poſe that the crooked lever virtually concerned in the ſtrain is DAB. We muſt find the point I, which is the centre of effort of all the attractive forces, or that point where the full coheſion of AD muſt be applied, ſo as to have a mo­mentum equal to the accumulated momenta of all the variable forces. We muſt in like manner find the centre of effort *i* of the repulſive or ſupporting forces exerted by the fibres lying between A and δ.

It is plain, and the remark is important, that this laſt centre of effort is the real fulcrum of the lever, although A is the point where there is neither extenſion nor contraction ; for the lever is ſupported in the ſame manner as it the repulsions of the whole line Aδ were exerted at that point. There­fore let S repreſent the ſurface of fracture from l to D, and *f* repreſent the abſolute coheſion of a fibre at D in the inſtant of fracture. We ſhall have fS × I + i = pl, or l : I + i = fS : p, that is, the length AB is to the diſtance be­tween the two centres of effort I and z, as the abſolute cohesion of the ſection between A and D is to the relative ſtrength of the ſection.

It would be perhaps more accurate to make AI and A *i* equal to the diſtances of A from the horizontal lines paſſing through the centres of gravity of the triangles *d*AD and δAδ. It is only in this conſtruction that the points I and i are the centres of real effort of the accumulated at­tractions and repulsions. But I and *i,* determined as we have done, are the points where the full, equal, actions may be all applied, ſo as to produce the ſame momenta. The final reſults are the ſame in both caſes. The attentive and duly informed reader will see that Mr Bulfinger, in a very elaborate diſſertation on the ſtrength of beams in the *Com­ment. Petropolitan.* 1729, has committed ſeveral miſtakes in his eſtimation of the actions of the fibres. We mention this becauſe his reaſonings are quoted and appealed to as autho­rities by Muſchenbroek and other authors of note. The ſubject has been conſidered by many authors on the conti­nent. We recommend to the reader’s peruſal the very mi­nute diſcuſſions in the Memoirs of the Academy of Paris for 1702 by Varignon, the Memoirs for 1708 by Parent, and particularly that of Coulomb in the Mem. *par les Scavans Etrangers,* tom. vii.

It is evident, from what has been ſaid above, that if S and s repreſent the ſurfaces of the ſections above and below A, and if G and g are the diſtances of their centres of gravity from A, and O and o the diſtances of their centres of oſcillation, and D and *d* their whole depths, the momentum of coheſion will be (fS × G × O)/D + (fs × g × o)/d = pl.

If (as is moſt likely) the forces are proportional to the extenſions and compreſſions, the diſtances AI and Ai, which are reſpectively = (G × O)/D and (g × o)/d, are reſpectively = 1/3DA, and 1/3∆A ; and when taken together are = 1/3D∆. If, moreover, the extenſions are equal to the compreſſions in the inſtant of fracture, and the body is a rectangular priſm like a common joiſt or beam, then DA and ∆A are alſo equal ; and therefore the momentum of coheſion is fb × 1/2d × 1/3d, = fbd2/6, fbd × 1/6d = pl. Hence we obtain this analogy, “ Six times the length is to the depth as the abſolute coheſion of the ſection is to its relative ſtrength.”

Thus we ſee that the compreſſibility of bodies has a very great influence on their power of withſtanding a tranſverſe ſtrain. We ſee that in this moſt favourable ſuppoſition of equal dilatations and compreſſions, the ſtrength is reduced to one half of the value of what it would have been had the body been incompressible. This is by no means obvious ; for it does not readily appear how compreſſibi­lity, which does not diminiſh the coheſion of a ſingle fibre, ſhould impair the ſtrength of the whole. The reaſon, however, is ſufficiently convincing when pointed out. In the inſtant of fracture a ſmaller portion of the ſection is actually exerting coheſive forces, while a part of it is only ſerving as a fulcrum to the lever, by whoſe means the ſtrain on the ſection is produced. We ſee too that this diminution of ſtrength does not ſo much depend on the ſenſible compreſſibility, as on its proportion to the dilatability by equal forces. When this proportion is ſmall, A∆ is ſmall in compariſon of AD, and a greater portion of the whole fibre is exerting attractive forces. The experiments already mentioned of Du Hamel de Monceau on battens of willow ſhow that its compreſſibiiity is nearly equal to its di­latability. But the caſe is not very different in tempered ſteel. The famous Harriſon, in the delicate experiments which he made while occupied in making his longitude watch, diſcovered that a rod of tempered ſteel was nearly as much diminished in its length as it was augmented by the ſame external force. But it is not by any means certain that this is the proportion of dilatation and compreſſion which obtains in the very inſtant of fracture. We rather imagine that it is not. The forces are nearly as the dilata­tions till very near breaking ; but we think that they dimi­niſh when the body is just going to break. But it ſeems certain that the forces which reſiſt compreſſion increaſe faſter than the compreſſions, even before fracture. We know inconteſtably that the ultimate reſiſtances to compreſſion are inſuperable by any force which we can employ. The re­pulſive forces therefore (in their whole extent) increaſe faſter than the compreſſions, and are expreſſed by an aſſymptotic branch of the Boſcovician curve formerly explained. It is therefore probable, especially in the more ſimple substances,that they increaſe faſter, even in ſuch compreſſions as fre­quently obtain in the breaking of hard bodies. We are diſpoſed to think that this is always the caſe in ſuch bodies as do not fly off in ſplinters on the concave side ; but this muſt be understood with the exception of the permanent changes which may be made by compreſſion, when the bo­dies are crippled by it. This always mcreaſes the compreſſion itself, and cauſes the neutral point to ſhift ſtill more to­wards D. The effect of this is ſometimes very great and fatal.

Experiment alone can help us to diſcover the proportion between the dilatability and compreſſibility of bodies. The ſtrain now under conſideration ſeems the beſt calculated for this reſearch. Thus if we find that a piece of wood an inch ſquare requires 12,000 pounds to tear it aſunder by a direct pull, and that 200 pounds will break it tranſverſely by act­ing 10 inches from the ſection of fracture, we muſt con­clude that the neutral point A is in the middle of the depth, and that the attractive and repulſive forces are equal. Any notions that we can form of the conſtitution of ſuch fibrous bodies as timber, make us imagine that the *ſenſible* compressions, including what ariſes from the bending up of the compreſſed fibres, is much greater than the real corpuſcular ex­tenſions. One may get a general conviction of this unexpected proposition by reflecting on what muſt happen du­ring the fracture. An undulated fibre can only be drawn ſtraight, and then the corpuſcular extenſion begins ; but it may be bent up by compreſſion to any degree, the corpuſ­cular compreſſion being little affected all the while. This obſervation is very important ; and though the forces of corpuſcular repulsion may be almost inſuperable by any com­preſſion that we can employ, a s*ensible* compreſſion may be produced by forces not enormous, sufficient to cripple the beam. Of this we ſhall ſee very important inſtances after­wards.