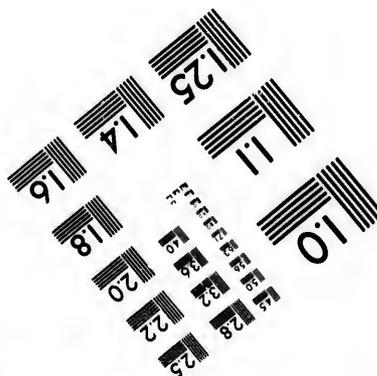
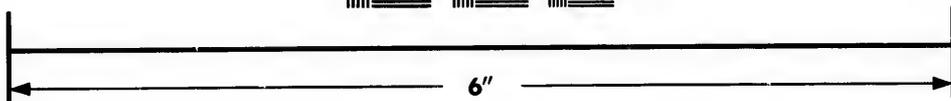
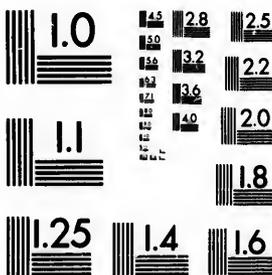


**IMAGE EVALUATION
TEST TARGET (MT-3)**



**Photographic
Sciences
Corporation**

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

**CIHM/ICMH
Microfiche
Series.**

**CIHM/ICMH
Collection de
microfiches.**



Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

© 1985

Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- Coloured covers/
Couverture de couleur
- Covers damaged/
Couverture endommagée
- Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée
- Cover title missing/
Le titre de couverture manque
- Coloured maps/
Cartes géographiques en couleur
- Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)
- Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur
- Bound with other material/
Relié avec d'autres documents
- Tight binding may cause shadows or distortion
along interior margin/
La reliure serrée peut causer de l'ombre ou de la
distorsion le long de la marge intérieure
- Blank leaves added during restoration may
appear within the text. Whenever possible, these
have been omitted from filming/
Il se peut que certaines pages blanches ajoutées
lors d'une restauration apparaissent dans le texte,
mais, lorsque cela était possible, ces pages n'ont
pas été filmées.
- Additional comments:/
Commentaires supplémentaires:

- Coloured pages/
Pages de couleur
- Pages damaged/
Pages endommagées
- Pages restored and/or laminated/
Pages restaurées et/ou pelliculées
- Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées
- Pages detached/
Pages détachées
- Showthrough/
Transparence
- Quality of print varies/
Qualité inégale de l'impression
- Includes supplementary material/
Comprend du matériel supplémentaire
- Only edition available/
Seule édition disponible
- Pages wholly or partially obscured by errata
slips, tissues, etc., have been refilmed to
ensure the best possible image/
Les pages totalement ou partiellement
obscurcies par un feuillet d'errata, une pelure,
etc., ont été filmées à nouveau de façon à
obtenir la meilleure image possible.

Pagination as follows : [311] - 319 p.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	14X	18X	22X	26X	30X
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12X	16X	20X	24X	28X	32X

The copy filmed here has been reproduced thanks to the generosity of:

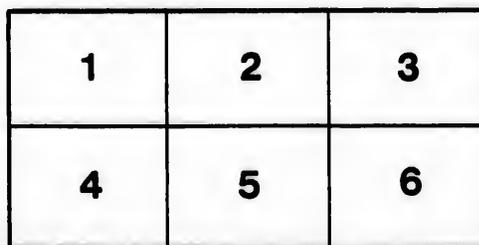
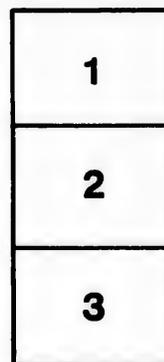
Medical Library
McGill University
Montreal

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol \rightarrow (meaning "CONTINUED"), or the symbol ∇ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

Medical Library
McGill University
Montreal

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole \rightarrow signifie "A SUIVRE", le symbole ∇ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.



o
M
a
b
t
f
a
a
in
in
th
fr
in

m
re
th
sp

A
v
si

si
M
o
re

THE *MUSCULUS STERNALIS* AND ITS OCCURRENCE
IN (HUMAN) ANENCEPHALOUS MONSTERS. By
FRANCIS J. SHEPHERD, M.D., C.M., *Professor of Anatomy*
in McGill University, Montreal. (PLATE XV.)

AT the meeting of the British Association held last summer in Montreal, Professor D. J. Cunningham, of Dublin, read a paper on "The Value of Nerve-Supply in the Determination of Muscular Anomalies," in which he stated his belief that the *musculus sternalis* belonged to the pectoral group—in fact, was an aberrant portion of the *pectoralis major*, as recently suggested by Mr Abraham, of Dublin.¹ Professor Cunningham had traced the nerve-supply² of the *musculus sternalis* in five cases, and found that it came from the internal anterior thoracic nerve, a proof he thought that it belonged to the pectoral group. He also threw out the suggestion that this might possibly be a new inspiratory muscle antagonistic to the *triangularis sterni* appearing in man (for it acted when well developed as an elevator of the ribs), and stated his impression to be that it occurred more frequently in females, as costal inspiration is more pronounced in women than in men.

In the discussion which followed, both Dr G. E. Dobson and myself held that the *musculus sternalis* was most likely a remnant of the *panniculus carnosus*. Dr Dobson considered that the *sterno-cuticularis* muscle of the hedgehog closely corresponded to the *musculus sternalis*.

Professor Cunningham also mentioned in his paper that Mr Abraham had recently found the *musculus sternalis* to occur very commonly in anencephalous monsters, as he had seen it in six out of eleven specimens examined.

Since the meeting of the British Association I have examined six anencephalous monsters which are in the museum of the Medical School of McGill University, and have found in each one a well-marked example of the *musculus sternalis*. My recent dissections of these monsters has had the effect of changing

¹ *Trans. Acad. Medicine in Ireland*, vol. i., 1883.

² *Jour. Anat. and Phys.*, January 1884.

my previous views in regard to the homology of this muscle. I have been convinced that it does not belong to the panniculus group, but very probably should be classed with the pectoral group for the following reasons:—

1. In seven out of the nine muscles found in these monsters (three had double muscles) the nerve-supply was furnished by the anterior thoracic; one of these seven, however, in addition, received a small branch from one of the intercostal. In the other two muscles, occurring in the same foetus, I was unable to satisfactorily make out the nerve-supply, but am inclined to believe it came from the anterior thoracic (Case III.).

2. In three the fibres of the abnormal muscles were continuous with those of the greater pectoral (figs. 1, 2, 6), and in one (fig. 5) the fibres pierced the greater pectoral.

3. In several the insertion of the *musculus sternalis* was covered by the *pectoralis major*, and the origin was in common with the upper sternal fibres of the *pectoralis major* (figs. 1, 4, 6).

4. The greater pectoral was deficient on the side on which the *musculus sternalis* was present in eight cases (figs. 1, 2, 3, 5, 6).

5. In one (Case VI.) the right *platysma myoides* was well developed, and passed some distance below the clavicle. It was separated from the *musculus sternalis* of that side by fascia and a thick layer of fat, and was on a plane quite superficial to the *musculus sternalis*.

In all the cases except one (fig. 3) the abnormal muscle was quite large and well developed, and had an attachment to the sternum and costal cartilages. The majority of the muscles were triangular in shape, though some were fusiform. In the last three dissected I had no difficulty in tracing the nerve-supply, as the nerve was always found passing along the interval which existed between the two portions of the greater pectoral, thence over the *pectoralis minor*, through the costo-coracoid membrane, to the internal anterior thoracic nerve. The nerve always entered the muscle on its deep surface. In three of the subjects the muscles were continuous with the sternal insertion of the *sterno-mastoid* (figs. 1, 2, 4). In two a portion of the muscle blended with the aponeurosis of the external abdominal oblique.

I do not propose in this paper to discuss all the various views that have been held in regard to the homology of the musculus sternalis, as this has already been ably done by Professor Turner¹ and others; but I might mention that Professor Bardeleben² has advanced the theory that some of these muscles belong to the sterno-mastoid, and are supplied by the intercostal nerves, whilst others should be classed with the pectoral group, because they receive their nerve-supply from the anterior thoracic. Malbrane's² observations agree with Bardeleben's, for in two living subjects he found the musculus sternalis standing out quite perceptibly under the skin.

In the first case faradisation of the intercostal nerves brought the muscle into action, but in the second it failed; but when faradisation of the thoracic nerves was employed, the muscle responded immediately.³

M. Testut⁴ holds that the musculus sternalis (pre-sternal) is in its upper part an appanage of the sterno-mastoid, and in its lower belongs to the external abdominal oblique. He says these muscles (sterno-mastoid and external abdominal oblique) are in the same muscular plane, and that the musculus sternalis is the remnant in man of the old connection which formerly existed between the two—a connection which exists in serpents.

As I said above, I feel disposed to consider the musculus sternalis as belonging to the pectoral group, and await further light to determine its proper morphological significance. In some of my cases it appeared to take the place of the absent portion of the greater pectoral, and where the muscle was well developed would act as an elevator of the ribs.

As to its occurrence in anencephalous monsters, I am unable to afford any explanation. As far as I can judge from the six specimens I have examined, it appears to be the normal condition. There seems to be great variety of origin, insertion, size, and shape of these muscles, no two being exactly alike. The fact that this muscle occurs so commonly in the brainless monsters would point rather to its being a rudiment than a new

¹ *Jour. of Anat. and Phys.*, vol. i. p. 246.

² Quoted by Testut in *Les Anomalies Musculaires chez l'homme*, 1884.

³ In Case III. in my series the muscle was supplied by both intercostal and anterior thoracic nerves.

⁴ *Les Anomalies Musculaires chez l'homme*, p. 84.

muscle appearing in man. For it is in these cases of arrest of development we should expect to find reversions, rudiments, and anomalies. On the other hand, no arrangement of any existing pectoral group resembles that found in these brainless monsters.

The proportion of female anencephalous monsters is very large in my series—five out of six are females; and as far as I can learn it is rather the exception for an anencephalous monster to be of the male sex.

The cases described in detail are as follows:—

CASE I. (fig. 1). *Female fetus, full term. Anencephalous. Musculus sternalis unilateral. Left.*

The musculus sternalis in this specimen is of large size, and arises from the fascia over the first piece of the sternum by a flat tendon, which is continuous above with the sternal origins of both sterno-mastoid muscles, and on the right side is connected with the muscular fibres of the greater pectoral arising from the manubrium. From this origin the muscle passes downwards and outwards to the left side, expanding as it descends into a large fusiform muscle, which is inserted into the whole of the fourth left costal cartilage and into the side of the sternum opposite the fifth and sixth cartilages; the innermost portion of the muscle is prolonged downwards over the lower part of the greater pectoral, and ends in the aponeurosis of the external oblique muscle of the abdomen.

The abnormal muscle lies on the sternum and costal cartilages, and has only a few of the deeper fibres of the greater pectoral beneath it. Above, on the outer edge, some muscular fibres came off from the musculus sternalis, and passing outwards form part of the greater pectoral muscle.

The nerve supplying the muscle enters its under surface about half-way down the muscle; it can be traced outwards through a cellular interval in the greater pectoral, over the pectoralis minor, to its upper border, where it pierces the costo-coracoid membrane, and joins the internal anterior thoracic nerve. As it lies between the two pectorals it gives off a branch to the lower part of the great pectoral.

CASE II. (fig. 2). *Female fetus. Anencephalous, with spina bifida of cervical and upper dorsal regions. Musculus sternalis bilateral.*

The two muscles have a common origin from the first piece of the sternum, which is continuous above with the sternal portions of both sterno-mastoid muscles. The *left* muscle, smaller than the right, consists of a flat narrow band of muscular fibres, which pass down from the common origin to be inserted into the third left costal cartilage and side of the sternum. At its insertion it is covered by the fibres of the lower segment of the greater pectoral. The *right* muscle is large and flat, and, besides the origin common to it and its fellow, is attached to the sternum opposite the second and third costal cartilages. It divides into three sets of muscular fibres—the outer inserted into the upper border of the lower segment of the pectoralis major, the middle continuous with the fibres of that muscle, and the inner inserted into the lower end of the sternum and upper part of the ensiform cartilage. On both sides a triangular portion of the greater pectoral is absent; the spaces thus left are partly covered by the abnormal muscles. This space is longer on the left than the right side. In this fetus, owing to its very friable condition, I was unable satisfactorily to trace the nerve-supply of these abnormal muscles, but am inclined to believe that the nerve-supply comes from the anterior thoracic, as on each side I traced a branch from the anterior thoracic over the lesser pectoral to the triangular interval between the two segments of the great pectoral, but there I lost it.

CASE III. (fig. 3).—*Female fetus. Anencephalous with spina bifida of cervical region. Musculus sternalis unilateral. Left side.*

In this case the abnormal muscle consists of a small fusiform slip which arises from the sternum opposite the second costal cartilage by a thin aponeurosis, passes down over the left greater pectoral a little outside the sternum, and finally expands into a broad aponeurosis, which blends with the fascia over the external abdominal oblique. It receives its nerve supply from two sources. The larger nerve, which enters the middle of the muscle, can be traced through the greater pectoral over the lesser pectoral, and through the costo-coracoid membrane to the

internal anterior thoracic. The smaller enters the muscle nearer its upper end, and can be traced through the intercostal space to the third intercostal nerve. Both nerves supply the muscle from its deep surface. This is the only case where a branch from the intercostal could be traced to the muscle itself. In several of the other cases the intercostal nerves pierced the muscle, but gave no branches to it. No portion of the greater pectoral is absent in this case.

CASE IV. (fig. 4).—*Male foetus. Anencephalous with spina bifida of cervical region. Musculus sternalis unilateral. Left.*

The abnormal muscle in this foetus is of large size, flat and triangular, arises by a tendon from the manubrium, in common with the upper sternal portion of the right pectoralis major and the sternal portion of the left sterno-mastoid with which its left border is continuous. As it passes down to the left it soon expands into a broad muscle which is inserted into the third costal cartilage. At its insertion it is covered by the fibres of the pectoralis major. Its inner edge is prolonged downwards over the lower portion of the last mentioned muscle. On the left side a triangular portion of the pectoralis major muscle, arising from the upper part of the sternum and costal cartilages of the second and third ribs, is wanting, the space left being partly covered by the musculus sternalis.

The nerve supplying the muscle can be seen crossing the triangular interval, and can be traced, as in the other cases, to the anterior thoracic.

CASE V. (fig. 5).—*Female foetus. Anencephalous in spina bifida. Musculus sternalis bilateral.*

Both muscles arise in common with the upper sternal fibres of the pectoralis major from the manubrium, and diverge from each other as they descend.

The *left* muscle passes down over the sternum and left costal cartilage, and is inserted into the fourth costal cartilage near the sternum. It is a flat triangular muscle of considerable size. Continuous with its lower fibres, and running along its inner edge, is a small muscular slip which has an attachment above by a round tendon to the middle of the sternum, passes over the

lower part of the greater pectoral, and is inserted into the fascia covering that muscle. A large portion of the central part of the pectoralis major is absent, the space left, as in the other cases, being partly covered by the abnormal muscle. The nerve supplying the muscle crosses this vacant interval, and can be traced, as in the other cases, to the internal anterior thoracic.

The *right* muscle goes down and out from the common origin, and soon divides into two slips, the outer of which, after piercing some fibres of the greater pectoral, is lost in the fascia covering that muscle. The inner slip continues down immediately to the right of the sternum, and ends in a tendinous expansion which is inserted into the fascia of the lower part of the pectoral muscle. On this side also the portion of the great pectoral is deficient which arises from the second and third costal cartilages and the corresponding portion of the sternum. The nerve can be traced crossing the triangular interval, and under the upper segment of the greater pectoral to join the anterior thoracic above the lesser pectoral.

CASE VI. (fig. 6).—*Female fetus. Anencephalous with spina bifida of cervical and upper dorsal regions. Musculus sternalis bilateral.*

The muscles of the two sides have a common origin from the manubrium.

The *right* muscle, triangular in shape, is the larger. It soon becomes muscular, crosses the triangular interval caused by absence of a portion of the great pectoral, and is inserted by muscular fibres into the upper border of the lower segment of the greater pectoral, and also into the sternum opposite the fourth costal cartilage. Some of its fibres pass over the pectoral muscle and blend with it. As in the other cases, it is supplied by a branch from the internal anterior thoracic nerve, which reaches the muscle in the usual way.

The *left* muscle divides into two portions, the outer of which is the larger, flat and ribbon-shaped, passes down over the triangular interval between the upper and lower segment of the greater pectoral, and is inserted into the third costal cartilage; the inner portion has an additional origin from the second piece of the sternum. It continues down, over, and to the left side of

the sternum, developing into a fusiform-shaped muscle, which ends by dividing into two tendinous slips, one of which is inserted into the lower end of the sternum, and the other into the fascia covering the pectoralis major. The nerve-supply is, as in the other cases, furnished by a branch from the internal anterior thoracic nerve, which joins the deep surface of the muscle after pursuing the usual course across the lesser pectoral and vacant interval between the two parts of the greater pectoral. In its course a small branch is given off, which goes to the lower part of the greater pectoral.

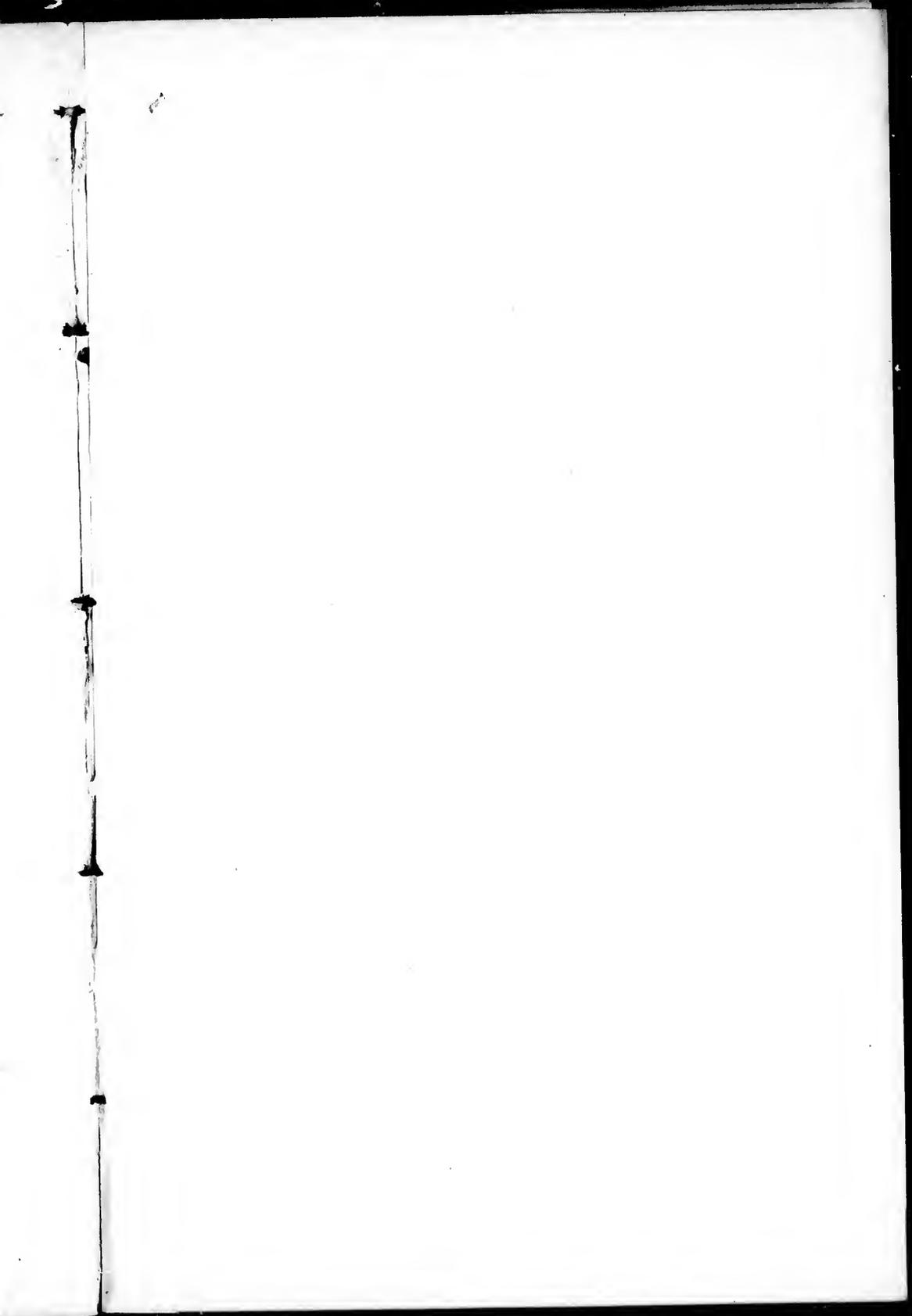
On each side there is a deficiency of the great pectoral, a triangular portion arising from the second and third costal cartilages being absent. The interval is larger on the right than the left side, and on each side is partially covered by the abnormal muscle.

In this fetus on the right side the platysma myoides is strongly developed, continues over the clavicle, and reaches for some distance below it. It is a well-developed muscle, and is separated from the musculus sternalis of that side by fascia and a thick layer of adipose tissue, so that it is on a plane quite superficial to the musculus sternalis.

Note.—I have, in adults, only seen the musculus sternalis three times¹ in three hundred subjects. Some cases, no doubt, escaped my notice, owing to the majority of the subjects having been injected through the heart, and, in consequence, the sternum having been sawn through the centre. In all the cases seen the muscle was well developed. In one case it was continuous above with the opposite sterno-mastoid, and below was attached to the cartilage of the fifth rib. In the second case it arose from the second costal cartilage, and passed down over the pectoral muscle, and ended by being inserted into the fascia covering that muscle. Some of its upper fibres intermingled with those of the platysma myoides. The subject was very thin.

In the third case the muscle was attached above and below to the fascia covering the greater pectoral. All three muscles occurred in males. Two of the muscles were on the left side and one on the right.

¹ *Annals of Anatomy and Surgery*, 1881-83.



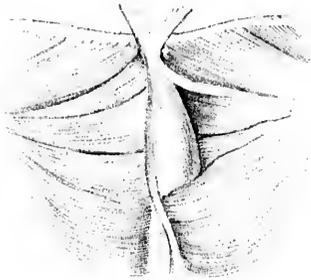


Fig. 1.

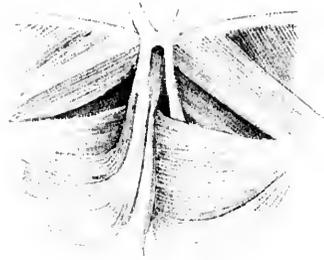


Fig. 2.



Fig. 3.

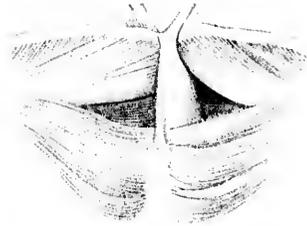


Fig. 4.



Fig. 5.



Fig. 6.

Fig.
sternu
fourth
with t
Fig.
comm
on rig
cartila
tive.
Fig
oppos
extern
thora
Fig
comm
inser
thora
Fi
uppe
pect
Mus
fron
F
side
two
apo
on l

EXPLANATION OF PLATE XV.

Fig. 1. Left musculus sternalis, arising from the first piece of sternum, and continuous with the sterno-mastoids, inserted into the fourth costal cartilage and side of sternum—a portion continuous with the left pectoral. Nerve-supply from anterior thoracic. (Female.)

Fig. 2. Double sternalis muscle, arising from manubrium, and, in common with upper fibres of great pectoral and sterno-mastoid, inserted on right side into sternum and great pectoral, on left into third costal cartilage. Sternal and costal origins of both greater pectorals defective. (Female.)

Fig. 3. A slender left musculus sternalis, arising from sternum opposite second costal cartilage, and inserted into the aponeurosis of external abdominal oblique. Supplied by a branch from anterior thoracic nerve and intercostal. (Female.)

Fig. 4. Left musculus sternalis, arising from manubrium, in common with sterno-mastoid and upper fibres of greater pectoral inserted into third costal cartilage. Nerve-supply from anterior thoracic. Left pectoralis major deficient in central part. (Male.)

Fig. 5. Double musculus sternalis, arising from manubrium, with upper fibres of greater pectoral on right side. Two slips piercing pectoral muscle, and inserted into aponeurosis covering that muscle. Muscle on left side inserted into fourth costal cartilage. Nerve-supply from anterior thoracic on both sides. (Female.)

Fig. 6. Double musculus sternalis, arising from manubrium. Right side flat muscle inserted into greater pectoral and sternum. Left side, two slips—one inserted into third costal cartilage, and other into aponeurosis of greater pectoral. Nerve-supply from anterior thoracic on both sides. Both greater pectorals defective. (Female.)

