SCIENCE.—SUPPLEMENT.

FRIDAY, DECEMBER 11, 1885.

PHYSIOLOGY OF THE BRAIN.

THE recently published memoir of Dr. J. Steiner[1] is an especially important contribution to this very difficult field of research, and one which is likely to have influence not only from its intrinsic merit as an investigation, but also from the unusual literary excellence characterizing the author's presentation of his subject. The frog was chosen for the experiments on account of the comparative simplicity of its brain. The experiments consisted in a series of systematic removals of portions of the brain; and to the thoroughness and patience with which this system of study was executed the success must be attributed. Steiner removed first the hemispheres, and records in his memoir the observed results; next both the hemispheres and optic thalami; then the mid-brain; then the cerebellum; finally the upper part of the medulla. Then follow experiments with asymmetrical removals. Together with the description of each operation is given the account of the physiological phenomena which ensue from it. The discussion of the interpretation of the observations is kept separate, — an essential advantage to the reader.

The most important conclusion reached is, that in the anterior portion of the medulla oblongata there is a common centre for the co-ordinated movements of the head, rump, and limbs; or, in other words, that we cannot separate the three centres topographically, and can establish the fact of their organic connection. This central office Steiner names the brain-centre (*hirncentrum*). By ingenious experiments and reasoning he renders it probable that the upper parts of the brain (*bigemnia*, etc.) contain no general co-ordinating motor-centres, but only sensory centres and pathways; that is to say, they act to the brain-centre the *rôle* of centrifugal nerves, and the brain-centre is the only locomotion centre of the body.

The relation of the brain-centre to the reflex centres of the spinal cord is very remarkable, and is demonstrated by the reactions of a frog deprived of its hemispheres to irritations produced by varying strengths of sulphuric acid placed on the skin. The strength is gradually increased until a reaction occurs. The first reaction is a locomotion; a little stronger, and there is first a locomotion, and then the well-known reflex wiping motion to remove the irritant; the wiping motion causes the stoppage of the locomotion — the interpretation of this fact is that the brain (locomotion) centre is more readily excited than the reflex centre in the cord, and that the reflex centre inhibits the action of the brain-centre. This is another of the increasing number of instances of the reaction consequent upon stimulation of a given part varying with the strength of the stimulus. This discovery already appears to us of very far-reaching significance for the future of nervous physiology.

In a second chapter the author establishes asymmetrical injury of the brain as the cause of compulsory curvilinear motions (*mouvements de manège, rollbewegungen*, clock finger movements, etc.). For further details we must refer to the interesting original.

Dr. Josef Paneth brings a new contribution[1] to the solution of the vexed question whether the cortex cerebri of new-born animals is irritable. He attributes Toltmann's negative results, which are accepted in most text-books, to the use of narcotics by that experimenter, and reports thirteen experiments made by himself on dogs, of which eight gave a positive, four a probably positive, and one a negative result. It may be added that animals which are born more advanced in development (as, for instance, guinea-pigs) have been already shown to have an irritable cortex at birth. The only irritable area was half a square centimetre in the region of the sulcus cruciatus. Microscopical examination showed the absence of medullated fibres in this region, so that Toltmann's view that their presence is essential to irritability is not sustained. Paneth's results agree with those previously reached by Lemoine.[2]

C. S. MINOT.

GEOLOGICAL SURVEY OF CANADA.

THE Dominion of Canada embraces nearly half the continent; but the greater part of this vast area is still a trackless wilderness; and the labors of the geological survey, in its earlier decades, were wisely concentrated upon those districts in the eastern provinces and the valley of the St. Law-

[1] *Untersuchungen über die physiologie des froschhirns.* Von Dr. J. STEINER. Braunschweig, *Vieweg*, 1885. 8°.

[1] *Ueber die erregbarkeit der hirnrinde neugeborener hunde.* Von J. PANETH. *Pflüg. archiv f. physiol.*, xxxvii. 202.

[2] Lemoine, *Contribution à la détermination et à l'étude expérimentale des localisations fonctionelles encéphaliques.* Paris, 1880.

rence which are and must always remain the chief seats of population and wealth, and an accurate knowledge of which must therefore always be of prime importance. This result is now in a large measure accomplished; and meanwhile the external conditions have greatly changed. The Canadian Pacific railway has connected the Gulf of St. Lawrence with the Gulf of Georgia, and flourishing communities have arisen in British Columbia and Manitoba. With this tide of immigration and development in the far west has come not only the possibility, but the necessity, of greatly extending the field and changing the plan of the survey. The outlines of the geology of a vast region are being rapidly traced, while the elaboration of details is mainly left to the future, save where there is promise of important economic developments.

The 'Report of progress of the Canadian geological survey for 1882–84,'[1] includes, besides the summary report of the director and two contributions from the chemist of the survey on the composition of the coals and lignites of the north-west territory, and various building stones and ores, thirteen separate reports on explorations, in nearly as many different sections of the dominion. These are arranged in geographical order, beginning in the far west; and it is therefore especially surprising to find that the first report was written twenty-five years ago, though now published for the first time. This is an account of the geology of the country near the 49th parallel, west of the Rocky Mountains, by Mr. H. Bauerman, geologist to the boundary commission. The publication of these rather antiquated observations seems to be justified by the fact that they largely relate to districts which have not been covered by more recent explorations.

This is followed by the most important of recent contributions to Canadian geology; Dr. G. M. Dawson's final report of 170 pages, on the region of the Bow and Belly rivers, embracing an area of about 27,000 square miles of prairie and plateau country lying in the angle between the United States boundary and the eastern base of the Rocky Mountains. This district, which touches the paleozoic rocks of the mountains, and is based on the cretaceous and Laramie formations, is the first in the north-west territory of which a systematic and proximately complete examination has been made, and is of special importance in consequence of the proximity of the valuable coal and lignite deposits to the line of the Canadian Pacific railway. These are shown to be wide-spread and practically inexhaustible; and the main geological features are so clear and easily read, that, although the details are largely left to the future, the present report and map will be found adequate for a long time. The treeless character of the plains is in a large measure offset by the fossil fuels, but their aridity is not thus mitigated. That the climate has become drier in post-glacial times, is very plainly indicated by the broad, deep drainage channels known as *coulées*, which were evidently formed by large rivers, but are now dry, or nearly so.

Dr. Robert Bell's report on the Athabasca River gives the results of a rapid geological reconnaissance of the valley of that stream from the 55th parallel to Lake Athabasca. We have here the first definite information concerning a geological section, which, like that on the Bow and Belly rivers, is chiefly remarkable for its simplicity and its promise of important economic developments. It consists of cretaceous marls and sandstones resting horizontally but unconformably on horizontal beds of Devonian limestone; and the lower part of the cretaceous is, over an area of thousands of square miles, supersaturated with asphaltum and petroleum. In no other extensive petroleum-field, probably, are the conditions so simple and so clearly exposed as here. It is very much as if the two thousand feet of barren rock covering the oil-sands of Pennsylvania were removed. In the Athabasca field, too, the much-vexed question of the origin of petroleum seems to find a ready solution, the facts affording substantial support to the theory that the oil has its source in the underlying limestone, which is distinctly oleiferous.

Dr. Bell also accompanied the expedition sent out in 1884 to establish meteorological stations at various points in Hudson's Strait and Bay. But he enjoyed no special facilities, and the desultory observations here published are all that could have been reasonably expected, even from so experienced an observer, especially considering that he was not only the geologist, but the zoölogist, botanist, taxidermist, photographer, and medical officer of the expedition. The glacial phenomena, past and present, received most attention; and the interesting fact is established that the top of the coast-range of Labrador projected above the ice-sheet, and was not glaciated. This report is accompanied by lists of the plants, mammals, birds, crustacea, marine invertebrates, and lepidoptera collected.

Professor Laflamme's observations on the Saguenay have so greatly extended and multiplied the known areas of Trenton limestone as to suggest that this rock may once have covered the Laurentian highlands continuously from the St. Lawrence to Hudson's Bay, this part of the continental nu-

[1] *Geological survey of Canada. Report of progress for 1882–84.* ALFRED R. C. SELWYN, director. Montreal, *Dawson*, 1885. 8°.

cleus having been completely submerged by the sea of that period. But it must have been dry land previously, since no traces of the Chazy, calciferous, and Potsdam are found beneath the Trenton, which rests directly and horizontally upon the Laurentian gneiss, and is so related to the present elevations and depressions of the gneissic surface as to indicate that they are in large part the result of erosion in pre-Cambrian times.

The reports by Messrs. Ells and Low on the Gaspé Peninsula, with the maps, indicate considerable progress in the elucidation of this small but very formidable wilderness; and Mr. Ells's notes on the geology of Prince Edward's Island prove that the so-called triassic beds of this island belong almost wholly to the Permo-carboniferous.

Prof. L. W. Bailey continues his investigation of the geology of New Brunswick in a report on Carleton and York counties, which is devoted chiefly to the Silurian and supposed Cambro-Silurian strata. The latter consist mainly of highly crystalline gneisses and schists; and the only evidence of their Cambro-Silurian age consists in the fact that they are overlain unconformably by the Silurian beds, coming between the latter and the great granite axis, by which it is supposed they have been metamorphosed.

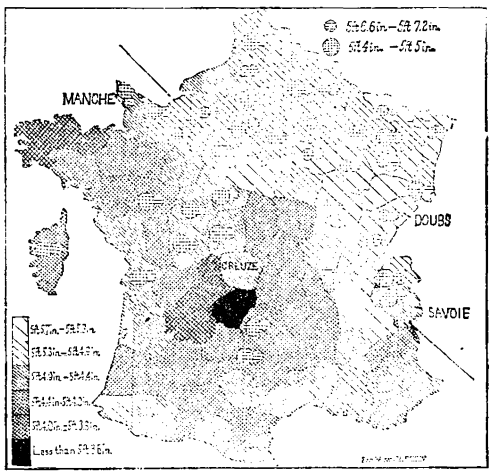
Mr. R. Chalmers describes at considerable length the interesting glacial phenomena of the same region.

Mr. Hugh Fletcher's extended report on the northern and hitherto unsurveyed portion of Cape Breton, with the accompanying map of the whole island, places the geology of this province on a par with that of the rest of Acadia. The scale of the map, which covers 24 sheets, is entirely too liberal, being at least twice as large as either the topographic or geologic details require; and the bulkiness of the map seriously diminishes its usefulness, especially in the absence of a general map of the island on one sheet.

The remainder of the volume is made up of detailed reports on the apatite mines and deposits of Ottawa county, and the gold mines of the Lake of the Woods, and some scattering observations on the mines and minerals of Ontario, Quebec, and Nova Scotia.

HEIGHT IN FRANCE.[1]

IN the accompanying map of France the average height of the inhabitants is indicated by the shading, in which the darker shades denote the smaller, and the lighter shades the greater heights. It will be seen that a line, as shown on the map, running diagonally from Manche in the north-west to Savoie (Lyons) in the south-east, divides the country into two parts. To the north-east of this line the inhabitants are above the average height; to the south-west of it, below the average. This phenomenon was known to Broca, who ascribed it to racial influences alone. He held that the Celts and the Cymri mentioned by Caesar were the racial ancestors of the present French people. The Celts were of mean height, and were further distinguished by their round heads and bulging foreheads, and light hair and eyes; while the Cymri (or Belges of Caesar) were tall, and had long heads, with broad, high foreheads and light hair and eyes. Broca had also pointed out that unusual deviations from the average height were more common in those regions which we may regard as the country of the Celts, and rare among



the Cymric people. Broca prepared his map according to the frequency of the deviations from the average height, and his result is quite similar to what is obtained when, as in the present instance, the average height itself is the basis of comparison. In both cases France is divided by a line from north-west to south-east into two parts, the inhabitants of one of which are markedly taller than those of the other, while about the same regions appear as the extremes either of tallness or smallness in both cases.

It is well known that if the height of a large number of men are taken, and the number of men at each height be recorded, the largest number of records will centre about the mean height of the whole group, and the number will grow smaller as we leave the point of average height to either side. It is further known that the frequency of the records at each point of the scale is determined by

[1] From the *Revue scientifique*, October, 1885. By M. JACQUES BERTILLON.