

in order to bring a bone at *p*, Fig. 39, down to the point *q*, the two muscles *A* and *B*, extending from the fixed points *M* and *N* may be employed; for as they exert forces in the directions *p M* and *p N*, there will result a force in the intermediate direction *p o*: and the effect desired will be accomplished more quickly, and with a smaller extent of contraction in the muscles producing it, than if the same power had been applied by means of a straight muscle in the direction *p o*.* It is by means of two sets of muscles, acting thus obliquely, that the ribs are brought in closer approximation every time that the chest is elevated in breathing. Thus carefully does nature dispose the muscular fibres so as to obviate the necessity of their being contracted beyond a certain extent: and thus does she economize, as much as possible, the expenditure of muscular power, wherever there is a constant call for its exertion.

The principle which I have just explained, whereby certain advantages result from the obliquity of the action of muscular fibres, is applied, not only to the entire muscle, but also to the internal arrangement of its fibres. Thus, we generally find that, in a flat muscle, its upper and under surfaces are covered by a thin sheet of fibrous texture, or thin expansion of ligament or tendon; and that the muscular fibres which are attached to them are directed obliquely from the one to the other, in the manner represented by the section, Fig. 40. There is frequently a middle tendinous layer interposed between those that are on the surface (as shown in Fig. 41,) in which case the muscular fibres pass obliquely from the former to the latter, but in different directions on each side; like the fibres proceeding from the shaft of a pen. A muscle thus constructed has accordingly been termed a *penniform muscle*; as is exemplified in the straight muscle inserted into the knee-pan (the *rectus extensor cruris*,) and also in the muscle which bends the great toe (the *flexor pollicis pedis longus*.) The arrangement first described, Fig. 40, forms the *semi-penniform muscle*; an instance of which occurs in the muscle of

* See a paper by Dr. Monro, in the Transactions of the Royal Society of Edinburgh. Vol. iii. p. 250.