*Addendum, January* 19, 1905.—The three rats inoculated on August 30, 1904, with extract of spinal cord have become paraplegic: one on December 14, 1904, one on January 2, 1905, and the third on January 11, 1905. No Trypanosomata have been seen in the blood of these animals, and, apart from paralysis of the hind limbs, they show no signs of ill health.

The spinal cord shows amœboid forms of the Trypanosomata in its tissue, and a considerable cellular exudation around the vessels; this lesion Dr. Mott found to be characteristic of cases of human Sleeping Sickness, and it is not found in monkeys, which have been the animals principally used in experimental work on this disease.

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"Further Histological Studies on the Localisation of Cerebral Function.—The Brains of *Felis, Canis,* and *Sus* compared with that of *Homo*."* By ALFRED WALTER CAMPBELL, M.D. Communicated by Professor SHERRINGTON, F.R.S. Received December 3, 1904,—Read January 19, 1905.

(Abstract.)

The present study is founded on an exhaustive examination of the cerebral cortex of *Felis domesticus, Canis familiaris,* and *Sus communis,* conducted on lines similar to those followed in the original work.

A recurrence in the lower mammal of distinctive types of cortex, akin to those recognised in the human brain, has allowed a subdivision of the surface into the following areas:—

Crucial or motor; postcrucial or sensory; parietal; visual; ectosylvian; limbic; rhinic; extrarhinic; frontal.

By a study of the distribution of these areas many functional analogies and structural homologies, previously unknown or misinterpreted, are made clear.

*Crucial or Motor Area.*—Giant cells of Betz characterise the motor cortex, but these elements appear not to be so highly specialised in *Sus* as in *Felis* and *Canis.* Such cells reside in what we may call the cruciate zone, and it is maintained that this field is functionally and morphologically akin to the motor area, as defined by Professors Sherrington and Grünbaum in the anthropoid ape, and by myself in man. It is held that a small indentation, called the "compensatory ansate" sulcus, and the sulcus coronalis are respectively interchangeable with the upper and lower constituents of the primate fissure of Rolando, chiefly because they, like the fissure of Rolando, limit the

* This paper is an addendum to the work presented to the Royal Society in November, 1903 (see 'Proceedings,' vol. 72, p. 488). The complete work will be published shortly in full by the Cambridge University Press, by aid of a subsidy from the Royal Society.

motor area on the parietal side. In man and the man-like ape, an unnamed but constant fissuret, situated on the paracentral lobule, immediately below and in front of the upper extremity of the fissure of Rolando, is looked upon as the homologue of the sulcus cruciatus.

*Visual Area.*—Showing how greatly the lower mammal relies on sight in the contest for survival, quite one-sixth of the brain surface is allotted to visual cortex. Architecturally it is astonishing how closely the human plan is followed. The lessons in homology learned are, that the "true calcarine" fissure (Elliot Smith's nomenclature) of lower mammals is the antecedent of the anterior calcarine fissure or "stem" of *Homo*, that the intercalary sulcus does not develop into the calloso-marginal of man, but undergoes retrograde changes, that the posterior calcarine fissure may continue as such, and that the suprasplenial sulcus of *Canis* and *Felis* (the so-called "lateral" sulcus of *Sus*) is the derivative of the human fissura extrema of Seitz (the Simian "sulcus intrastriatus lateralis"). The research throws no light on the problem of the "Affenspalte."

*Postcrucial or Sensory Area.*—The postcrucial or sensory field forms a morphological buffer to the crucial or motor, and is maintained to be the homologue and analogue of the postcentral area in primates.

*Lobus Pyriformis and Hippocampal Region.*—The variations in distribution of the different types of cortex found hereabouts are contrasted in the microsmatic and macrosmatic brain.

*Limbic Area.*—It is found that types of cortex akin to those recognised in man are repeated in the lower mammal. The genual fissure is taken as the homologue of the calloso-marginal.

*Parietal Area.*—Histology suggests that this field is the forerunner of the parietal area in *Homo*, and that its cortex is older, in the sense of phylogeny, than frontal cortex. Support is given to the assumption that the lateral sulcus, as seen in most mammals, is the antecedent of the intraparietal sulcus of primates. In *Sus*, the so-called "suprasylvian" sulcus is really the lateral, the true suprasylvian sulcus being both placed at a lower level and rudimentary.

*Ectosylvian Region.*—Out of the ectosylvian region of lower mammals is developed the sylvian region, including the insula, and much of the temporal lobe of primates. A small field investing the so-called fissure of Sylvius of lower mammals appears to be the analogue of the "audito-sensory" area of man and the homologue of the transverse temporal gyri. From this as a basis important deductions can be drawn.

*Frontal Lobe.*—The types of cortex which characterise the frontal lobe in man are not represented in lower mammals.

*Some General Conclusions.*—The stability of the architectural plan of any given field of cortex is directly related to the phylogenetic age of that cortex and to the importance, as a means to survival, of the function it subserves.

The human brain shows signs of having expanded more decisively in some parts than in others, yet that expansion, if we except the visual and olfactory areas, has been general in kind.

By super-imposing on our cerebral plans drawn from naked-eye inspection others giving the results of histological examination, this as a preliminary to the final localisation of function by the physiologist and workers in other departments, all existing doubt on various homologies may be removed.

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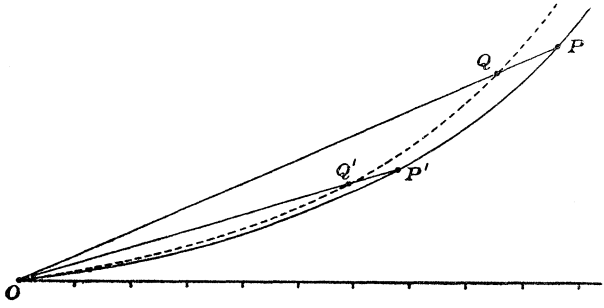
"Exterior Ballistics.—'Error of the Day,' and other Corrections to Naval Range-tables." By Professor GEORGE FORBES, F.R.S. Received December 19, 1904,—Read January 26, 1905.

One of the most common problems that meet artillerists is that of correcting for retardation caused by air-resistance, this being proportional to the air-density. The published range-tables, as calculated for any type of gun with given weight and form of shot, and given charge of powder, are based on trials with different elevations when the range and time of flight are measured directly. The range-tables are calculated from the experiments by making corrections for muzzle velocity and for air density. The problem now before us is to find a simple rule for deducing from the published range-table another range-table with a different air-density.




Abscissæ represent ranges.
Ordinates represent elevations.
PP′ range table elevations at normal air density.
QQ′ „ with air density increased 10 per cent.
$QP = \frac{1}{11} OP$, $Q'P' = \frac{1}{11} OP'$.

The solution of this problem, for flat trajectories at least, is extremely neat when stated geometrically. Draw a curve in which abscissæ are ranges and ordinates are the elevations of the range-table.