(Beevor and Horsley). As in the case of the hallux focus, degeneration was also confined to the pyramidal tracts of the same side (left) as the lesion, throughout the pons and medulla. At the decussation of the pyramids there was also a slight division of the degenerated fibres, but in this case a few fibres only (less than one in ten) went to the lateral column of the same (left) side of the cord. There may have been two or three degenerated fibres left in the direct tract after the decussation, but this could not be positively stated. In the cervical and upper dorsal regions the degenerated fibres gradually decreased in number. At the level of the second dorsal there were a very few degenerated fibres still left in each lateral column. At the third dorsal they had entirely disappeared.

It seems probable, from these observations, that a second decussation lower down in the cord—recrossing—does not occur, and that the bi-lateral degeneration observed by Pitres, Sherrington, Langley, Muratoff, and others is a genuine bi-lateral descent of fibres from one hemisphere.

II. "On the Relations of the Secular Variation of the Magnetic Declination and Inclination at London, Cape of Good Hope, St. Helena and Ascension Island, as exhibited on the Magnetarium." By HENRY WILDE, F.R.S. Received February 19, 1894.

In a paper which was read before the Royal Society in June, 1890, I showed that the principal phenomena of terrestrial magnetism and the secular changes in its horizontal and vertical components could be explained on the assumption of an electro-dynamic substance (presumably liquid or gaseous) rotating within the crust of the earth in the plane of the ecliptic, and a little slower than the diurnal rotation. By means of some electro-mechanism, new to experimental science, which I termed a magnetarium, the period of backward rotation of the internal electro-dynamic sphere required for the secular variations of the magnetic elements on different parts of the earth's surface was found to be 960 years, or 22·5 minutes of a degree annually. It was also demonstrated that the inclination of the axes of the electro-dynamic and terrestrial globes to each other of 20° 30′, was the cause of the inequality of the declination periods about the same meridian in the northern and southern hemispheres; as instanced in the short period of outward westerly declination at London, and the long period of outward westerly declination at the Cape of Good Hope and St. Helena.

The object of the present communication is, firstly, to make a more

direct comparison of the declination periods at London and at the Cape of Good Hope than was set forth in my former paper; and, secondly, to show a further agreement between the indications of the magnetarium and the results of recent observations of the dip and declination at the Island of Ascension.

The rate of backward rotation of the internal electro-dynamic sphere, as I have said, is 22·5 minutes = 0·375° annually. Now, the period of the westerly march of the declination needle at London from zero in the year 1657 to its maximum of 24° 30′ in the year 1817 is 160 years; therefore, 0·375° × 160 = 60° of differential rotation of the internal sphere. Again, the westerly march of the needle at the Cape of Good Hope from the year 1609 to its maximum of 30° in the year 1881 is 272 years. Therefore, 0·375° × 272 = 102° of differential rotation of the internal sphere. Hence, 60° : 160 years : : 102° : 272 years; the outward westerly declination periods at London and the Cape of Good Hope respectively, as shown by observation and on the magnetarium. Subjoined are tables of the declination and inclination at London, the Cape of Good Hope, and on the magnetarium for the same epochs.

Table I.—Secular Changes of the Declination and Inclination at London.

Epoch.	Declination.	Epoch.	Inclination.
1657	0° 00′	1723	74° 42′ N.
1665	1 22 W.	1773	72 19
1672	2 30	1780	72 08
1692	6 00	1790	71 53
1723	14 17	1800	70 35
1748	17 40	1821	70 03
1773	21 09	1830	69 38
1787	23 19	1838	69 17
1795	23 57	1854	68 31
1805	24 08	1860	68 19
1813	24 20	1864	68 09
1815	24 27	1870	67 58
1818	24 38	1882	67 34
1820	24 34	1887	67 26 N.
1830	24 00		
1858	21 54		
1860	21 40		
1865	20 59		
1870	20 19		
1875	19 41		
1881	18 50		
1887	17 49 W.		

Table II.—Secular Changes of the Declination and Inclination at London on the Magnetarium.

Differential motion of globes.	Epoch.	Declination.	Differential motion of globes.	Epoch.	Inclination.
° 0	1657	° ′ 0 00	° 0	1723	° ′ 74 30 N.
6	1673	6 00 W.	6	1736	74 00
12	1689	10 00	12	1752	73 30
18	1705	15 00	18	1768	73 00
24	1721	17 30	24	1784	72 30
30	1737	19 30	30	1800	71 30
36	1753	21 30	36	1816	70 30
42	1769	22 30	42	1832	69 30
48	1785	23 30	48	1848	68 30
54	1801	24 00	54	1864	67 30
60	1817	24 30	60	1880	66 30
66	1833	24 00	66	1896	65 30
72	1849	23 30	72	1912	64 00
78	1865	22 30	78	1928	62 30
84	1881	22 00	84	1944	61 00
90	1897	21 30	90	1960	59 30
96	1913	20 30	96	1976	58 30
108	1945	18 30	108	2008	56 00
120	1977	16 30	120	2040	54 00
132	2009	13 30	132	2072	52 00
144	2041	10 30	144	2104	50 30
156	2073	7 30	156	2136	50 00
168	2105	4 00 W.	168	2168	49 30
180	2137	0 00	180	2200	49 00 N.

Table III.—Secular Changes of the Declination and Inclination at the Cape of Good Hope.

Epoch.	Declination.	Epoch.	Inclination.
1605	0° 30′ E.	1751	43° 00′ S.
1609	0 12 W.	1770	44 25
1614	1 30	1775	45 19
1622	2 00	1780	46 46
1675	8 00	1792	47 25
1691	11 00	1818	50 47
1721	16 25	1836	52 35
1751	19 15	1839	53 06
1768	19 30	1846	53 40
1774	21 36	1880	57 00 S.
1780	22 16		
1783	22 23		
1788	24 04		
1792	24 31		
1818	26 31		
1836	28 30		
1839	29 09		
1842	29 05		
1845	29 07		
1850	29 18		
1880	30 00 W.		

Table IV.—Secular Changes of the Declination and Inclination at the Cape of Good Hope on the Magnetarium.

Differential motion of globes.	Epoch.	Declination.	Inclination.
°		° ′	° ′
0	1609	0 00	27 00 S.
6	1625	3 30 W.	27 30
12	1641	6 20	28 00
18	1657	9 40	28 30
24	1673	12 30	29 00
30	1689	15 00	30 00
36	1705	17 20	32 00
42	1721	19 40	34 00
48	1737	21 40	35 30
54	1753	23 20	37 30
60	1769	24 40	40 00
66	1785	26 20	42 30
72	1801	27 40	46 00
78	1817	28 30	49 00
84	1833	29 00	52 00
90	1849	29 40	54 30
96	1865	30 00	56 30
102	1881	30 00	58 00
108	1897	30 00	60 00
114	1913	29 30	61 30
120	1929	28 20	63 00
132	1961	26 00	66 00
144	1993	22 30	68 00
156	2025	15 30	70 00
168	2057	8 00 W.	71 30
180	2089	0 00	72 00 S.

The secular changes of the magnetic elements at St. Helena are interesting from the fact that the declination period agrees well with the geographical position of this island, which is west of the meridians of London and the Cape of Good Hope.

The epochs of the zeros of the declination at these places are in the order of their longitudes respectively,

Cape of Good Hope	long. 18° 28′ E.	1609.
London................	„ 0 0	1657.
St. Helena	„ 5° 43′ W.	1683.

As St. Helena is south of the equator, the outward westerly march of the declination needle has a long period which is not yet completed (prop. V). The length of this period, as shown on the magnetarium, is 256 years, and will arrive at its maximum in the year 1939.

Further proofs of the truth of the theory that the secular changes in the magnetic elements are caused by the rotation of an electro-

Table V.—Secular Changes of the Declination and Inclination at St. Helena.

Epoch.	Declination.	Epoch.	Declination.
1677	0° 40′ E.	1825	14° 56′ S.
1691	1 00 W.	1835	18 00
1724	7 30	1839	17 55
1775	12 18	1840	18 16
1789	15 30	1847	19 23
1796	15 48	1880	29 00 S.
1806	17 18		
1839	22 17		
1840	22 53		
1846	23 11		
1880	26 00 W.		

Table VI.—Secular Changes of the Declination and Inclination at St. Helena on the Magnetarium.

Differential motion of globes.	Epoch.	Declination.	Inclination.
0	1683	0° 00′	4° 30′ N.
6	1699	2 30 W.	4 00
12	1715	5 00	3 30
18	1731	8 00	2 30
24	1747	11 00	0 00
30	1763	13 00	2 00 S.
36	1779	15 00	5 00
42	1795	17 00	8 00
48	1811	19 00	11 00
54	1827	20 40	15 00
60	1843	22 20	19 00
66	1859	24 00	23 00
72	1875	25 30	28 30
78	1891	26 30	34 00
84	1907	26 40	37 00
90	1923	27 00	41 00
96	1939	27 20	45 00
102	1955	27 00	49 00
108	1971	26 40	52 00
114	1987	26 20	54 00
120	2003	26 00	56 00
132	2035	24 00	60 00
144	2067	21 00	63 00
156	2099	18 00	66 00
168	2131	11 00 W.	67 00
180	2163	0 00	68 00 S.

dynamic substance within the earth's crust are afforded (1) by the dipping needle making only one downward or upward motion (outside the space comprised within the north and south limits of the magnetic equator) for the outward and return march of the declination needle, as instanced in the continued diminution of the dip in the British Isles during the westerly outward and return march of the declination needle since the year 1723. (2) From the secular changes of the dip in opposite directions about the same meridian in the northern and southern hemispheres, as instanced in the dip diminishing in the British Isles and increasing at the Cape of Good Hope and St. Helena for the same epoch (prop. X). (3) The rapid increase of the dip about the nodes of the magnetic equator, as first indicated by Sabine in the Gulf of Guinea and St. Helena. Before the time of my experiments no attempt had been made to assign a cause for the large and rapid change in the dip (about 17 minutes annually) on this part of the terrestrial surface until I found that the results obtained on the magnetarium agreed very closely with the observations. Subjoined are tables of the declination and inclination at St. Helena and on the magnetarium.

On working the inclination backwards on the magnetarium chronologically, it will be seen from the Table VI that about the year 1747 the dip changed the sign from south to north. As no observations were made on the dip at St. Helena previous to the year 1825, there is no record of this interesting fact, nor has it hitherto been deduced from theory.

A further confirmation of the agreement of the results obtained on the magnetarium with actual observations has recently been brought under my notice in the bulletin issued by the United States Coast and Geodetic Survey, No. 23, March 16th, 1891. In this publication

Table VII.—Secular Changes of the Declination and Inclination at Ascension Island and on the Magnetarium.

Ascension Island.			Magnetarium.		
Epoch.	Declination.	Dip.	Dip.	Declination.	Epoch.*
1834		1°·57 N.	2°·0 N.		66°·5
1842	19°·27 W.	0·08 S.	0·0	20°·0 W.	69·5
1863	21·63	4·47	5·0 S.	21·0	77·0
1876	22·75	7·56	8·0	22·5	82·0
1890	23·00	11·37 S.	12·0 S.	23·0	87·5

* Annual differential motion of internal sphere 22′·5 = 0·375° from zero at London in the year 1657.

a table is given of the declination and dip at Ascension Island for the epoch 1834—1890, in which the change of the dip from north to south occurs between the years 1842—1839. The same change is not only shown on the magnetarium but also the amount of the dip and declination for the epoch 1834—1890.

The correlation of the maximum rate of change of the inclination with the minimum rate of change of the declination about the nodes of the magnetic equator is well seen in the observations, and is also demonstrated in my paper (prop. XVIII) and on the magnetarium.

III. "Terrestrial Refraction in the Western Himalayan Mountains." By General J. T. WALKER, C.B., R.E., F.R.S. Received January 13, 1894.

In the operations of the Great Trigonometrical Survey of India it is customary to determine the coefficient of refraction by reciprocal vertical observations between contiguous stations on the sides of all the principal triangles, and also as many as possible of the secondary triangles.

[The sum of the reciprocal vertical angles, *plus* the angle at the earth's centre, would be exactly equal to 180° if there were no refraction; the excess gives the sum of the refractions in both the angles, and half of it is taken as the amount for each angle.—March 2.]

The values of the coefficient thus obtained for the operations in the Western Himalayas—between the meridians of 73° and 80° east of Greenwich—have been grouped together for comparison in successive ranges of 2000 ft. of altitude between the elevations of 5,000 and 21,000 ft. above the sea level. The operations happen naturally to have been divided into two sections; for the regions lying between the great snowy ranges on the southern face of the Himalayas and the plains of India were first completed, and some time subsequently the still higher regions to the north, extending up to the Karakoram and Kuenlun Ranges, which look down on the plains of Turkestan. The first portion appertains to what is called the N.W. Himalayan Series, the second to what is called the Kashmir Triangulation. Thus the values of the coefficients of refraction were obtained separately for each section, and the results are shown in the following table, where the heights have reference to the middle points of the sides of the triangles, of which the number is given for each group :—