and the same inference is drawn respecting the nature of the tail; for if it were sufficiently dense to be visible by reflected light alone, at the distance of 235 millions of miles, its opacity would entirely prevent our seeing stars through it.

The length of the tail is computed to have been on the 18th of October upwards of nine millions of miles.

The resemblance of this comet to a nebula during the last ten weeks of its appearance excites a suspicion in Dr. Herschel's mind, that he may possibly have classed as nebulæ other cometary bodies; but it would be a task of too many years' labour to revise his catalogue of nebulæ for the chance of discovering any deficiency of those formerly observed.

In the second part of this paper, Dr. Herschel informs us, that he has remarked a new irregularity in the apparent form of Saturn; for that in the month of June last, there was a visible protuberance of its south pole, which could not have been overlooked at the time of his former observations. This he ascribes to the refraction of light in its passage through the atmosphere of the ring, which was interposed between us and the southern hemisphere, but, passing behind the northern hemisphere, did not occasion a similar protuberance.

Hydraulic Investigations, subservient to an intended Croonian Lecture on the Motion of the Blood. *By* Thomas Young, *M.D. For. Sec. R.S.* Read May 5, 1808. [*Phil. Trans.* 1808, *p.* 164.]

In the present inquiry, Dr. Young undertakes to investigate minutely and comprehensively the motion of fluids in pipes as affected by friction; the resistance occasioned by flexure, the laws of propagation of impulses through fluids contained in elastic tubes, the magnitudes of pulsations in conical vessels, and the effect of progressive contraction along a canal;—the physiological application of the results being reserved for a future opportunity.

In the first section the friction and discharge of fluids through pipes are considered; and the author assents to the encomiums bestowed on Mr. Dubuat, by Professor Robison, and other late authors on hydraulics, for his skill in adapting a formula to express the results of numerous experiments on this subject. But since the form of his expressions is not so convenient for practice as might be wished, and fails altogether in its application to extreme cases, Dr. Young has by approximation arrived at a formula, which appears to agree fully as well as Dubuat's with Dubuat's own experiments, which accords better with those of Gerstner, and extends also with equal accuracy to all extreme cases in which the former was erroneous.

In considering the velocities of water flowing through pipes, the friction appeared to consist of two parts, one of which is most apparent in small tubes, and varies as the velocity simply, and the other as the square of the velocity.

In order to show the agreement of Dr. Young's formulæ with the results of experiments, a table is formed containing forty experiments,

taken from Dubuat and Gerstner, with some of his own, the results of which are compared with the velocities calculated according to the formulæ of Dubuat and of the author.

The next section treats of the resistance occasioned by flexure of the channel. In this case Dubuat directs the squares of the sines of the angles of flexure to be added together and multiplied by the square of the velocity, and considers the quantity thus obtained proportional to the height necessary for overcoming the resistance. But since the magnitude of this quantity is evidently dependent on the number of parts into which the angle is arbitrarily divided, the author prefers attending merely to the aggregate angle of flexure as expressed in degrees to which the resistance is proportional, but varies also inversely as the radii of curvature, or more nearly as that power of the radius which is expressed by $\frac{7}{8}$. A table which follows shows the comparative correctness of the author's formula with that of Dubuat.

Dr. Young next considers the propagation of impulses through tubes, the elasticity of which supplies the want of elasticity of the fluid contained, and admits the same mode of reasoning that is employed in the case of elastic fluids or solids; for if the elastic force of the tube be as the increase of its circumference, a certain finite height may be assigned, which would cause infinite extension, and which may be called the modular column. The velocity of an impulse at any point will be equal to half that which is due to the height of this point above the base of such a column, and hence the time of ascent of an impulse will be twice as great as that of a falling body; and if the pipe be inclined, the ascent of an impulse will bear the same relation to that of a body moving along an inclined plane.

The magnitude of diverging pulsations is next examined, and the conclusions of Euler, Lagrange, and Bernouilli, who have demonstrated that the velocity of each particle of an elastic fluid is as its distance from the centre of impulse, are supported by a new method of considering the subject.

When a wave is reflected from two surfaces distinctly opposed to each other, they evidently sustain equal pressures; and if to one of these surfaces two others be opposed converging at the acute angle, the wave will be elevated higher as it approaches the angle; and if the height be supposed in the inverse subduplicate ratio of the corresponding subtense of the angle, the pressure will then be equal to that upon the single surface opposed: and hence is an additional reason for inferring, that in all transmissions of impulses the intensity is in the inverse subduplicate ratio of the extent of parts collaterally affected, and this in conformity to the law of the ascending force; but in the case of intersecting waves, there is observed to be a paradoxical deviation, which is deserving of further consideration.

From considering the effect of bodies moving along an open canal, the author infers, that by means of a contraction moving progressively along an elastic pipe, the quantity of fluid impelled will be very

small, unless the contraction be very great in proportion to the diameter of the pipe.

A Letter on the Alterations that have taken place in the Structure of Rocks, on the Surface of the basaltic Country in the Counties of Derry *and* Antrim. *Addressed to* Humphry Davy, *Esq. Sec. R.S. By* William Richardson, *D.D.* Read March 17, 1808. [*Phil. Trans.* 1808, *p.* 187.]

The general design of this paper is to show the great distance to which the same strata may be found to extend, or to have extended, over the surface of a country, and thereby to explain the existence of small detached portions of the same species of matter at considerable distances from each other, as having been originally connected by continuity of the same material over the whole surface of the country, whatever be the present interval, and whatever be the quantity of matter which such an hypothesis supposes to have been removed.

The basaltic area which comprehends most part of the county of Antrim and a portion of Derry, appears to Dr. Richardson peculiarly favourable to such speculations, uncommonly regular in its stratification, and highly favoured by nature in the frequent exposure of the strata in their abrupt and precipitous terminations.

In the island of Rathlin, more especially, the original features are most happily displayed, and are still in good preservation.

It is in the periphery at the northern side that the sections are seen to the greatest advantage, as the perpendicular façades are often continued for miles together.

Of these façades, four are more distinguished for their grandeur and beauty than the rest,—Magilligan, Cave Hill, Fairhead, and Bengore. The two former are the extreme points of the N.W. and S.E. diagonal, and are forty miles asunder; at the summits of mountains, accessible by land. The two latter are visible only from the sea, but are more diversified and more curious in their structure.

The promontory of Bengore, which is nearest to the place of Dr. Richardson's residence, has principally engaged his attention; and the minute description of its strata forms a considerable portion of his memoir, for the purpose of showing the station which the Giant's Causeway occupies in the arrangement of the promontory, and also for the purpose of noticing several facts, which he thinks likely to throw light upon the operations performed on our globe since the *period* of its consolidation.

In the order of the description, Dr. Richardson first gives a general sketch of the promontory when approached from the west, with an account of the inclination, ascent, culmination, and dip of its strata. Of these he enumerates as many as sixteen, and observes that these are all cut perpendicularly in eleven different places by those mighty walls called in Scotland whyn dykes.

These all reach from the top of the precipice to the water, out of