

*Determination of the North Polar Distances and proper Motion of Thirty fixed Stars.* By John Pond, Esq. Astronomer Royal, F.R.S. Read June 15, 1815. [*Phil. Trans.* 1815, p. 384.]

In the former catalogue which the Astronomer Royal gave in 1813, he estimated the probable extent of error at not more than one fourth of a second; and his present catalogue, which may be presumed to be improved by a greater number of observations, confirms the justness of that estimate; since the greatest difference observable is not more than two tenths of a second.

A comparative catalogue is also given of the places of the same stars in 1756, as deduced from the observations of Dr. Bradley; and thence is added a column of annual proper motions for each of the stars in the collection.

*An Essay towards the Calculus of Functions.* By C. Babbage, Esq. Communicated by W. H. Wollaston, M.D. Sec. R.S. Read June 15, 1815. [*Phil. Trans.* 1815, p. 389.]

In the same manner as an exponent expresses one operation on quantity, namely, the multiplication of it by itself a certain number of times, or raising it to the power expressed by that exponent, so the term Function, which has been introduced into modern analysis, is intended to express generally the results of all the various operations that can be performed upon quantity. Many of these operations consist of two parts, the *direct* and the *inverse*. To extract a root is the inverse, with reference to that of raising any number to a higher power. So the *integral* is the inverse of the differential calculus; and the same observation applies to finite differences. In all these cases the inverse method is by far the more difficult of the two.

The author's object in the present essay is to consider the inverse method with respect to functions, and, if possible, to determine the value of an unknown function by means of any functional equation given, instead of discovering, as in the direct method, the value of a quantity from an equation in which the function is known. But the mode in which the author pursues his inquiry, of course could not admit of being publicly read.

*Some additional Experiments and Observations on the Relation which subsists between the Nervous and Sanguiferous Systems.* By A. P. Wilson Philip, Physician in Worcester. Communicated by Thomas Andrew Knight, Esq. F.R.S. Read June 15, 1815. [*Phil. Trans.* 1815, p. 424.]

This paper comprises a series of very numerous experiments on the effects of various stimuli applied to the brain and nerves of rabbits and frogs, in exciting the voluntary muscles, the heart, and the blood-vessels; from which the author infers,—

That the laws which regulate their effects on the muscles of voluntary and involuntary motion are different.

That both mechanical and chemical stimuli applied to any part of the nervous system tend to increase the action of the heart.

That neither mechanical nor chemical stimuli applied excite the muscles of voluntary motion, unless they are applied near the origin of the spinal marrow.

That mechanical stimuli have more effect than chemical on voluntary muscles, but the reverse with respect to those of involuntary motion.

That all stimuli continue to affect the heart long after they have failed to excite the muscles of voluntary motion.

That the motions thus excited in voluntary muscles are irregular, but those of the heart more regular.

That the former occur chiefly at the first moment of application, but those of the latter as long as the stimulus is applied.

That the former depend on intensity of the stimulus, the latter on the extent of surface to which it is applied.

That the power of the blood-vessels, like that of the heart, is independent of the nervous system, though they may be influenced through that system, as the heart is.

That the actions thus excited are regular, as those of the heart, and that their power, like that of the heart, may be destroyed through the nervous system.

*On the Fire-damp of Coal Mines, and on Methods of lighting the Mines so as to prevent its Explosion.* By Sir H. Davy, LL.D. F.R.S. V.P.R.I. Read November 9, 1815. [*Phil. Trans.* 1816, p. 1.]

The great sources of fire-damp in coal mines are blowers or fissures from which currents of this inflammable gas issue in considerable quantities and for a long series of years; but there is also a certain quantity produced by the workings. The author was informed by Mr. Hodgson, that if a cask be filled with a quantity of recently pounded coal, and a small aperture be made in it, inflammable gas will issue from the aperture.

In several specimens of fire-damp which the author has analysed, the inflammable part was the same in all; in some instances mixed with a small quantity of common air, in others with azote and carbonic acid. The purest contained only  $\frac{1}{13}$ th of atmospheric air. One measure of this gas required nearly two measures of oxygen for its combustion, and formed nearly one measure of carbonic acid.

Sulphur heated in this gas decomposed it, forming sulphuretted hydrogen, and precipitating charcoal.

This gas, when mixed with chlorine, does not combine by exposure to light; so that it appears to contain neither olefiant gas nor hydrogen, and seems to be the same as the inflammable gas of marshes, or pure carburetted hydrogen.