fourth, and fifth articular depressions.[1] It affords attachment on either side to the sternal origin of the Pectoralis major. At the junction of the third and fourth pieces of the body is occasionally seen an orifice, the **sternal foramen**, of varying size and form. The **posterior surface**, slightly concave, is also marked by three transverse lines, less distinct, however, than those in front; from its lower part, on either side, the Transversus thoracis takes origin.

Borders.—The **superior border** is oval and articulates with the manubrium, the junction of the two forming the **sternal angle** (*angulus Ludovici*[2]). The **inferior border** is narrow, and articulates with the xiphoid process. Each **lateral border** (Fig. 117), at its superior angle, has a small facet, which with a similar facet on the manubrium, forms a cavity for the cartilage of the second rib; below this are four angular depressions which receive the cartilages of the third, fourth, fifth, and sixth ribs, while the inferior angle has a small facet, which, with a corresponding one on the xiphoid process, forms a notch for the cartilage of the seventh rib. These articular depressions are separated by a series of curved interarticular intervals, which diminish in length from above downward, and correspond to the intercostal spaces. Most of the cartilages belonging to the true ribs, as will be seen from the foregoing description, articulate with the sternum at the lines of junction of its primitive component segments. This is well seen in many of the lower animals, where the parts of the bone remain ununited longer than in man.

Xiphoid Process (*processus xiphoideus; ensiform or xiphoid appendix*).—The xiphoid process is the smallest of the three pieces: it is thin and elongated, cartilaginous in structure in youth, but more or less ossified at its upper part in the adult.

Surfaces.—Its **anterior surface** affords attachment on either side to the anterior costoxiphoid ligament and a small part of the Rectus abdominis; its **posterior surface**, to the posterior costoxiphoid ligament and to some of the fibers of the diaphragm and Transversus thoracis, its **lateral borders**, to the aponeuroses of the abdominal muscles. Above, it articulates with the lower end of the body, and on the front of each superior angle presents a facet for part of the cartilage of the seventh rib; below, by its pointed extremity, it gives attachment to the linea alba. The xiphoid process varies much in form; it may be broad and thin, pointed, bifid, perforated, curved, or deflected considerably to one or other side.

Structure.—The sternum is composed of highly vascular cancellous tissue, covered by a thin layer of compact bone which is thickest in the manubrium between the articular facets for the clavicles.

Ossification.—The sternum originally consists of two cartilaginous bars, situated one on either side of the median plane and connected with the cartilages of the upper nine ribs of its own side. These two bars fuse with each other along the middle line to form the cartilaginous sternum which is ossified from *six* centers: one for the manubrium, four for the body, and one for the xiphoid process (Fig. 118). The ossific centers appear in the intervals between the articular depressions for the costal cartilages, in the following order: in the manubrium and first piece of the body, during the sixth month; in the second and third pieces of the body, during the seventh month of fetal life; in its fourth piece, during the first year after birth; and in the xiphoid process, between the fifth and eighteenth years. The centers make their appearance at the upper parts of the segments, and proceed gradually downward.[3] To these may be added the occasional existence of two small episternal centers, which make their appearance one on either side of the jugular notch; they are probably vestiges of the episternal bone of the monotremata and lizards. Occasionally some of the segments are formed from more than one center, the number and position of which vary (Fig. 120). Thus, the first piece may have two, three, or even six centers. When two are

[1] Paterson (The Human Sternum, 1904), who examined 524 specimens, points out that these ridges are altogether absent in 26.7 per cent.; that in 69 per cent. a ridge exists opposite the third costal attachment; in 39 per cent. opposite the fourth; and in 4 per cent. only, opposite the fifth.

[2] Named after the French surgeon Antoine Louis, 1723–1792. The Latin name *angulus Ludovici* is not infrequently mistranslated into English as "the angle of Ludwig."

[3] Out of 141 sterna between the time of birth and the age of sixteen years, Paterson (*op. cit.*) found the fourth or lowest center for the body present only in thirty-eight cases—*i. e.*, 26.9 per cent.