http://www.geology.19thcenturyscience.org/books/1858-Whewell-HistSci/README.htm

and rupture end, and the compression and crushing begin: a point which has been called *the neutral axis*. This was pointed out by Mariotte; and the notion, once suggested, was so manifestly true that it was adopted by mathematicians in general. James Bernoulli,[2] in 1705, investigated the strength of beams on this view; and several eminent mathematicians pursued the subject; as Varignon, Parent, and Bulfinger; and at a later period, Dr. Robison in our own country.

But along with the fracture of beams, the mathematicians considered also another subject, the flexure of beams, which they undergo before they break, in virtue of their elasticity. What is the *elastic curve?*—the curve into which an elastic line forms itself under the pressure of a weight—is a problem which had been proposed by Galileo, and was fully solved, as a mathematical problem, by Euler and others.

But beams in practice are not mere lines: they are solids. And their resistance to flexure, and the amount of it, depends upon the resistance of their internal parts to extension and compression, and is different for different substances. To measure these differences, Dr. Thomas Young introduced the notion of the *Modulus of Elasticity*:[3] meaning thereby a column of the substance of the same diameter, such as would by its weight produce a compression equal to the whole length of the beam, the rate of compression being supposed to continue the same throughout. Thus if a rod of any kind, 100 inches long, were compressed 1 inch by a weight 1000 pounds, the weight of its modulus of elasticity would be 100,000 pounds. This notion assumes Hooke's law that the extension of a substance is as its tension; and extends this law to compression also.

There is this great advantage in introducing the definition of the Modulus of Elasticity,—that it applies equally to the flexure of a substance and to the minute vibrations which propagate sound, and the like. And the notion was applied so as to lead to curious and important results with regard to the power of beams to resist flexure, not only when loaded transversely, but when pressed in the direction of their length, and in any oblique direction.

But in the fracture of beams, the resistance to extension and to compression are not practically equal; and it was necessary to determine

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[2] *Opera*, ii. p. 976.

[3] Lecture xiii. The height of the modulus is the same for the same substance, whatever its breadth and thickness may be; for atmospheric air it is about five miles, and for steel nearly 1500 miles.