the requirements of the age should rather be engrafted on and be in as complete harmony as possible with the old one.

In this view the following suggestions are offered:

Our first effort should be to find a suitable unit measure of time, uniform in length, and, for obvious reasons, the shortest to be found in nature.

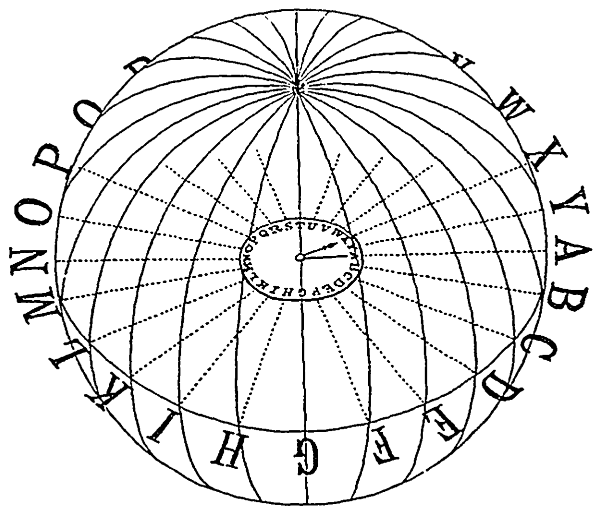
The sidereal day fulfils these conditions, and therefore suggests itself as being suited for the standard required.

The sidereal day is not, however, sufficiently marked for the ordinary purposes of life. The generality of mankind could not easily note the culmination of a star. On the other hand, the diurnal return of the sun in the heavens is a more striking and easier observed phenomenon. Accordingly, there is everything to suggest the adoption for the unit measure, not the solar day on account of its variable length, but the mean period occupied by a revolution of the earth on its axis, in relation to the sun.

That period would be precisely equal in length to the artificial day, known as the mean solar day. The unit measure proposed should not, however, be considered in the light of an ordinary day, but rather as a known period of abstract time—"day" being the name given to denote certain local phenomena successively and continuously occurring at the earth's surface.

It is proposed to divide the unit measure into twenty-four equal parts, and these again into minutes and seconds, by a standard timekeeper or chronometer, hypothetically stationed at the centre of the globe.

Fig. 1.



It is proposed that, in relation to the whole globe, the dial plate of the central chronometer shall be a fixture, as in Fig. 1; that each of the twenty-four divisions into which the unit of time is divided, shall be assumed to correspond with certain known meridians of longitude, and that the machinery of the instrument shall be arranged and regulated so that the index or hour hand shall point in succession to each of the twenty-four divisions as it became noon at the corresponding meridian. In fact, the hour hand shall revolve from east to west with precisely the same speed as the earth on its axis, and shall therefore point directly and constantly towards the sun, while the earth moves round from west to east.

Each of the twenty-four parts into which the time-unit is proposed, as above, to be divided, would be exactly equal in length to an hour; but they ought not to be considered hours in the ordinary sense, but simply twenty-fourth parts of the mean time occupied in the diurnal revolution of the earth. Hours, as we usually refer to them have a distinct relation to noon or to midnight at some particular place on the earth's surface, while the time indicated by the standard chronometer would have no special relation to any particular locality or longitude. It would be common and equally related to all places, and the twenty-four sub-divisions of the unit-measure would be simply portions of abstract time.

The standard time-keeper is referred to the centre of the earth, in order clearly to bring out the idea that it is equally related to every point on the surface of the globe. The standard might be stationed anywhere—at Yokohama, at Cairo, at St. Petersburg, at Greenwich, or at Washington. Indeed, the proposed system, if carried into force, would result in establishing many keepers of standard time, perhaps in every country, the electric telegraph affording the means of securing perfect synchronism all over the earth.

In order properly to distinguish the new unit measure and its subdivisions from ordinary days and ordinary hours, a new nomenclature might be advisable. The employment of the letters of the alphabet for the twenty-four divisions would in most civilized countries completely distinguish them from local hours, and the twenty-four meridians, which on the surface of the globe would correspond with the sub-divisions, might also be so known. It would farther be expedient to distinguish the proposed new system from sidereal, astronomical, civil or local time. For this purpose either of the designations, "common," "universal," "non-local," "uniform," "absolute," "all world," "terrestrial," or "cosmopolitan," might be employed. For the present it may be convenient to use the latter term.

Besides the standard keepers of "cosmopolitan" time, established at many places possibly in every civilized country, it is suggested that every clock and watch should, as far as practicable, move synchronically, all indicating the same time.

As a theory, it is proposed that when the hands of any one timepiece point to *A* or to *G*, the hands of each and every other horological instrument in use throughout the globe should point to *A* or to *G* at the same moment.

It is proposed that, in establishing the zero of the sub-divisions and its corresponding meridian in relation to the surface of the earth, regard be had to the general convenience, and that the views and interests of all nations should, as far as practicable, be equally consulted.

Under the system of cosmopolitan time, the meridian which corresponds with zero would practically become the initial or prime meridian of the globe. The establishment of this meridian must necessarily be arbitrary. It affects all countries, more especially maritime countries, and in consequence of prejudice and national sentiment, it is possible that delicacy and tact and judgment may have to be exercised in the consideration of the subject. There ought not, however, to be much difficulty in dealing with the question. Matters of scientific concern are not and should not be made subservient to national jealousy. Science is cosmopolitan, and no question can be more thoroughly so than that which we are attempting to investigate.

In a separate paper, I have at some length discussed this branch of the subject, and I trust I have succeeded in pointing out a convenient and suitable position for a prime meridian, common to all the world, a selection which would offend no prejudice, and when carefully considered would, I feel assured, commend itself as well calculated to meet all the purposes for which a common initial meridian has for a great many years back been proposed, and likewise those special objects for which it is now suggested.

COSMOPOLITAN AND LOCAL TIME.

Assuming a common zero of longitude established by general concurrence, each rotation of the earth on its axis may be noted by all nations simultaneously. Under the system of cosmopolitan time, it would be everywhere practicable to keep an accurate chronological reckoning without complication or confusion. It is necessary, however, to consider the points in which all parts of the earth have equally an interest; and it is important to inquire how the scheme of reckoning proposed can be generally adapted to the ordinary requirements of life.

The diurnal return of the prime meridian to a point in the heavens opposite the sun, would mark the common unit-measure of time throughout the world. Its beginning and ending, its twenty-four divisions and its sub-divisions, would each in turn prevail everywhere at the same moment of absolute time. This common measure would, however, completely coincide with the local day of only one meridian. The local days of countless other longitudes would have as little coincidence with the unit-measure as with each other. At the same moment they would all differ; while it would be noon with one, it would be midnight with another, sunrise with a third; and so on.

Men and nations may agree to establish for convenience a common unit-measure of time; but dawn and dusk, light and darkness, will sweep round the globe, following each other in silent yet certain succession, as long as the world lasts—phenomena to prescribe in every land when men shall sleep, and when return to active life. The position of the sun in every local sky will always control domestic usages and continue to govern social customs. Do what we may, the ever changing local day, as it continully progresses from longitude to longitude, will everywhere assert itself and exact recognition.

How then are we to derive any practical good from the advantages which, as a theory, the system of cosmopolitan time appears to promise?

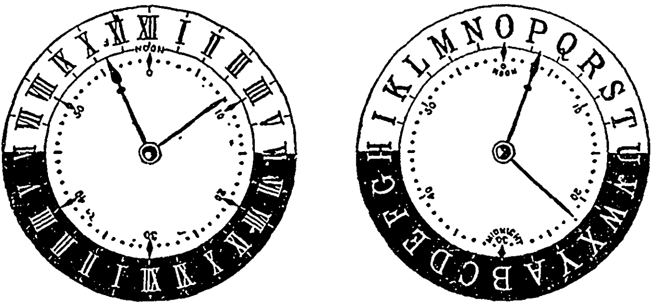
(1) All old customs may be retained for local purposes as at present, the new system being introduced as the means of more accurately reckoning time in connection with telegraphs and steam communication by land and water, and in describing events in which all mankind have a common interest.

(2) On the other hand, the new system may to some extent supersede present customs, and be employed for reckoning local as well as general time.

(3) A compromise may be suggested by which we would have cosmopolitan time as a common measure for reckoning dates and periods of general interest, and a number of sub-standards, each equally related to the common standard, for distinct local time.

It is obvious that to retain the old custom of reckoning hours, and at the same time secure the advantages of the cosmopolitan or non-local system, dual time-keepers, but not necessarily two distinct sets of time-keepers, would be required. This object is attained by having two dials to the one time-keeper, placed, in the case of a watch, back to back, or in the case of a stationary clock, side by side, as in Fig. 2;

FIG. 2.



LOCAL TIME. COSMOPOLITAN TIME.

the instruments being constructed so that the same wheel-work would move the hands of both dials. The figure No. 2 is suggested for a stationary clock; the night half of the dials are shaded.

The dial with the Roman numerals is designed for local time, while the lettered dial is for cosmopolitan or non-local time, to be used in connection with railways, steamboats and telegraphs, and as a record of passing historical events.

It is obvious that if clocks and watches were constructed on these principles, the difficulties and inconveniences which have been alluded to, and which seem inseparable from the present system, would be fully met. Assuming the scheme to be in general use: while local time would be employed for all domestic and ordinary purposes, cosmopolitan time would be used for all purposes not local; every telegraph, every steam line, indeed every communication on the face of the earth, would be worked by the same standard. Every traveller having a good watch, would carry with him the precise time that he would find observed elsewhere. *Post meridian* could never be mistaken for *ante meridian*. Railway and steamboat time-tables would be simplified and rendered intelligible, and no one can claim that such now is the rule.

As an illustration, I present condensed time-tables of the great railway route now being established from London to the Pacific through Canada. Table A is prepared in accordance with the present system. Tables B and C are two different modes of applying the system of cosmopolitan time, and illustrate the simplicity of that system for such purposes. (*Vide* Appendix, No. 1.)

It has been said that the 24 sub-divisions of the unit-measure may be known by letters, in order to be distinguished from local hours. But why use numerals for local hours? Numerals have no special advantage over letters; habit has undoubtedly rendered the former familiar to the mind of this generation in connection with the hour of the day; but if the 24 divisions had to be again named, and letters instead of numerals were adopted, the time of day could be as well expressed and as easily comprehended as at present. On the other hand, letters when arranged in a circle, as on the dial of a clock, have at least this advantage over numerals: they are all symbols of equal importance, and any one letter could be taken to represent the beginning of the series of the 24 which make up the day; while in the case of numerals, the lowest number can only represent the first of the series.

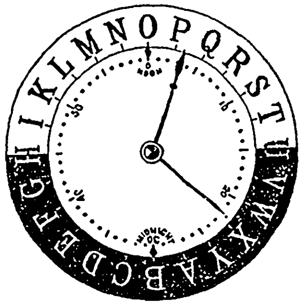
Let us take an illustration of the advantages of letters in connection with the scheme. Suppose *G* to be the noon letter at a particular place, how easy it would be for a resident to comprehend that it was always noon when the hour hands of the clock pointed to *G*; that it was always midnight when they pointed to *T*, the letter on the dial plate opposite to *G*; or, in speaking of any particular time of day, say four hours before mid-day, it would be as easy to comprehend the time referred to by the use of the letter *C* as by the numeral 8. Persons living in that locality would soon become familiar with the relation which the several letters had to the time of day.

Again, if we pass to a locality where another letter *O* becomes the meridian or noon letter, there could be no misunderstanding the meaning of the expression, *Time P. 22.* It could have but one meaning, viz., 1 hour and 22 minutes after mid-day, while 1.22 has a double meaning, undetermined without the addition of "*ante meridian*" or "*post meridian.*"

Thus it may be shown, if we could entirely ignore old practices and begin *de novo*, the nomenclature proposed for cosmopolitan time might very readily be employed for local purposes.

To render the dial plates of time-pieces perfectly intelligible in each place when used for local time, the expedient shown in Fig. 3 might be adopted.

FIG. 3.



LOCAL AND COSMOPOLITAN TIME.

Here the noon and midnight letters are easily distinguished, and that portion of the day which includes the hours of darkness cannot be mistaken. These or similar expedients could be employed with the same effect in the clocks and watches used in every place on the surface of the earth.

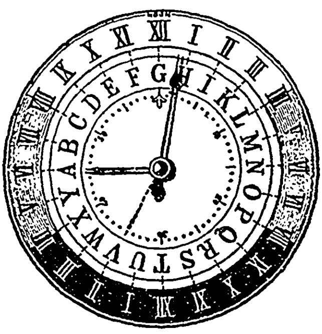
It would, however, be vain to assume that the present system could be at once abolished and disregarded. It becomes expedient, therefore, to consider how the advantages of the scheme of cosmopolitan time could be secured in everyday life. It is perfectly obvious that the present system cannot be overlooked; and that, although it may not be always maintained, it must for some time be continued. We must therefore look for some means by which the new notation may be employed in conjunction with the old, until the latter would fall into disuse.

It may be said that local time is almost always more or less arbitrarily established. Our clocks but rarely indicate true local time, and the most perfect time-pieces are for the greater portion of the year either faster or slower than the sun. In fact, correct ordinary time-keepers must necessarily at certain seasons be about 15 minutes faster or slower than true solar time, and no inconvenience whatever is found to result. The adoption of Irish time in England, or English time in Ireland, could not be felt in civil affairs. The difference between English and Irish time, as arbitrarily established, is twenty-five minutes; but in the west of Ireland local mean time is forty minutes, and solar time sometimes fifty-five minutes behind English time (Greenwich). Greenwich time is used throughout England and Scotland, although it is half an hour faster than local mean time, and sometimes forty-five minutes faster than solar time on the west coast of the latter country.

In every country, local time is more or less arbitrarily established; it could not be otherwise, without causing great confusion, as no two places, unless in the same meridian, have the same true local time. In considering the whole subject, it is felt that if some simple rule could be agreed upon for defining local time everywhere, it would materially add to general convenience.

It is suggested that each of the twenty-four lettered meridians (Fig. 1) should be taken as standards for establishing approximate local time, and that as a general rule all places should adopt the local time of the nearest of these meridians. This would divide the surface of the globe into twenty-four "lunes," forming distinct local sections. Although the twenty-four fixed meridians would be at one hour's distance from each other, only in extreme cases would the difference between the true and approximate local time be as much as half an hour. In many cases there would be no difference, and in no case could the difference be of the slightest moment in the ordinary business of civil life. Whenever exact time was required for any purpose, cosmopolitan time, assuming it to be in general use, would be available, or a third hand, such as shown by the dotted line in the figure, might in certain cases be used.

FIG. 4.



COSMOPOLITAN WATCH DIAL.

Fig. No. 4 represents a compound dial designed to indicate non-local as well as local time, on the same face of a clock or watch, by means of one set of hands. In this arrangement it is proposed to have the Roman numerals for local time inscribed on a movable disc, adjustable for each separate hour, and may thus be set for any one of the twenty-four fixed meridians referred to. The adjustment would be effected without in the least disturbing the machinery of the instrument, or interfering with the index hands.

Church clocks and other stationary time-pieces would have the local time disc permanently secured in the proper position. Only in the case of persons travelling beyond any particular local time section would the local time disc of their watch require to be changed. Its adjustment under such circumstances would be simple; it would only be necessary to move the disc round until 12 o'clock noon coincided with the meridional letter of the new locality. Suppose, for example, the letter *G* represented the longitude of the new position of the watch: 12 noon placed in conjunction with *G* would complete the adjustment of the instrument. For every other new position the same operation would be repeated. Notwithstanding every change that may be made for local time, the machinery of the watch need not be interfered with, and the hands would continue to indicate correct cosmopolitan time. The distinction between cosmopolitan time and local time would always be perfect; the former would invariably be known by letters; the latter, as at present, by the Roman numerals.

As in the diagrams, it is proposed to denote that portion of the day which includes the hours of darkness by a black or dark ground, in order that the night hours could never be mistaken for the hours in the middle of the day, which have the same numerals. The several "watches" into which the day is divided on shipboard might be distinguished. The local time disc exhibits a light portion between 8 a.m. and 4 p.m.; this includes and represents the forenoon and afternoon watches, noon being the dividing point. The dark portion, extending four hours before and four hours after midnight, embraces the two night watches; while the shaded portions, from 4 p.m. to 8 p.m., and from 4 a.m. to 8 a.m., represent the dog watches and the morning watch. This arrangement would perhaps prove useful, in view of the hundreds of thousands who navigate the ocean, and the yearly increasing number of ships that adopt and constantly use this division of the day into "watches," finding it, as they appear to do, the most convenient scheme of division for daily routine at sea.

Other modes of carrying into execution the principles of construction proposed will readily suggest themselves to practical men. (*Vide* Appendix No. 2.) It seems only here necessary to allude to one point. It may be objected that the change of system would render the clocks and watches in use valueless. But the remedy is simple, as local time may be retained and indicated side by side with cosmopolitan time by altering the dial plates or substituting new ones.

The establishment of twenty-four fixed meridians, as proposed, at one hour's distance from each other, as standards for local time, would secure complete uniformity in the indication of the minutes in all the clocks of the world; the hours of local time only differing. Appendix No. 3 illustrates this feature; it shows simultaneous time at each of the twenty-four standard meridians; local time varying one hour in each case; cosmopolitan time remaining constant.

In this communication I have endeavoured to submit the inconveniences and difficulties inseparable from our present mode of reckoning dates, and from our system of keeping and noting smaller divisions of time. I have referred to the various usages and customs which prevail, and I have drawn special attention to the fact that the application of steam to locomotion by land and sea, and of electricity to the telegraph, literally without limit, has rendered the present practice of reckoning time ill suited to modern life.

It cannot be supposed that these agents of progress have completed their mission. We may rather assume that these extraordinary powers have but commenced their wonderful career, and that they will achieve further triumphs in civilization.

It is in America these agents have been introduced to the greatest relative extent, as the subjoined estimate of the length of railways constructed will show:

	Population.	Miles of Railway.
Asia	824,548,500	7,643
Europe	309,178,300	88,748
Africa	199,921,600	1,451
N. and S. America	85,519,800	83,655
Australasia	4,748,600	1,752
Totals	1,423,917,800	183,248

It has been suggested, that the difficulties already met in portions of America threaten to become increased as the railway system is extended. It may therefore be assumed, that any practicable scheme to effect a remedy would be favourably received. The importance of the subject is not confined to America, for the other quarters of the globe are now or will be similarly interested. Australia and Africa will before long be pierced, perhaps girdled, by railways. Asia, with more than half the population of the world, must in due time follow in the general progress. In North and South America, there is room for a great increase of railways; but taking the present mileage and population of that continent as a basis, the proportion would give to Europe and Asia together more than one million miles of lines. These two great continents have as yet only 96,000 miles of railway, and it would probably be taking too sanguine a view to suppose that so great an increase will speedily be realized. No one, however, can doubt that the network of railways in Western and Central Europe will before long be greatly enlarged; that branches will extend to Asia; and that off-shoots will ultimately be prolonged to the farthest shores of the Chinese and Russian Empires. A comparatively few years may indeed witness extraordinary progress in this direction, to bring into prominence the difficulties alluded to, and which cannot fail to make themselves felt.

The subject which we are now considering, in different degrees clearly concerns all countries; it is especially important to the United States, Brazil, Canada, indeed to the whole of America. It is important to France, Germany, Austria, and to every nation in Europe. It is of peculiar interest to the gigantic empire of Russia, extending over nearly 180 degrees of longitude, and with a total variation in local time of about twelve hours. It is of still greater importance to the Colonial Empire of Great Britain, with its settlements and stations in nearly every meridian around the entire globe, and with vast territories to be occupied in both hemispheres.

Before the introduction of railways in England, every town and village kept its own time. The traveller found his watch constantly at variance with the local clocks. On the establishment of the railway system this state of things could not be tolerated, as local time could only lead to complication and confusion. The railways demanded uniform time, and Greenwich time came to be used. This was looked upon as an innovation, and was for a considerable period vigorously opposed. At last the advantages of uniform time became so manifest, that Greenwich time came into general use throughout Great Britain.

But for the employment of uniform time in England, Scotland and Ireland, it would be an extremely difficult task to regulate safely the great number of daily trains. The safe working of the railways in the United Kingdom is indeed a problem sufficiently difficult even with uniform time; and we can scarcely conceive how much the problem would be complicated if in Great Britain they were to revert to the system of local time as it prevailed in the days of stage coaches, when every town and hamlet kept its own time.

Among the several objects which the scheme of cosmopolitan time has in view, not the least important is to extend to the world similar advantages to those which have been conferred on Great Britain by the general adoption of uniform time since the commencement of the railway era.

Meteorologists have felt the necessity of some general scheme of reckoning by non-local time, such as that now proposed. The enormous number of meteorological observations recorded in every part of the world are of but little value until accurate allowances are made for the differences in local time. The immense labour involved will be understood when the number of stations and the number of daily and hourly observations are considered. Accordingly, it will be seen that meteorological science would derive great advantages from the general adoption of uniform time.

Navigators are required to employ a standard time to enable them from day to day, when on long voyages, to compute their longitude. For this purpose it is a practice with ships to carry the local time of the national observatory of the country to which they respectively belong. For example: French ships reckon their longitude by Paris time; British ships by Greenwich time. Cosmopolitan time would serve precisely the same purpose as a standard for geographical reckoning, and it would be some advantage to the marine of the world to have a uniform standard established—the common property of all nations, and in common use by land and water everywhere. It has already been said that the telegraph provides the means of securing perfect accuracy at all stations, however remote; indeed, through this agency, time-keepers may be made to beat time synchronously all over the globe. Already the length of telegraph lines in operation approaches 400,000 miles; and we are warranted in believing that ultimately the means of instantaneous communication will ramify through every habitable country, and find its way to every port of commercial importance.

I take the ground that we have entered upon a remarkable period in the history of the human race. Discoveries and inventions continue to crowd upon each other in almost magical succession, and who can tell what progress will be made within the coming fifty years? Steam and electricity are really narrowing the limits of the world. Lines of telegraph and steam communications, the creations of but yesterday, are girdling the earth and bringing the most distant countries into close neighbourhood. In a few years the wire and the rail will have brought men of all races face to face to intercommunicate knowledge and dispel prejudices. Sooner or later the barbarous custom of dividing the day into two sets of twelve hours, as if 12 was the limit of arithmetical knowledge, will be judged at its right value. The hands of time-keepers pointing in all conceivable directions at the same instant of absolute time will be held as an extraordinary anomaly, and steps will be taken to avoid the spectacle of men at the one moment nominally living in different hours, in different days, and in some extreme cases in different months and years.

The system of chronometry which we have inherited may have been well suited to the purpose for which it was designed long centuries ago, when the known world was confined within the pillars of Hercules, or it may even have answered all the requirements of man a few generations back, before the great modern civilizers, steam and electricity, began their work. Now we realize the fact that the system is awkward and inconvenient. In a few years—and who can count them—may we not find a radical change imperatively demanded by the new conditions of the human race.

It is probably not now unseasonable to discuss the subject. It would be a vain task to attempt at once to abolish a custom so hoary with age, and so generally practised as our system of computing time. But the necessity of change once admitted, the public mind will gradually become familiar with the idea, and will learn to welcome any modification in the system when its expediency is established.

But it will be important first to determine the extent of the required modification. The scheme should be well considered so as to be free from the imperfections which result from haste. It should be rendered generally acceptable, so that whenever the necessity arises in any country or community for its introduction, it may be spontaneously adopted; the inhabitants feeling assured that they were selecting a system eventually to become universal.

The suggestions I have ventured to offer are presented with the view of drawing attention to the subject. They point to the establishment of a common prime meridian as the first important step, and as the key to any cosmopolitan scheme of reckoning. This step taken, the more progressive nations would probably promote the establishment of a comprehensive system of chronometry suitable to every condition of civilization, and advantageous to the inhabitants of the globe on every line of longitude and on every parallel of latitude.

APPENDIX No. 1.

Condensed time-tables, illustrative of the application of the cosmopolitan system of time-reckoning, to railway and steamboat communications. The great mail and passenger route now being established through Canada is selected as an example. Table A is arranged according to the present system. Table B is arranged for cosmopolitan time. Table C is arranged for local time standards, established by lettered meridians 15° of longitude apart, each varying one hour. The hours of the day are numbered from 1 to 24 instead of two sets from 1 to 12.

TABLE A.—*Arranged according to the present system.*

Principal Stations.	Local Time.		Slower than Greenwich.
London	8.00 p.m.	Greenwich time	0.00
Dublin	8.00 a.m.	Irish time	0.25
(en route)	1st noon	Irish time	"
W. Coast Ireland	1.00 p.m.	Irish time	"
(at sea)	2nd noon	Ship's time	1.00
(at sea)	3rd noon	Ship's time	1.40
(at sea)	4th noon	Ship's time	2.20
(at sea)	5th noon	Ship's time	3.00
St. John, Newfoundland	9.00 a.m.	Newfoundland time	3.30
(en route)	6th noon	Newfoundland time	"
St. George, Newfoundland	6.00 p.m.	Newfoundland time	"
Shippigan	10.00 a.m.	New Brunswick	4.30
(en route)	7th noon	New Brunswick	"
Riv. du Loup	10.00 p.m.	Quebec time	5.00
Quebec	2.00 a.m.	Quebec time	"
Montreal	8.00 a.m.	Quebec time	"
(en route)	8th noon	Quebec time	"
Ottawa	1.00 p.m.	Quebec time	"
Nippising	8.30 p.m.	Huron time	5.30
L. Superior	10.00 a.m.	Superior time	6.00
(en route)	9th noon	Superior time	"
Fort William	3.30 p.m.	Superior time	"
Keewatin	1.30 a.m.	Manitobah time	6.30
Selkirk	6.00 a.m.	Mantiobah time	"
(en route)	10th noon	Mantiobah time	"
Livingston	3.00 p.m,	Saskatchewan time.	7.00
Saskatchewan	9.30 p.m.	Saskatchewan time.	"
Battleford	1.00 a.m.	Athabasca time	7.30
Edmonton	9.20 a.m.	Athabasca time	"
(en route)	11th noon	Athabasca time	"
Montbrun	2.15 p.m.	Athabasca time	"
Yellow Head Pass	7.00 p.m.	Rocky Mount'n time	8.00
Tete Jaune Cache	8.15 p.m.	Rocky Mount'n time	"
(en route)	12th noon	Rocky Mount'n time	"
Pacific Ocean	11.30 p.m.	B. Columbia time	8.30

TABLE B.

Arranged for Cosmoplitan Time.

PRINCIPAL STATIONS.	COSMOPOLITAN TIME.
LONDON	P. 00
DUBLIN	C. 25
1st *Noon* (*en route*)	G. 25
W. COAST IRELAND	H. 25
2nd *Noon* (*at sea*)	H. 00
3rd *Noon* (*at sea*)	H. 40
4th *Noon* (*at sea*)	I. 20
5th *Noon* (*at sea*)	K. 00
ST. JOHN, Newfoundland	G. 30
6th *Noon* (*en route*)	K. 39
ST. GEORGE, Newfoundland	R. 00
SHIPPIGAN	I. 30
7th *Noon* (*en route*)	L. 30
RIV. DU LOUP	W. 00
QUEBEC	B. 00
MONTREAL	H. 00
8th *Noon* (*en route*)	M. 00
OTTAWA	N. 00
NIPPISING	V. 00
L. SUPERIOR	L. 00
9th *Noon* (*en route*)	N. 00
FORT WILLIAM	Q. 30
KEEWATIN	C. 00
SELKIRK	G. 30
10th *Noon* (*en route*)	O. 00
LIVINGSTON	R. 00
SASKATCHEWAN	X. 30
BATTLEFORD	C. 30
EDMONTON	M. 00
11th *Noon* (*en route*)	P. 00
MONTBRUN	Q. 45
YELLOW HEAD PASS	W. 00
TETE JAUNE CACHE	X. 15
12th *Noon* (*en route*)	P. 30
PACIFIC OCEAN	W. 30

TABLE C.

Local Time Standards, established one hour apart.

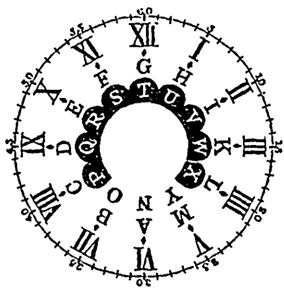
PRINCIPAL STATIONS.	LOCAL TIME.	
	Hours.	By Standard.
LONDON	20.00	M.
DUBLIN	8.25	"
1st *Noon* (*en route*)	12.00	"
W. COAST IRELAND	13.25	"
2nd *Noon* (*at sea*)	12.00	N.
3rd *Noon* (*at sea*)	12.00	O.
4th *Noon* (*at sea*)	12.00	O.
5th *Noon* (*at sea*)	12.00	P.
ST. JOHN, Newf'dland	8.30	Q.
6th *Noon* (*en route*)	12.00	"
ST. GEORGE, Newf'dland	17.30	"
SHIPPIGAN	9.30	R.
7th *Noon* (*en route*)	12.00	"
RIV. DU LOUP	22.00	"
QUEBEC	2.00	"
MONTREAL	8.00	"
8th *Noon* (*en route*)	12.00	"
OTTAWA	13.00	"
NIPPISING	20.30	"
L. SUPERIOR	10.00	S.
9th *Noon* (*en route*)	12.00	"
FORT WILLIAM	15.30	"
KEEWATIN	1.00	T.
SELKIRK	5.30	"
10th *Noon* (*en route*)	12.00	"
LIVINGSTON	15.00	"
SASKATCHEWAN	21.30	"
BATTLEFORD	1.30	"
EDMONTON	10.00	"
11th *Noon* (*en route*)	12.00	V.
MONTBRUN	13.45	"
YELLOW HEAD PASS	19.00	"
TETE JAUNE CACHE	20.15	"
12th *Noon* (*en route*)	12.00	"
PACIFIC OCEAN	11.00	"

APPENDIX No. 2.

The application of the proposed Scheme of Time-reckoning to the practice of Daily Life.

Reference has been made to the means by which cosmopolitan time may be indicated by ordinary time-pieces. This may be accomplished by inscribing the proper letters on the dials of clocks and watches now in use. A still better expedient would be to substitute new dials, such as Fig. 5. In this, the letters which represent the night hours in any particular locality are on a dark ground.

FIG. 5.



By a simple expedient of this description it could be practicable, without superceding the old time-keepers, to secure the advantages of the new scheme, in any country of comparatively limited extent.

Clocks and watches in use might thus be utilized and made to show cosmopolitan, in addition to local time. It would be only necessary to prepare railway and steam-boat time-tables in accordance with the new system, to bring its advantages into common use. But this would apply only to stationary clocks, or to watches in use in countries limited in extent. The improvement would not be general until time-keepers for ordinary purposes, and especially watches, were constructed on new principles. A general change could only be gradually effected; but as there are hundreds of thousands of watches and chronometers made every year, in the event of the subject being deemed worthy of attention, it would be well for manufacturers to consider the expediency of introducing some change in the construction of them.

There are various methods by which the principles set forth may be applied, and these will readily suggest themselves to practical men. Simply to illustrate one mode, Figures 6 and 7 are supplied.

Fig. 6.

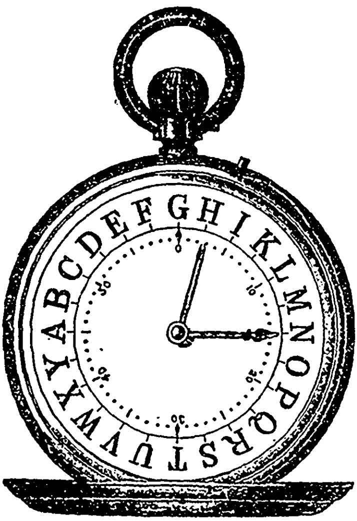
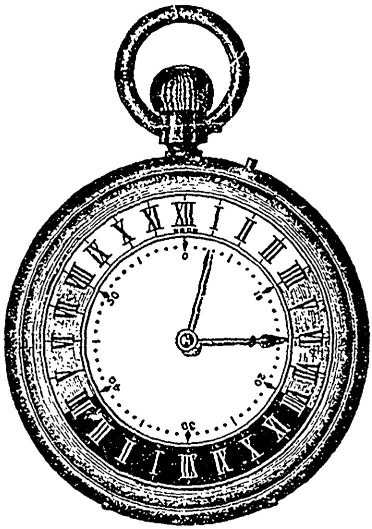


Fig. 7.



The object is to indicate cosmopolitan and local time by the same watch. Fig. 6 shows the watch case open, with the dial for cosmopolitan time exposed. Fig. 7 shows the watch case closed, with the local time numerals engraved on the face of the case, the latter being pierced in order that the hands may be seen. The local time disc is designed to be adjustable for any one of the 24 lettered meridians. By this arrangement only the local hours would vary; there would be a complete coincidence in the minutes of cosmopolitan and local time at every station. The application of double dials to a watch may be effected in another manner. The watch may have two faces back to back; one for for cosmopolitan time, the reverse for local time, the hands in both instances being moved by the same wheelwork, and those for local time supplied with the means of adjustment for change of longitude.

The latter plan has advantages peculiar to itself. Other methods of construction may be proposed, but it is unnecessary; the present object is simply to show that there is no practical difficulty in the way of carrying the scheme of time reckoning set forth in the accompanying paper into the practice of daily life.

APPENDIX No. 3.

Illustrating Simultaneous Time at each of the twenty-four lettered meridians proposed as Local Standards; Local Time differing one hour in each case; Cosmopolitan Time remaining constant.

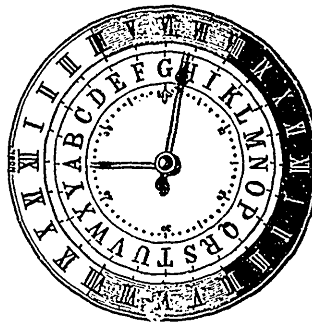
MERIDIAN A.

Local time................ 6.45 p.m.

Cosmopolitan time .... G. 45

Longitude (proposed new reckoning)............ 15°

Longitude, old style ...... 165° East.



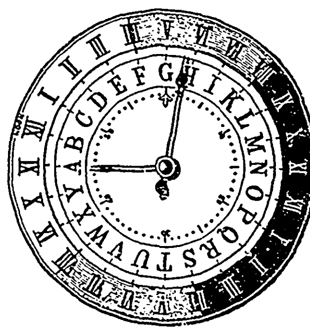
MERIDIAN B.

Local time .... 5.45 p.m.

Cosmopolitan time.......... G. 45

Longitude .... 30°

Longitude, old style .... 150° East.



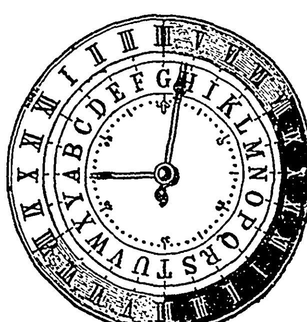
MERIDIAN C.

Local time .... 4.45 p.m.

Cosmopolitan time.......... G. 45

Longitude .... 45°

Longitude, old style .... 135° East.



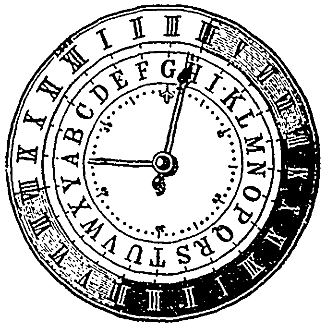
MERIDIAN D.

Local time .... 3.45 p.m.

Cosmopolitan time.......... G. 45

Longitude .... 60°

Longitude, old style .... 120° East.



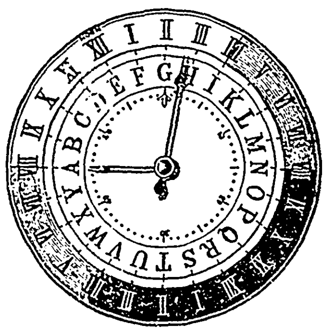
MERIDIAN E.

Local time .... 2.45 p.m.

Cosmopolitan time.......... G. 45

Longitude .... 75°

Longitude, old style .... 105° East.



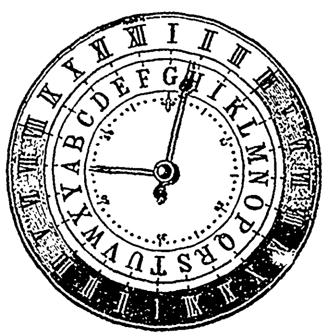
MERIDIAN F.

Local time .... 1.45 p.m.

Cosmopolitan time.......... G. 45

Longitude .... 90°

Longitude, old style .... 90° East.



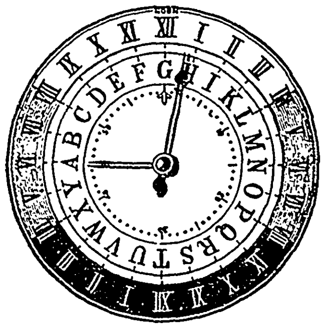
MERIDIAN G.

Local time .... 12.45 p.m.

Cosmopolitan time.......... G. 45

Longitude .... 105°

Longitude, old style .... 75° East.



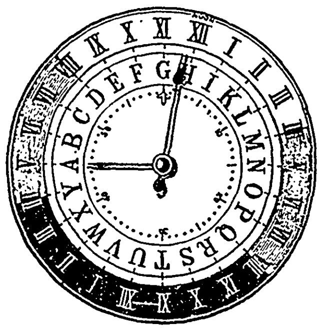
MERIDIAN H.

Local time .... 11.45 a.m.

Cosmopolitan time.......... G. 45

Longitude .... 120°

Longitude, old style .... 60° East.



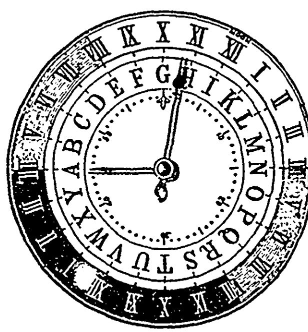
MERIDIAN I.

Local time .... 10.45 a.m.

Cosmopolitan time.......... G. 45

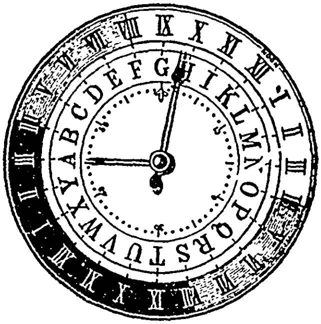
Longitude .... 135°

Longitude, old style .... 45° East.



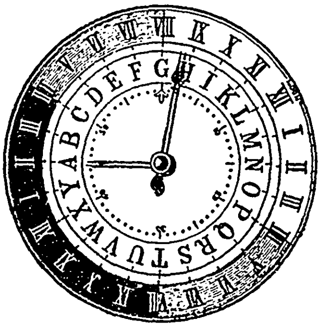
MERIDIAN K.

Local time..................	9.45 a.m.
Cosmopolitan time	G. 45
Longitude	150°
Longitude, old style	30° East.



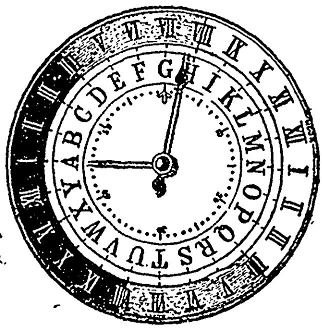
MERIDIAN L.

Local time..................	8.45 a.m.
Cosmopolitan time	G. 45
Longitude	165°
Longitude, old style	15° East.



MERIDIAN M.

Local time..................	7.45 a.m.
Cosmopolitan time	G. 45
Longitude	180°
Longitude, old style......	0° Greenwich



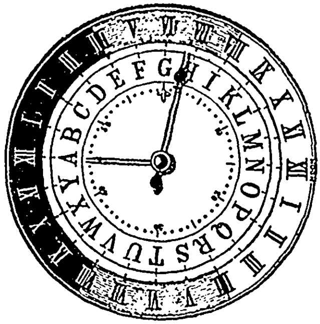
MERIDIAN N.

Local time .... 6.45 a.m.

Cosmopolitan time.......... G. 45

Longitude .... 195°

Longitude, old style .... 15° West.



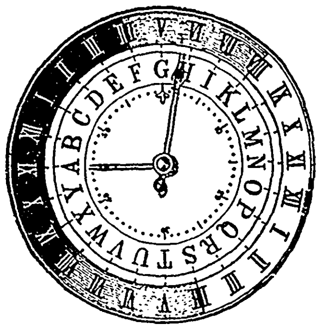
MERIDIAN O.

Local time .... 5.45 a.m.

Cosmopolitan time.......... G. 45

Longitude .... 210°

Longitude, old style .... 30° West.



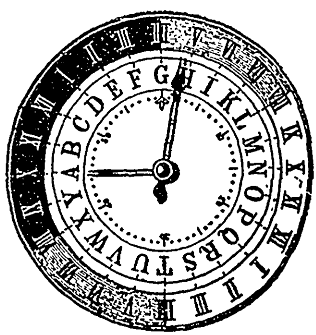
MERIDIAN P.

Local time .... 4.45 a.m.

Cosmopolitan time.......... G. 45

Longitude .... 225°

Longitude, old style .... 45° West.



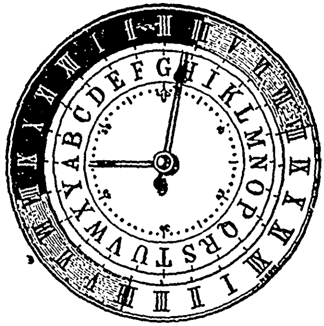
MERIDIAN Q.

Local time .... 3.45 a.m.

Cosmopolitan time.......... G. 45

Longitude .... 240°

Longitude, old style .... 60° West.



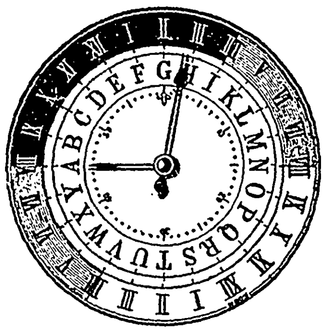
MERIDIAN R.

Local time .... 2.45 a.m.

Cosmopolitan time.......... G. 45

Longitude .... 255°

Longitude, old style .... 75° West.



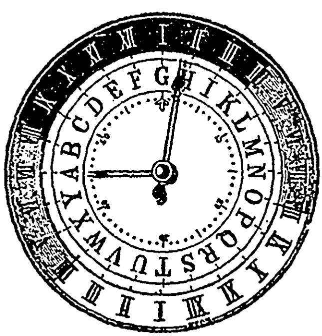
MERIDIAN S.

Local time .... 1.45 a.m.

Cosmopolitan time.......... G. 45

Longitude .... 270°

Longitude, [illegible] style .... 90° West.



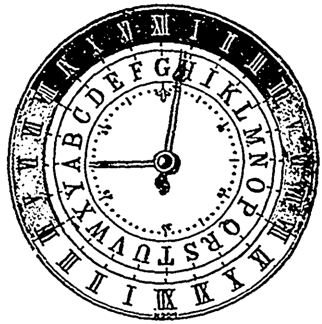
MERIDIAN T.

Local time................ 12.45 a.m.

Cosmopolitan time .... G. 45

Longitude .... 285°

Longitude, old style........ 105° West.



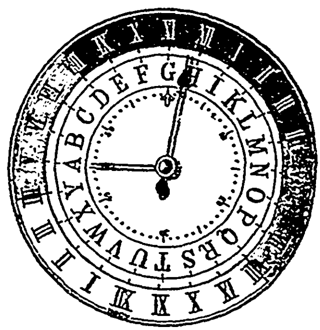
MERIDIAN U.

Local time................ 11.45 p.m.

Cosmopolitan time .... G. 45

Longitude .... 300°

Longitude, old style........ 120° West.



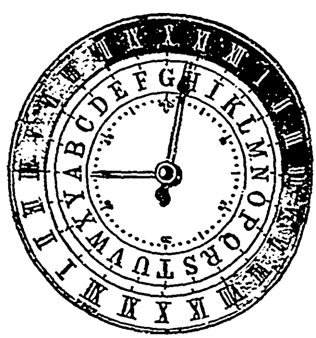
MERIDIAN V.

Local time................ 10.45 p.m.

Cosmopolitan time .... G. 45

Longitude .... 315°

Longitude, old style........ 135° West.



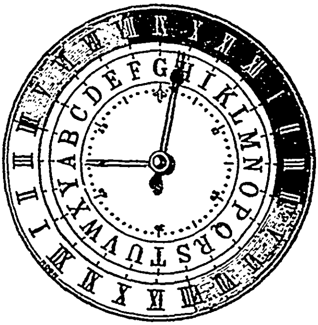
MERIDIAN W.

Local time................ 9.45 p.m.

Cosmopolitan time .... G. 45

Longitude .... 330°

Longitude, old style ...... 150° West.



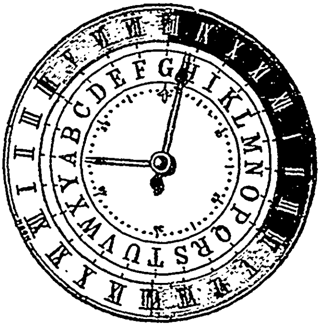
MERIDIAN X.

Local time................ 8.45 p.m.

Cosmopolitan time .... G. 45

Longitude .... 345°

Longitude, old style ...... 165° West.



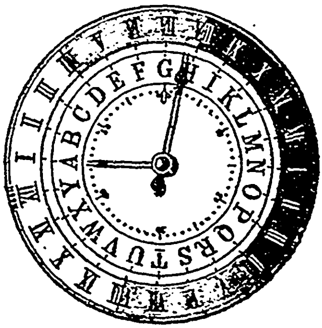
THE PRIME MERIDIAN.

Local time................. 7.45 p.m.

Cosmopolitan time .... G 45.

The Common Zero of Longitude 0°

Longitude, old style, 180° East & West.



LONGITUDE AND TIME-RECKONING.

A FEW WORDS ON THE SELECTION OF A PRIME MERIDIAN TO BE COMMON TO ALL NATIONS, IN CONNECTION WITH TIME-RECKONING.

BY SANDFORD FLEMING, C.M.G., ETC.

In another paper which I have submitted to the Institute, it has been stated that the only means of obviating the confusion inseparable from the present system of reckoning dates, is to measure time by the absolute diurnal revolutions of the earth.

By the system now followed, we count days by the consecutive passage of the sun over the meridian of each spot on the earth's surface. The number of spots around the globe may be said to be infinite, and accordingly the duration of the day, as it is locally distinguished, considered in relation to absolute time, is marked by an equally infinite variety.

It has been argued that the earth should be considered as a whole, and that its mean diurnal revolution should be the unit measure for reckoning dates; and this theory points to the consideration of the necessity of establishing a common prime meridian.

If we were placed in some neutral position, such as the earth's centre, or its poles, and were called upon to determine the time occupied by a diurnal revolution, we could fix on a point arbitrarily chosen in a circle inscribing the earth's axis, and note the time between two consecutive passages of the sun over that point. A plane passing through that point and the poles, extended to the surface of the globe, would establish a first or prime meridian from which longitude may be reckoned.

The establishment of an initial or prime meridian as the recognized starting point of time-reckoning by all nations, affects the whole area of civilization, and conflicting opinions may arise concerning its position. Its consideration must therefore be approached in a broad, cosmopolitan spirit, so as to avoid offence to national feeling and prejudice.

As far as practicable, the interests of all nations should be consulted in its choice, and the principle should be recognized, that the first meridian should be determined in accordance with the views of the greatest possible number.

Although the general acceptance of a common meridian for reckoning longitude has long been desired, unanimity has in no way been attained.

The meridians passing through the following points are more or less in use at the present time, viz.: Cadiz, Christiania, Copenhagen, Ferro, Greenwich, Lisbon, Naples, Paris, Pulkova, Rio de Janeiro, Stockholm, and Washington.

Several other meridians have at different times been used, or proposed to be used, for the computation of longitude. Ptolemy, to whom we are indebted, along with Marinus, for introducing the terms 'longitude' and 'latitude,' drew the first meridian through the Insulæ Fortunatæ, or Canary Islands, as the western limit of the earth's boundaries of his time; the exact position is not known with certainty.

According to Malte Brun, Louis XIII. of France, in order to render the manner of expressing longitude in French geography uniform, ordered, by an express declaration, that the first meridian should be placed in the Isle of Ferro, the most western of the Canaries. Delisle, one of the first who endeavoured to give precision to geographical determinations, fixed the longitude of Paris 20 degrees east of that meridian. When, by more rigorous observations, it was known that the difference of longitude between Paris and the principal town of the Isle of Ferro was 20° 5′ 50″, it was necessary to advance the first meridian 5′ 50″ to the east of that point, so that it is now a circle of mere convention, which passes through no remarkable point.

Geographers at one time established the first meridian at the island of St. Nicholas, near Cape Verd; others at the isle of St. James. Gerard Mercator, who lived in the sixteenth century, selected the meridian passing through the Island del Corvo, one of the Azores, on account, it is said, of the magnetic needle pointing due north at that time. It was not then known that the needle itself was subject to variations. The Dutch placed their first meridian at the Peak of Teneriffe. The Spaniards have chosen Cadiz. The British formerly used Cape Lizard, but subsequently selected Greenwich Observatory, near London. The Russians, Pulkova, near St. Petersburg. Washington was adopted by the United States, and the charts of that country are still constructed with Washington as a first meridian, although Greenwich is now used for reckoning longitude by all sea-going ships carrying the United States flag. The Italians selected Naples; and ships of the empire of Brazil reckon in part from Rio de Janeiro.

An earnest desire has frequently been expressed for the determination of one prime meridian common to all nations, but all attempts for its establishment have failed. On all sides there has been an adherence, with more or less tenacity, to the arbitrary zeros adopted or suggested by the national navigators. Recommendations have however from time to time been made in the general interests of science, which is unconfined by national boundaries and unprejudiced by national vanity. Some astronomers have proposed Alexandria, from its being the place to which Ptolemy's observations and computations were reduced. The Great Pyramid has also been proposed as the point through which the world's prime meridian should be drawn; it has found an earnest advocate in Professor Piazzi Smyth, Astronomer Royal for Scotland.

Other astronomers have proposed that a meridian should be established from celestial phenomena, so that national sensitiveness shall in no way be hurt. Laplace recommended the adoption of a universal first meridian, upon which it was 12 o'clock when the sun entered the point of the vernal equinox in the year 1250, in which the apogee of the earth's orbit coincided with the solsticial point in Cancer. According to Maury, such a universal meridian would pass about 8 miles west of Cape Mesurada, on the coast of Africa.

This initial meridian was favoured by Herschel. It is certainly suggested by no local circumstances such as noon or midnight, or by the observatory or metropolis of any nation. Its determination is made solely by the motion of the sun among the stars, in which all the nations of the earth have a common interest. Herschel designated the time reckoned by this meridian "Equinoctial time." But this meridian possesses no one advantage not common to all other meridians, beyond being perfectly free from national relationships.

The initial meridian for the world should be chosen for other reasons than any of those which, as far as I know, have yet been advanced. In another place I have shown that it would be the separating line on the surface of the earth, between two consecutive diurnal revolutions; that is to say, between one cosmopolitan date (or day) and another. It would be, therefore, inexpedient to have it passing through London or Washington, or Paris, or St. Petersburg, or indeed through the heart of any populous or even inhabited country. We must seek for a position free from this characteristic.

We should look for a meridian, if possible, to pass through no great extent of habitable land, so that hereafter the whole population of the world would follow a common time-reckoning; and simultaneous human events would be chronicled by concurrent dates. If we examine the terrestrial globe, we shall find that two, and only two, limited sections of the sphere present themselves with these qualifications.

A meridian may be drawn through the Atlantic Ocean, so as to pass Africa on the one side and South America on the other without touching any portion of either continent, avoiding all islands and all land except a portion of eastern Greenland.

The configuration of the continents will also admit of a meridian being similarly drawn in the opposite hemisphere so as to pass through Behring's Strait, and through the whole extent of the Pacific Ocean without touching dry land.

Either of these meridians would serve the desired purpose, but a meridian in close proximity to Behring's Strait suggests itself as the most eligible.

It must be admitted that the establishment of a common prime meridian should be so determined that, if at all practicable, one of the several systems of the divisions of longitude now employed might be maintained. It would be a still greater advantage if the new initial meridian could harmonize with the longitudinal divisions most in use in the navigation of the high seas.

If we refer to the map of the world, we find that the *anti* or *nether* meridians of some of the capitals of Europe pass at no great distance from Behring's Strait, and the addition or subtraction of 180° would, in any one case, be a ready means of harmonizing the proposed new zero with the old reckoning of longitude. Six of these places are at present employed as prime meridians, viz.:

1. Christiania.	4. Naples.
2. Copenhagen.	5. Paris.
3. Greenwich.	6. Stockholm.

The following table, prepared from the latest authorities within reach, gives an estimate of the number and tonnage of steamers and sailing ships belonging to the several nations of the world; likewise the first meridians which they use in ascertaining their longitude:

Country.	Ships of all Sorts.		First Meridians Used.
	Number.	Tonnage.	
Great Britain and the British Colonies	20,938	8,696,532	Greenwich.
United States ..	6,935	2,739,348	Greenwich.
Norway	4,257	1,391,877	Christiania and Greenwich.
Italy	4,526	1,430,895	Naples and Greenwich.
Germany	3,380	1,14[illegible],640	Ferro, Greenwich and Paris.
France	3,625	1,118,145	Paris.
Spain	2,968	666,643	Cadiz.
Russia..........	1,976	577,282	Pulkova, Greenwich and Ferro.
Sweden	2,151	462,541	Stockholm, Greenwich and Paris.
Holland	1,385	476,193	Greenwich.
Greece..........	2,036	424,418	
Austria	740	363,622	Greenwich and Ferro.
Denmark	1,306	245,664	Copenhagen, Paris and Greenwich.
Portugal........	491	164,050	Lisbon.
Turkey	348	140,130	
Brazil, &c., S. America....	507	194,091	Rio de Janeiro and Greenwich.
Belgium	50	38,631	Greenwich.
Japan, &c., Asia.	78	39,391	Greenwich.
	57,697	20,312,093	

Taking these returns as a basis, it is roughly estimated that the shipping of the world reckon their longitude from the meridian of the several points mentioned in the following proportions, viz.:

From	Ships of all Kinds.		Per Cent.	
	Number.	Tonnage.	Ships.	Tonnage.
Greenwich	37,663	14,600,972	65	72
Paris	5,914	1,735,083	10	8
Cadiz	2,468	666,602	5	3
Naples..................	2,263	715,448	4	4
Christiania..............	2,128	695,988	4	3
Ferro	1,497	567,682	2	3
Pulkova	987	298,641	1½	1½
Stockholm	717	154,180	1½	1
Lisbon....	491	164,000	1	1
Copenhagen	435	81,888	1	½
Rio de Janeiro	253	97,040	½	½
Miscellaneous	2,881	534,569	4½	2½
	57,697	20,312,093	100	100

It thus appears that of the total commerce of the world which in a greater or less degree bases its system of navigation on eleven different first meridians for the reckoning of longitude, 65 per cent. of the number of ships, and 72 per cent. of the total tonnage, compute their longitude east and west of Greenwich.

The United States of America at one time used the meridian of Washington. But the importance of having a common zero of measurement has been felt to be so great, that practical effect has been given to the idea, on the part of the United States, by all sea-going ships of the Republic, giving up Washington, and adopting the meridian of Greenwich. Russia, Norway, Holland, Belgium and Japan have taken the same course, and Germany, Sweden, Austria and Denmark have partially done so.

It is accordingly clear that of the six places mentioned, the nether meridians of which are convenient to Behring's Strait, Greenwich takes the first position with respect to the number and tonnage of ships navigating by it. The six several places, as far as known, seem to stand in the following order, viz.:

	SHIPS.	TONNAGE.
Greenwich	37,663	14,600,972
Paris	5,914	1,735,083
Naples	2,263	715,448
Christiania	2,128	695,988
Stockholm	717	154,180
Copenhagen	435	81,888

The meridian drawn 180° east and west of Greenwich crosses a small angle of Kamtschatka, immediately on the western side of Behring's Strait; with this exception, it passes over no land between the Arctic and Antarctic circles. The foregoing shows clearly that it is, of all the meridians, the one which would best accommodate the greatest number and tonnage of the world's shipping. By the adoption of this as a common prime meridian, there would be no disarrangement in the charts, the nautical tables, or the descriptive nomenclature of nearly three-fourths of the ships navigating the high seas. The same lines of longitude would be traced on the maps, although differently notated. The necessity would simply arise of falling back on the familiar phrases of 'new style' and 'old style,' first applied in connection with chronological dates in England in

1752—the year when popular prejudice was met and the calendar reformed.

The following table will show all the change that would be callep for in notating the degrees of longitude. It will be observed that the table is limited to the twenty-four lettered meridians elsewhere alluded to:

Hour Meridian.	Longitude.	
	New Style.	Old Style.
Prime Meridian	Zero	180° E. & W. of Greenwich
A	15°	165° E. of Greenwich.
B	30°	150° E. "
C	45°	135° E. "
D	60°	120° E. "
E	75°	105° E. "
F	90°	90° E. "
G	105°	75° E. "
H	120°	60° E. "
I	135°	45° E. "
K	150°	30° E. "
L	165°	15° E. "
M	180°	0° Greenwich
N	195°	15° W. of Greenwich.
O	210°	30° W. "
P	225°	45° W. "
Q	240°	60° W. "
R	255°	75° W. "
S	270°	90° W. "
T	285°	105° W. "
U	300°	120° W. "
V	315°	135° W. "
W	330°	150° W. "
X	345°	165° W. "
Prime Meridian	360 or Zero	180° W. "

But a proposal of this character cannot be effected without much discussion. Such a change must be the work of time, for it is to be feared that much passive if not active opposition would have to be overcome before general concurrence be obtained. Whatever benefits a measure may promise, there will always be those who fail to recognize the anticipated advantages; and there are generally not a few who consider it a duty to combat the least innovation on existing practices. The object of these remarks, however, is to show that there is no impediment to the establishment of a prime meridian for the world unmarked by national pre-eminence, a meridian in itself admirably adapted for the important purposes referred to in connection with the notation of time, and the accurate reckoning of chronological dates in every country on the surface of the earth.

The advantages to be derived, with the complications and confusion to be avoided, have been elsewhere set forth. Suffice it to say here, the object to be attained is the establishment of a more accurate and more convenient system of time-reckoning than now obtains. It is not proposed to interfere in the least with the local divisions—the weeks and the days of the week. The week is an arbitrary division, but it has been recognized by man from remote antiquity, and it is a period recorded in the earliest teachings of religion and history.

Amongst the many changes which were violently enforced by the French Revolution, there was perhaps none that more shocked public sentiment than the alteration of the ancient calendar by the substitution of a ten-day period for a seven-day period. The week, as well as the week day, has become an integral part of our civilization, and we must accept both as unalterable. As regards the earth as a whole, both are governed by local and superficial phenomena occurring in perpetual succession around the circumference of the sphere; yet this is no barrier to the establishment of a mode of scientific reckoning determined in harmony with them, and cosmopolitan in its character. The aim is to introduce a scheme whereby years and months, hours, minutes and seconds, at all the meridians of the globe, shall be practically as well as theoretically concurrent; for the division will be based on the one unit measure, an established period in absolute time. However variable may be the ordinary weeks and week days as they occur in different localities around the globe, the effort is to secure to mankind, by a simple uniform system of universal application, the means of truly notating dates, and recording events as they transpire.

To accomplish this end, the first requisite is that each revolution of the globe on its axis be defined by a line of demarcation on the earth's surface acceptable to all nations. The interval of time between two consecutive passages of the sun over this line would denote the unit measure. By whatever name they may be known, the number of these units, from the commencement of a month or of a year, would indicate any particular date, common to all. The unit measure would be divided into twenty-four. These divisions represented on the surface of the globe by twenty-four fixed meridional lines, at one hour's distance from each other, would establish the standards for local time everywhere. Perfect uniformity would thus be secured in all the clocks in the world. The minutes, and indeed all the sub-divisions of time, would be concurrent; the local numbers of the hours only would differ.*

The position of the twenty-four secondary meridians is governed by the selection of a primary meridian; and hence the first step to the consummation of the scheme is the establishment of an initial meridian as a common starting point.

Is it too much to affirm that the meridian suggested will fully meet every requirement? To the writer it seems, that with the concurrence of those nations acknowledged as the fountain heads of civilization, it might at once take the place of all other initial meridians which have hitherto been employed. It could be established without any clashing with existing customs, or any violent departure from the rules and practices and traditions of the great majority of mariners. By its adoption the expression so familiar to us, "the longitude of Greenwich," would simply pass out of usage, and some other name take its place. There would be no favoured nation, no gratification of any geographical vanity. A new prime meridian so established would be essentially cosmopolitan, and would tend towards the general benefit of humanity. As the line of demarcation between one date and another it would be of universal interest, and a property common to the hundreds of millions who live on the land, and the hundreds of thousands who sail on the sea.

Since the foregoing was written, I have seen the weekly edition of the *Times* of the 17th ultimo. (Jan. '79). The following extract

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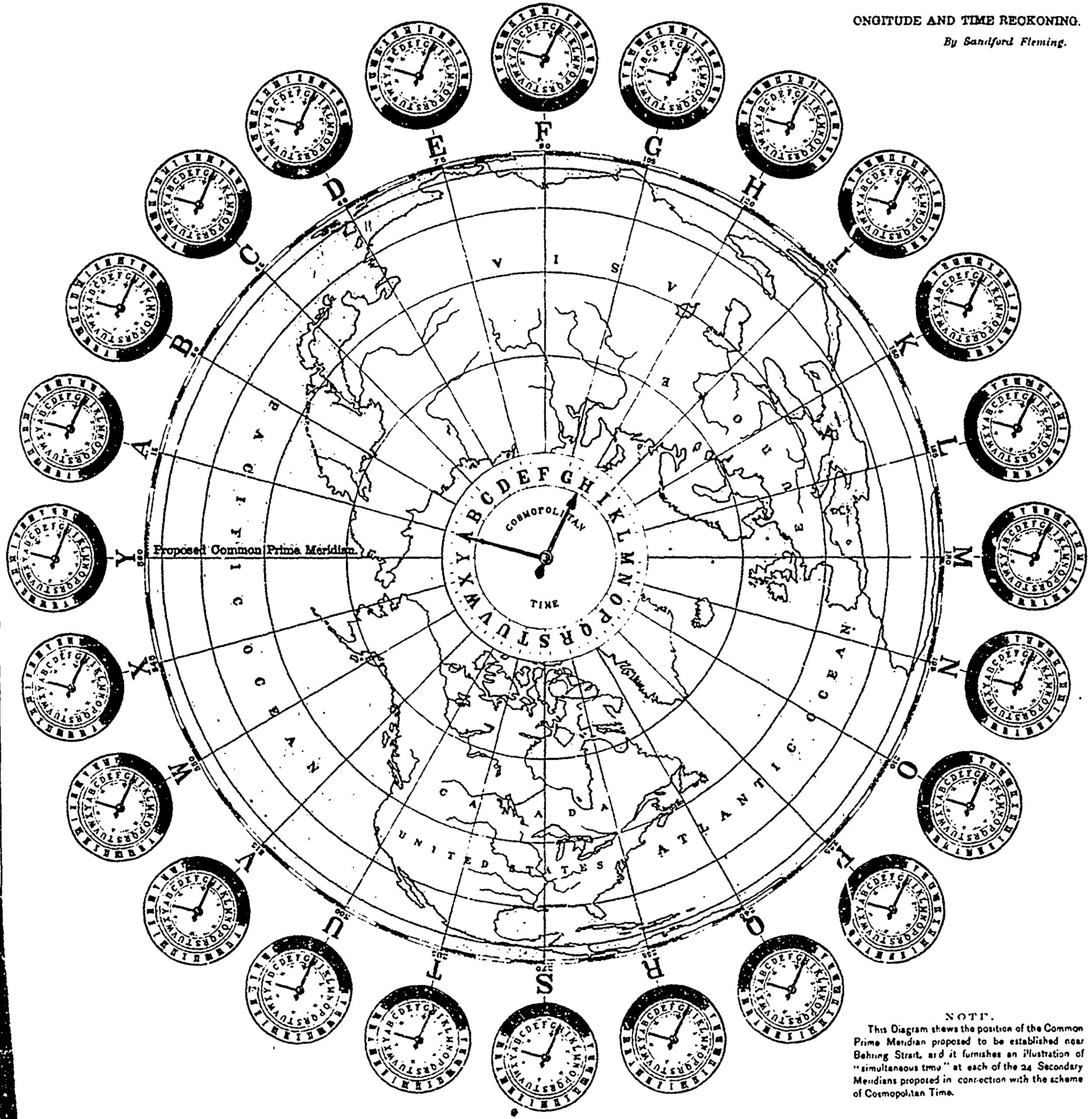
* One of the unavoidable, results might be held to be objectionable, but, it may prove less disadvantageous than anticipated. Only on one meridian would the ordinary local day correspond with the unit of time. 15° west of that meridian it would be one hour later, 30° west it would be two hours later; and for each 15° degrees of westing one hour later still. Thus the epoch of change from one cosmopolitan date to another would occur at midnight in one locality, at noon in another, at six a.m. at a third, and at every hour of the 24, as the longitude would determine. This peculiarity would doubtless be felt to be an inconvenience during a brief interval of transition from the present to the new system. The accompanying plate illustrates the variation of changes, and shows that, while cosmopolitan time would be absolutely identical in every locality, local time would vary one hour at each fixed local standard around the circumference of the globe.

ONGITUDE AND TIME RECKONING.

By Sandford Fleming.



NOTE.

This Diagram shews the position of the Common Prime Meridian proposed to be established near Behring Strait, and it furnishes an illustration of "simultaneous time" at each of the 24 Secondary Meridians proposed in connection with the scheme of Cosmopolitan Time.

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which it contains shows that the subject we have been considering is engaging the attention of eminent geographers in Europe:

"A NEW FIRST MERIDIAN.—It is admitted by geographers that the present variety of 'first meridians' is extremely embarrassing and not conducive to accuracy. A good many proposals have been made recently for the establishment of a common first meridian for all countries, but, as one might expect, there is a want of agreement as to what line should be chosen. The question was taken up at the last International Congress of Geography at Paris, and among the contributions to the subject was a paper by M. Bouthillier de Beaumont, President of the Geographical Society of Geneva. The subject was brought on a former occasion before the Antwerp Geographical Congress, where it was very thoroughly discussed by competent geographers. The proposal, however, did not receive more than expressions of sympathy and encouragement. To propose, as M. de Beaumont says, to take the meridian of Greenwich or any other national meridian as the initial one, is not to advance the question; rather, it leaves it *in statu quo*. Nor would it be a happy solution to take the old meridian of Ferro, abandoned by the chief maritime nations and presenting peculiar difficulties in its actual position. At the Congress of Paris of 1875 Jerusalem was proposed, a proposal more creditable to the heart than the head of the professor. Now M. de Beaumont asks: 'Does there exist and can we find a meridian which, by its position on the earth, is sufficiently determined to be taken as the initial meridian, solely on account of its natural and individual character?' In reply he draws attention to the meridian passing through Behring's Strait, as satisfying beyond any other this demand. It is now the 150th meridian west of the island of Ferro, or 30 deg. E., or 10 deg. E. of Paris. This meridian, M. de Beaumont maintains, can be very easily connected with works based on the principal meridians of Ferro, Paris, Greenwich, &c. It touches the extremity of the American continent at Cape Prince of Wales; traverses, on the one hand, the whole length of the Pacific without touching any land, and, on the other, all Europe, through its centre, from the top of Spitzbergen, passing Copenhagen, Leipsic, Venice and Rome; then cuts the African continent from Tripoli to Cape Frio, about 18 deg. S. lat. M. de Beaumont urges several advantages on behalf of this new meridian. It would cut Europe into east and west, thus giving emphasis to a division which has been tacitly recognized for ages; it presents about the largest possible terrestrial arc, from 79 deg. N. to 18 deg. S. lat., 97 degrees altogether, thus giving to science the longest continuous line of land as a basis for astronomical, geodetic, and meteorological observations, and other important scientific researches. Passing as it would through a great number of States, it would become a really international meridian, as each nation might establish a station or observatory on the line of its circumference. Such a meridian M. de Beaumont proposes to call mediator, on the analogy of equator. This proposal of M. de Beaumont is strongly approved by the eminent French geographer, M. E. Cortambert, and has received considerable support from other continental geographers. Whether M. de Beaumont's particular proposal be generally accepted or not, there can be no doubt of the advantage of having some common international arrangement as to a common meridian for geographical purposes at least."

It is somewhat remarkable that the important query of M. de Beaumont is one which, without the slightest idea that it had been asked by him, I have anticipated by my reply. The coincidence, however, is less strange, that we have arrived substantially at the same conclusions. A Behring's Strait meridian is almost the only one which, by its position, may be taken as the initial meridian, on account of its natural and individual character.

It is not a little satisfactory to discover that the views which I have expressed are confirmed in the main by so distinguished an authority. What difference exists is in matters of detail. M. de Beaumont proposes that the common meridian should be established 150° west of Ferro, or nearly 180° from a meridian passing through or at no great distance from Copenhagen, Leipsic, Venice and Rome. This would throw the initial meridian a little to the east of Behring's Strait; while the one suggested by the writer is to the west in the same locality. Either would perfectly serve the desired purpose. The only question remaining is, which of the two would least interfere with present practices; least disarrange charts, tables and nautical nomenclature; which would most accommodate and best satisfy the greatest number of those who use and are governed by the maps and forms and astronomical almanacs now in use;—in fact, which of the two lines would most readily meet with general concurrence? I think the answer is conclusive. The anti-meridian of the one proposed by M. de Beaumont, passes through Copenhagen—a meridian recognized probably by less than one per cent. of ocean-going vessels: while the anti-meridian of the line advocated in this paper is in use for reckoning longitude by at least 72 per cent. of the floating tonnage of the world.

The proposal of the President of the Geographical Society of Geneva, supported as it is by M. E. Cortambert and other continental geographers, advances the settlement of an extremely embarrassing question, and encourages the hope that at no distant day there may be an international arrangement, through which mankind may secure the advantages of a common first meridian for geographical, chronometrical and all other general purposes; one that in its actual and in its astronomical sense will be indeed cosmopolitan.

Two communications on the subject have lately appeared in the "Bulletin de la Société Geographie, Paris, 6th Series, Vol. 9."

The first, originally submitted to the Imperial Geographical Society of Russia by M. Otto Struve, Director of the Pulkova Observatory, was subsequently read before the Geographical Society, Paris, by M. le Comte Guidoboni Visconte. The second, was communicated to the same society by M. A. Germain, Ingénieur Hydrographie.

The recommendation of M. Germain is that the meridian of Paris should be maintained. He takes an essentially national and non-cosmopolitan view of the subject. The line of argument adopted by him does not call for refutation, even if controversy in this instance fell within the province of the writer.

M. Germain seems to think, for his opinions are not positively expressed, that if England would adopt the metrical measurement of France, it would be a gracious act for France to accept the prime meridian of England.

The communication of M. Otto Struve is of a different character. He argues for the necessity of a common first meridian, in the general interests of navigation, of geography and of astronomy. He points out that national vanity seems to have been the sole cause that up to the present time, to the great detriment of scientific advancement, different first meridians are in use. He very correctly writes: "La question de l'unification des méridiens ne dépend d'aucune considération d'économie politique, elle intéresse uniquement le monde savant. Sa réalisation n 'exige pas certains sacrifices de la part du public; elle demande seulement quelques concessions d'habitudes et de préjuges nationaux, et cela, de la part de ceux-là mêmes qui, après une courte période de transition, en tireront les plus grands profits. Cela est exclusivement l'affaire du monde scientifique, et nous espérons qu 'aucun de ses membres ne refusera de faire les insignifiantes concessions dont nous parlions pour parvenir à cette entente d'une utilité générale."

M. Struve's paper will well repay perusal. His remarks are totally free from national bias; he favours the adoption of the Greenwich meridian in preference to any other, mainly on account of the fact that the exact and the most useful ephemerides published known under the name of the "Nautical Almanac," are calculated to correspond with it. He admits, however, that it is impossible to disregard the influence of national jealousies, and he points out how much they stand in the way of obtaining a general recognition of any first meridian established on national grounds.

The conclusions to be drawn from the valuable paper of M. Otto Struve are, that although he gives the preference to Greenwich as a common first meridian, that a meridian passing through the ocean, away from every country, and an exact multiple of 15° from Greenwich, would be a simple and desirable alternative.

The Pacific meridian advocated in the present paper meets these conditions, and in itself offers many positive advantages. It passes through the ocean without meeting any continent, except uninhabited land on the Arctic circle. The Nautical Almanac, recognized by M. Struve, and by the leading astronomers of the world, to be the most complete work of the kind published, and in consequence the most generally used, would apply to it without interpolation. And as no national jealousy would be awakened, all national objections to the initial meridian proposed would entirely disappear, and its general acceptance be considered a ready and harmonious solution to an embarrassing difficulty in a matter of the greatest scientific importance.