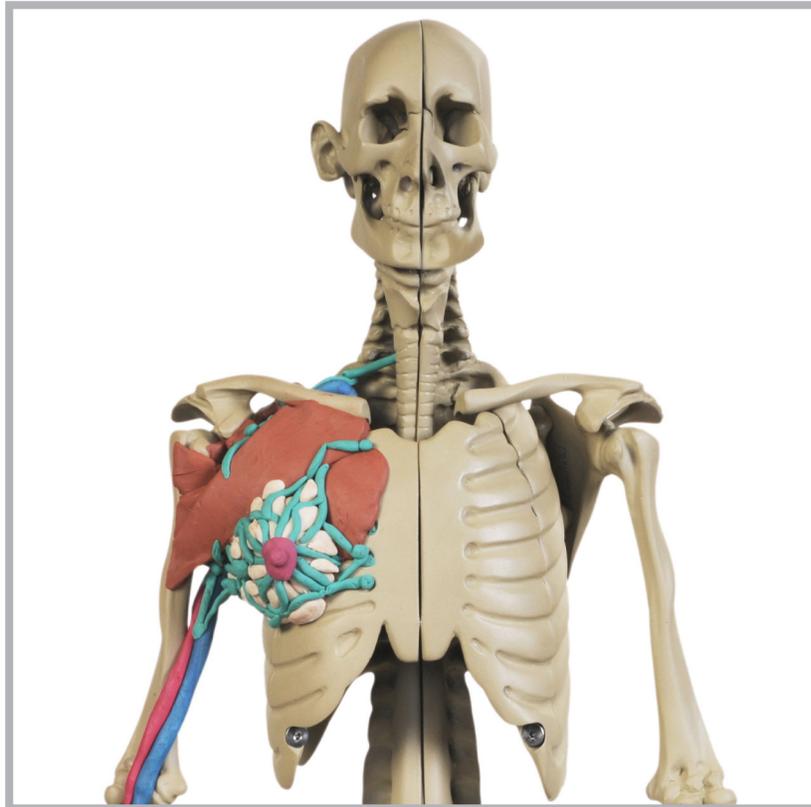


An **Anatomy in Clay®** Workbook  
*The Simplified Human Female  
Breast and Its Lymphatics*



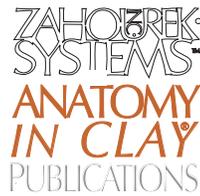
The *StepByStep™* Series

by Jon Zahourek

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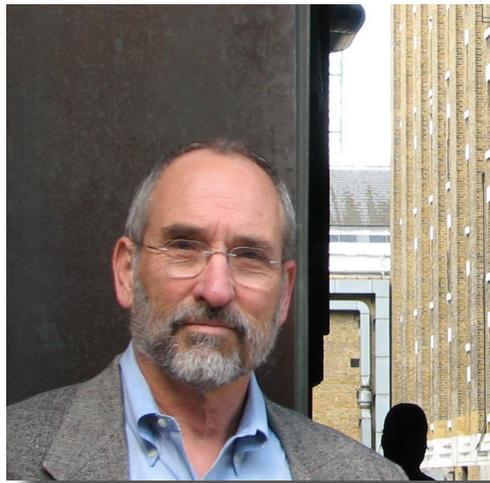


# A Workbook on *The Simplified Human Female Breast and Its Lymphatics* The StepByStep™ Series

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ZSP-0004

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Jon Zahourek is widely known as the author of an innovative and revolutionary approach to the study of anatomy, which features kinesthetic learning through building clay muscles onto the MANIKEN® model and a range of other, comparative vertebrate models. His series of CoreData™ intensive workshops are attended by participants from every continent. He has held posts at the University of Denver, Parsons School of Design, Banks Street College, New School of Social Research, Art Student League, and New York Academy of Art. With Columbia University's Department of Physical Medicine, he was co-investigator of a study in 1982-83 comparing his Anatomy In Clay® System to traditional anatomy study.

Zahourek retired from Zahourek Systems, Inc. in 2009, and now is active as Jon Zahourek, Artist & Anatomist, and as the Chairman of the Board in the not-for-profit Zoologik® Foundation and its Formative Haptics Institute, which researches the neuroscience of learning by forming analyses in the hands.

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# A Workbook for building a simplified human female breast and its accompanying lymphatics from the inside out

This StepByStep publication is intended to be used as a workbook. It presents a very simplified view of the gross anatomy of the human female breast and its lymphatic system. Just as often, those seeking to understand them are challenged as to exactly where in the body they run. This workbook is designed to help understand how all those systems work in layers and with each other. Other *StepByStep Workbooks* in this series cover those structures and can be coordinated with this one.

In following this workbook you'll build everything in simple children's plasticine clay.



muscles  
terra cotta



arteries  
red



veins  
blue



lymph system  
green



breast tissue  
beige

## Workbook Procedures

- 1 Form a simple harness consisting of arteries and veins that pass through the axilla.
- 2 Form a simple version of the lymphatic network that follows along the axillary venous system.
- 3 Form the deep and superficial pectoralis muscles. Extend the lymph ducts out from the axilla and onto these muscles.
- 4 Form and develop a simple breast. Place it onto its "footprint" on top of the pectoralis major muscle and into the armpit, contacting the main lymph nodes there.
- 5 Develop the mesh-like network of lymph vessels that serve the breast.
- 6 Form a few lymph nodes near the breast. One vital lymph structure, the sentry node, is the key element among these.

For major terms, *italics* indicates the formal latin or greek name of a key structure being built in a given step. The type of structure is indicated by a letter-form, typical in anatomy work, as listed below.

a. = artery

m. = muscle

o. = osteological feature

aa. = arteries (plural)

mm. = muscles (plural)

v. = vein

l. = ligament

n. = nerve

vv. = veins (plural)

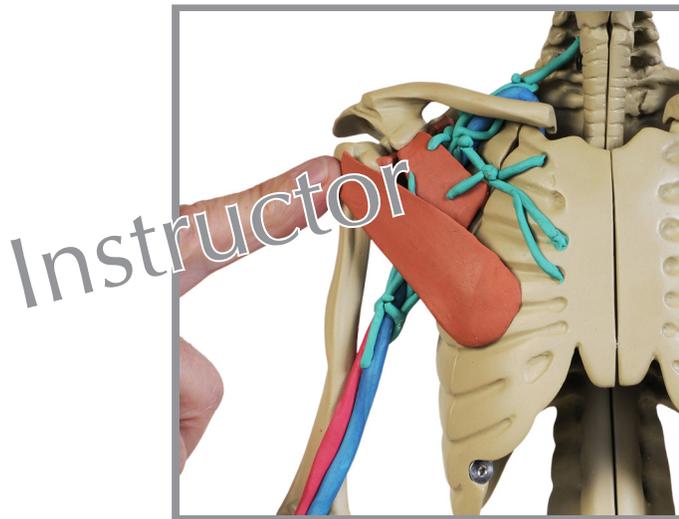
ll. = ligaments (plural)

nn. = nerves (plural)

## The two different versions of Anatomy in Clay® Publications' StepByStep™ Workbooks

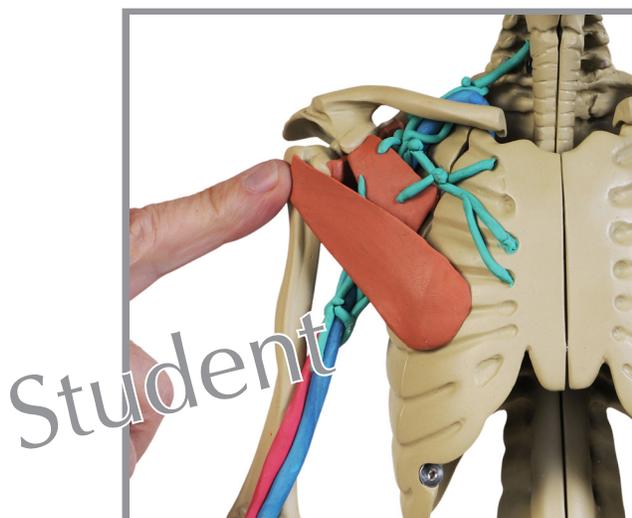
The Instructor's version includes text suggesting to the instructor how to explain what is being done in each step and why — a “script” that describes the activity. On the Student's version, there are only numerals so that he or she must pay attention to what the instructor says and not simply race through the Workbook. These numerals allow a student who has lost his place to go immediately to the step which the instructor has directed.

This allows the Instructor, if desired, to easily skip steps, omitting material when necessary. At any time during a class, the instructor may wish to jump ahead or around in the material. He can simply say, “Go to Number 51.” These numerals also make it easy for someone who has just entered the classroom — or who has lost track — to get back on track.



# 29

This is the first bundle of the *pectoralis major* m. This muscle has a deep ascending costal head. It is sometimes called the abdominal bundle.



# 29

The student's version omits the text so that a student must pay attention to the instructor for the explanations



# 1

The Maniken® models are made so that the branchial, pectoral, and pelvic subsystems can be detached from the axial subsystem. This model of the human skeleton divides into left and right sides.



# 2

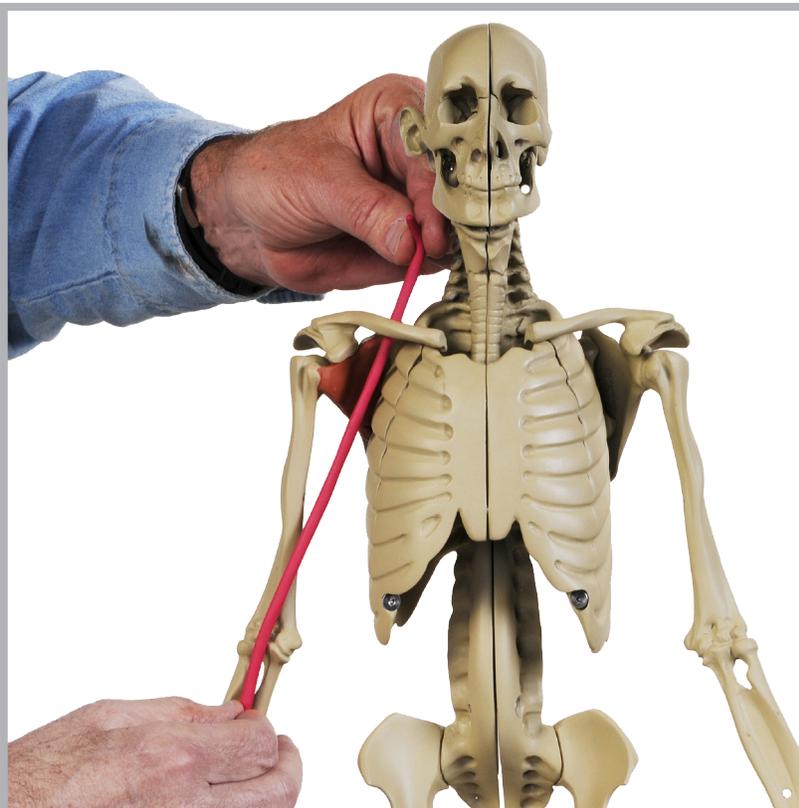
Remove the right arm assembly of the body (the pectoral subsystem).

Construct a triangle of clay to represent the *subscapularis* m. Place it on the costal surface of the scapula. The *subscapularis* m. presents the rear or dorsal wall of the axilla (or armpit).



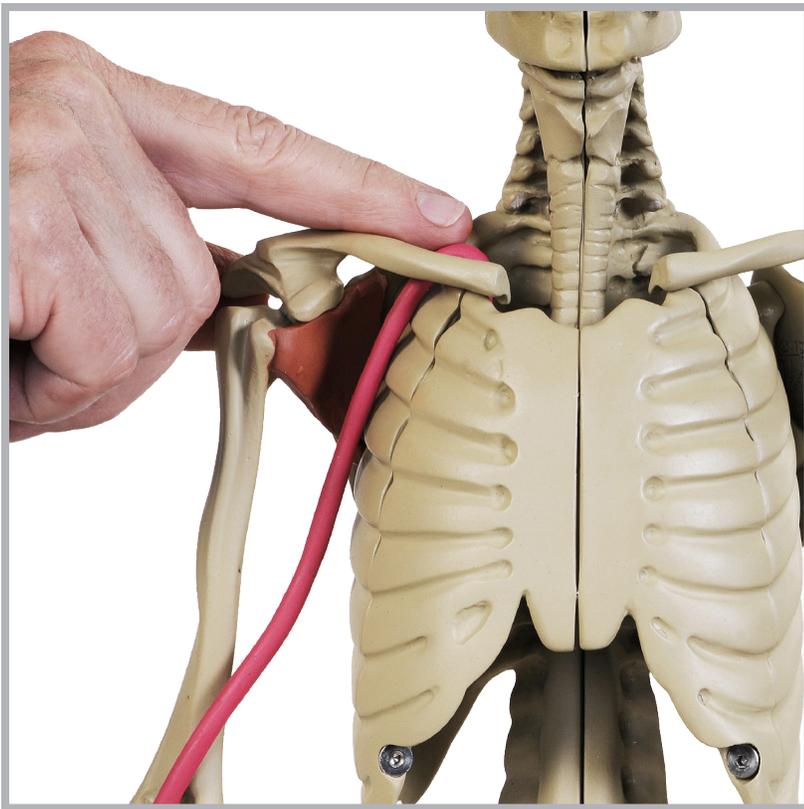
### 3

Cut off the vertebral margin of the *subscapularis* m. so that the arm will fit up to the stand-off for the pectoral subsystem. This will allow the arm assembly to be attached to the axial subsystem of the skeleton.



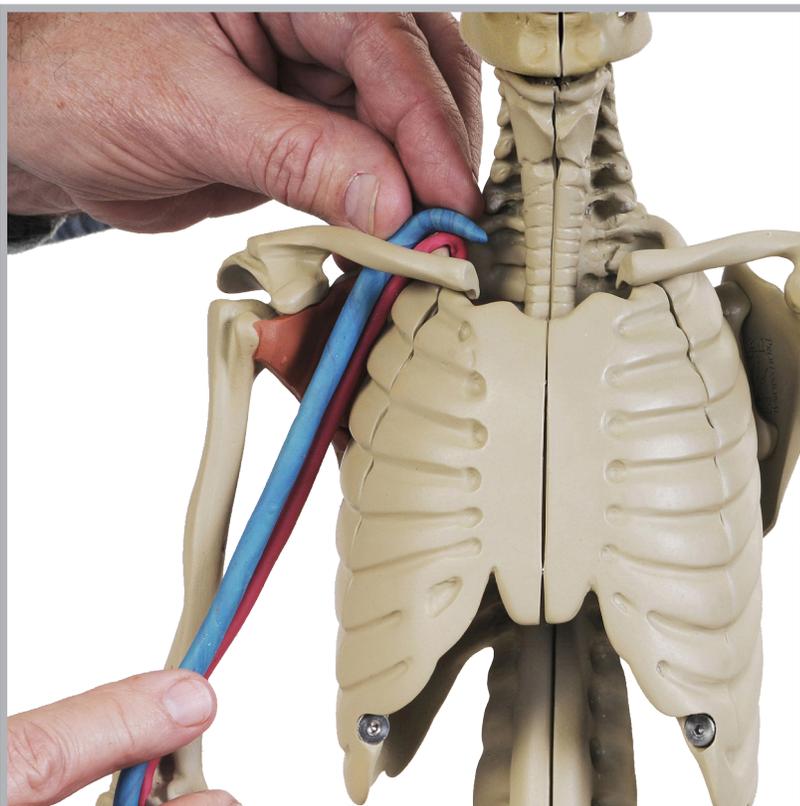
### 4

Construct the axillary part of the *brachial* a. Slip a tube of red clay (approximately 1/8" in diameter) up and under the clavicle.



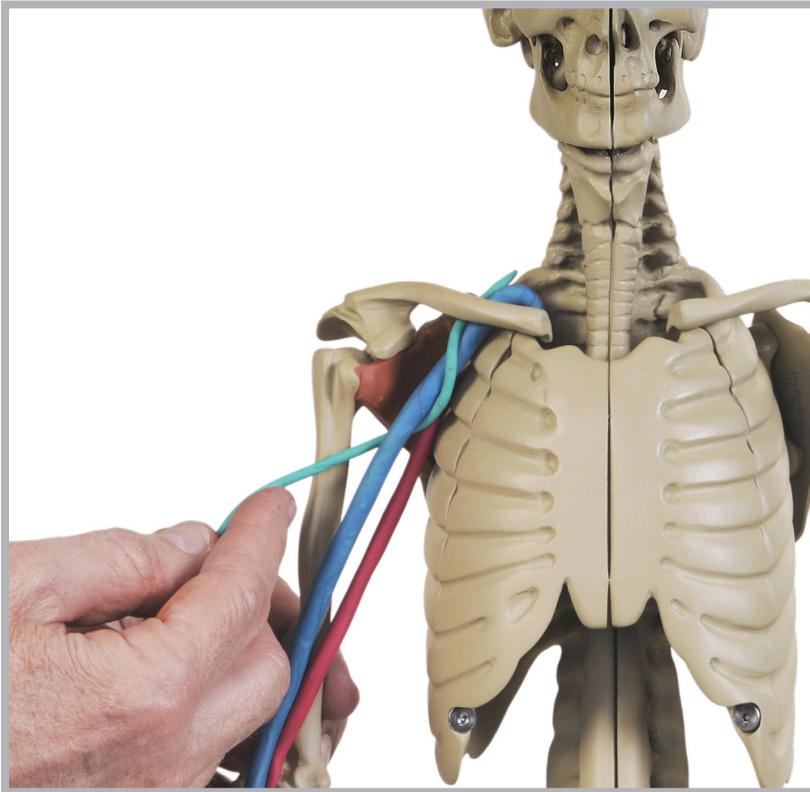
# 5

Turn the proximal end of the *brachial* a. over the first rib to create the clavicular portion of the artery.



# 6

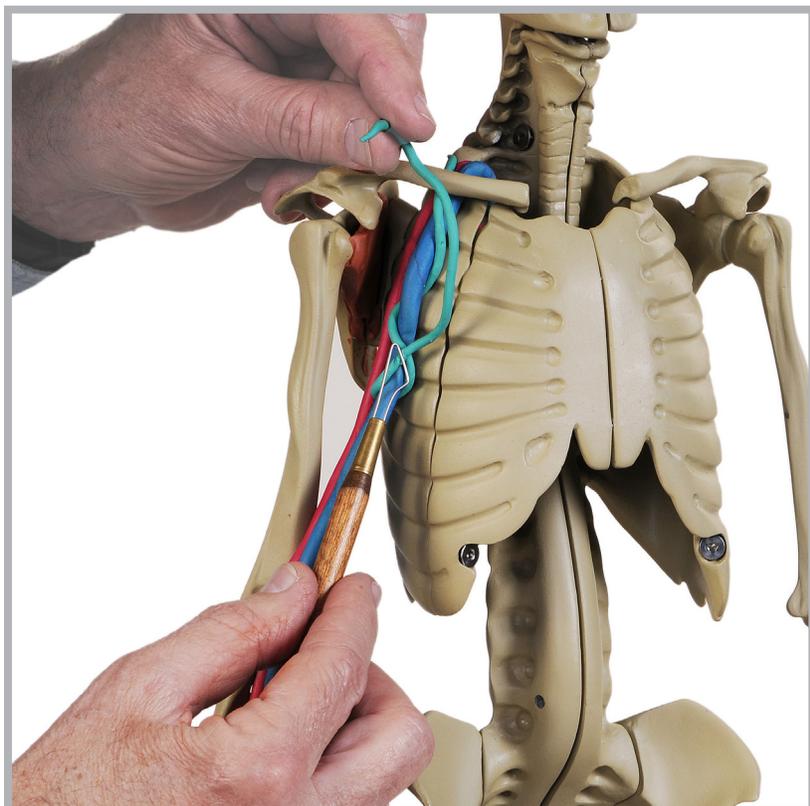
Construct the *axillary/brachial* vein out of blue clay and slip it under the clavicle and along the artery. Turn it over the first rib as well.



# 7

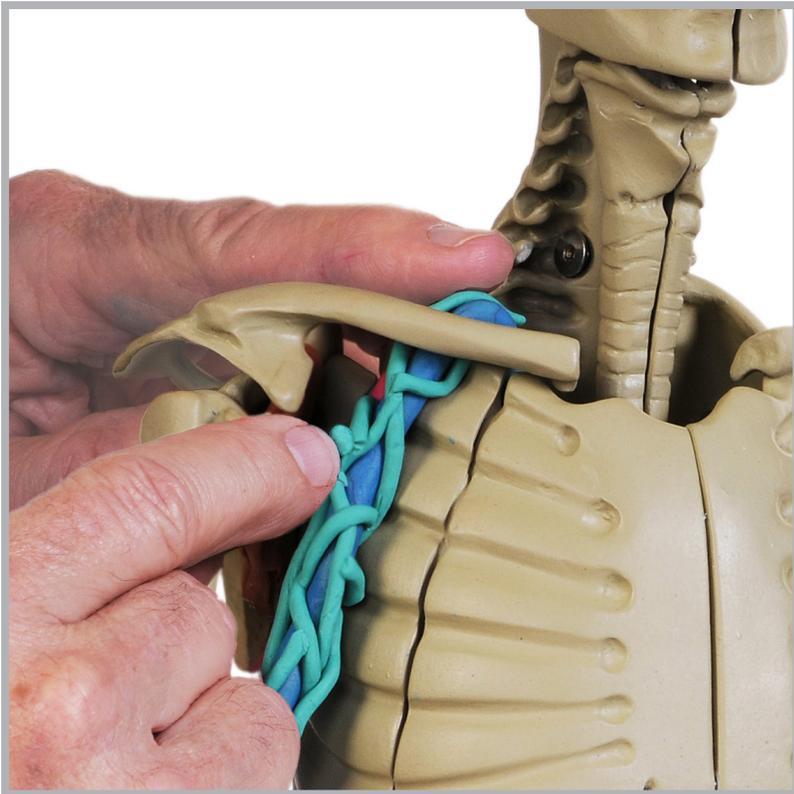
With a smaller string of green clay, wrap a series of spirals around the *axillary v.* Add several more to begin forming the mesh-like network of lymphatic vessels.

This network lies along the vein and returns the fluid of the lymph into the venous system.



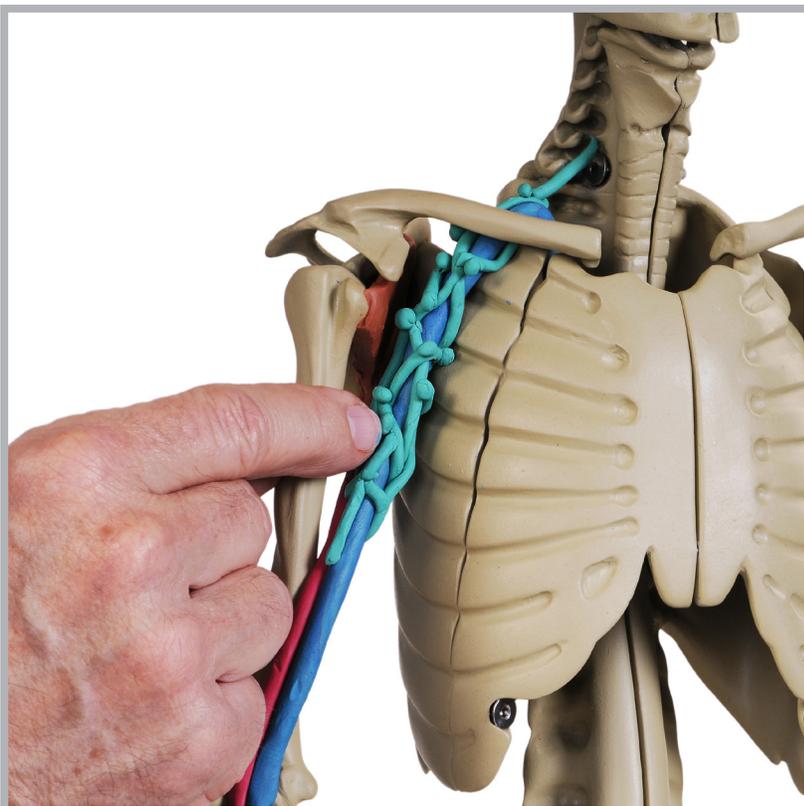
# 8

Spiral backwards and forwards to create the mesh.



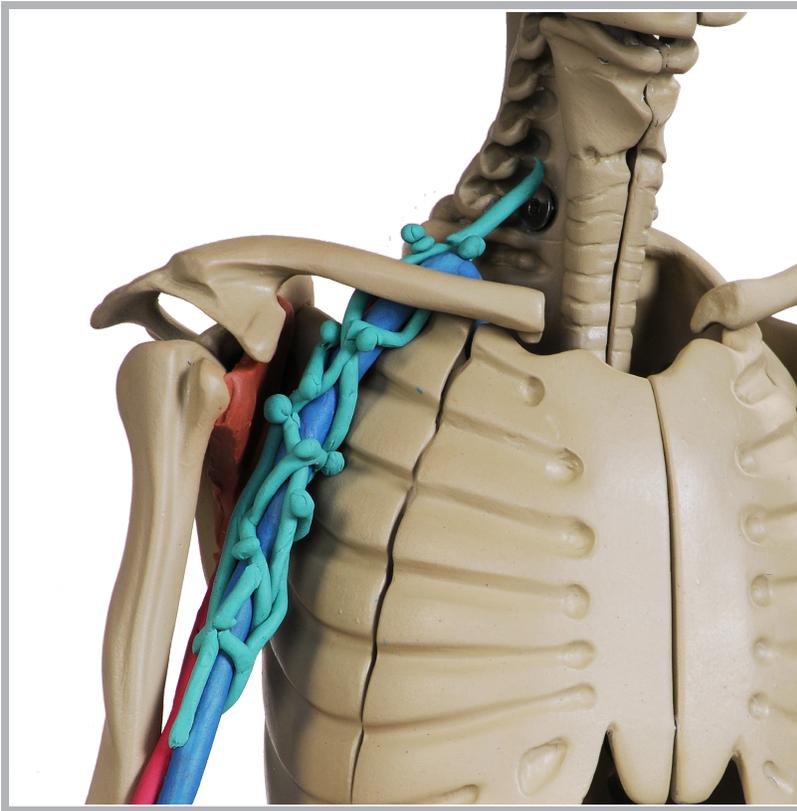
# 9

Wrap more strings around the vein, creating many intersections throughout the network.



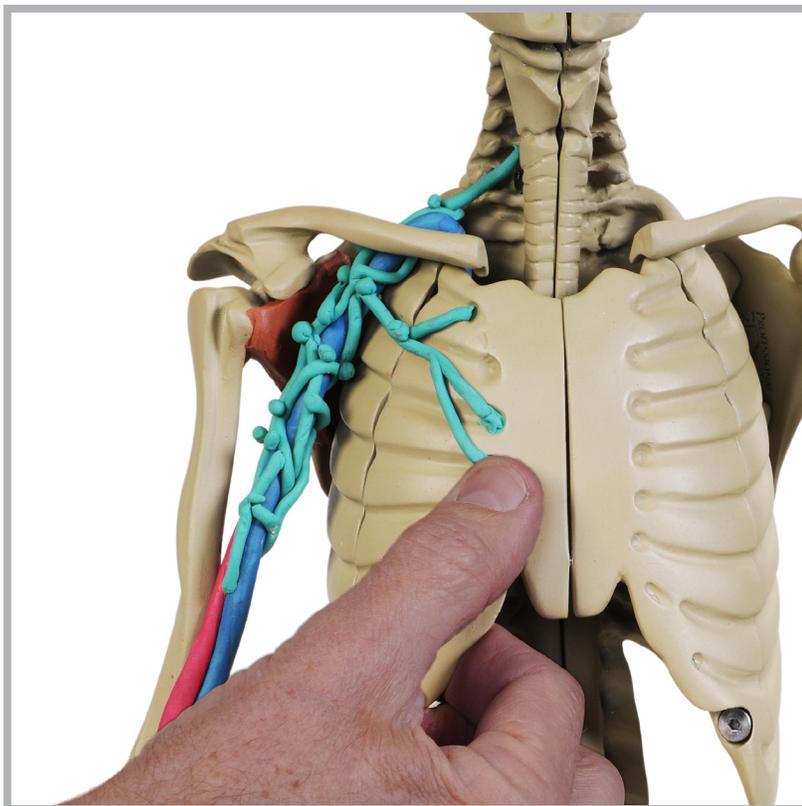
# 10

At the junctions of the pathway and at the terminals along this lymphatic mesh, add small, somewhat flattened balls of green clay to create representative lymph nodes.



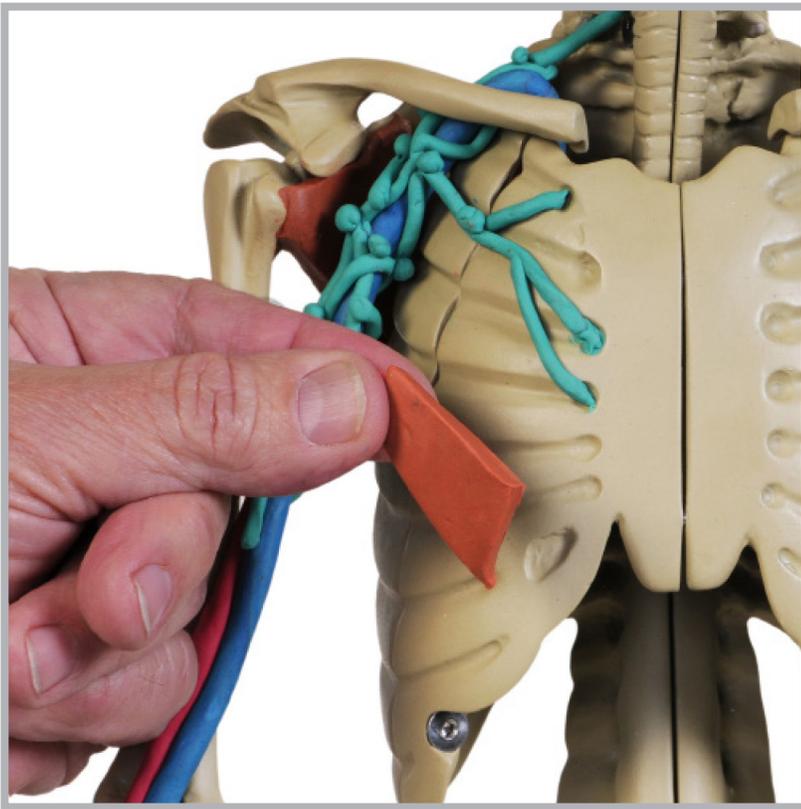
# 11

These nodes are concentrated in the axilla.



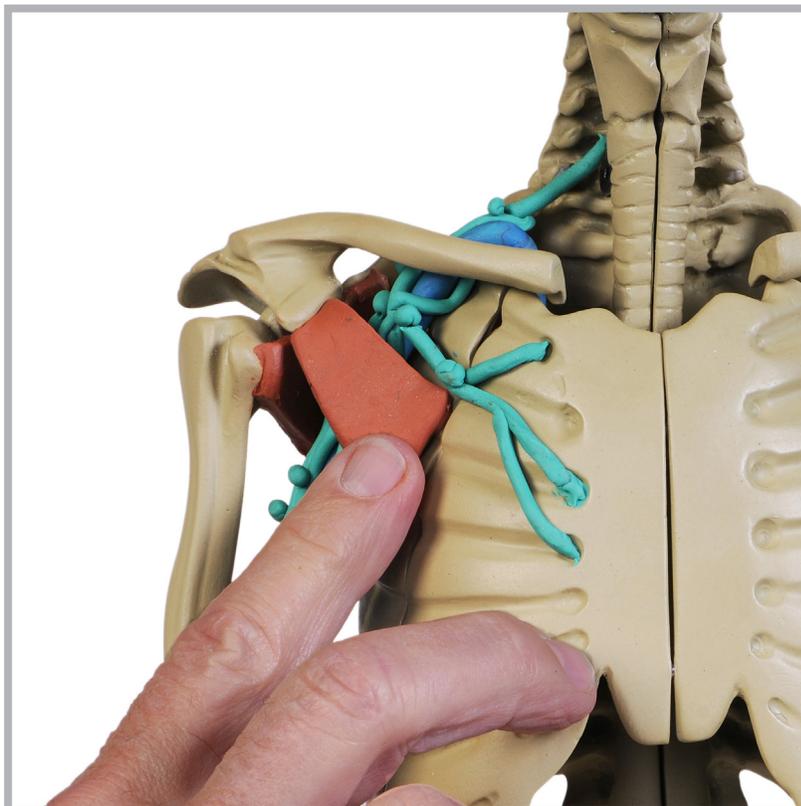
# 12

From between the sternocostal junctions, add a few lymph ducts from the internal lymphatic system that exits the rib cage. These ducts reach across the rib cage in order to create a network with the axillary lymphatic mesh.



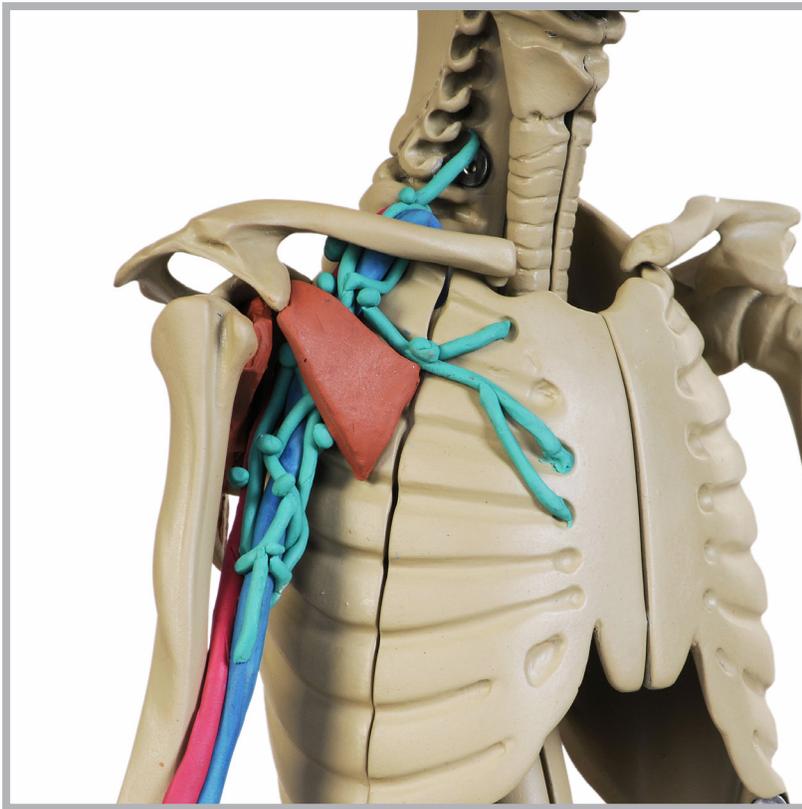
# 13

Form a small cone of terra cotta clay and flatten it into a thin triangle with its apex cut off.



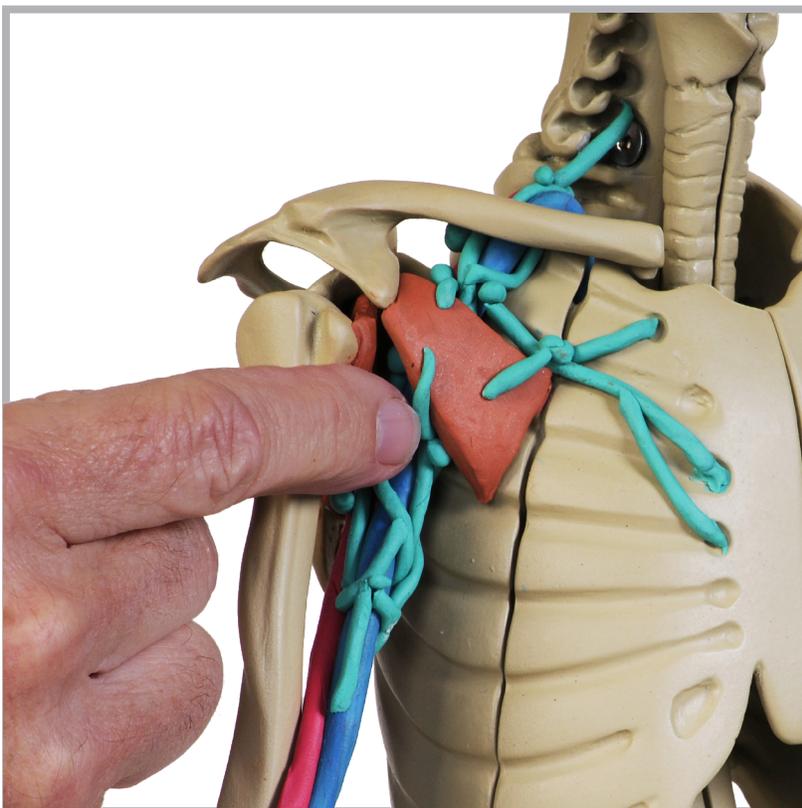
# 14

This is the *pectoralis minor* m. Attach the blunted apex of the triangle to the coracoid process. Attach the base of the triangle to the ribs T3 through T5.



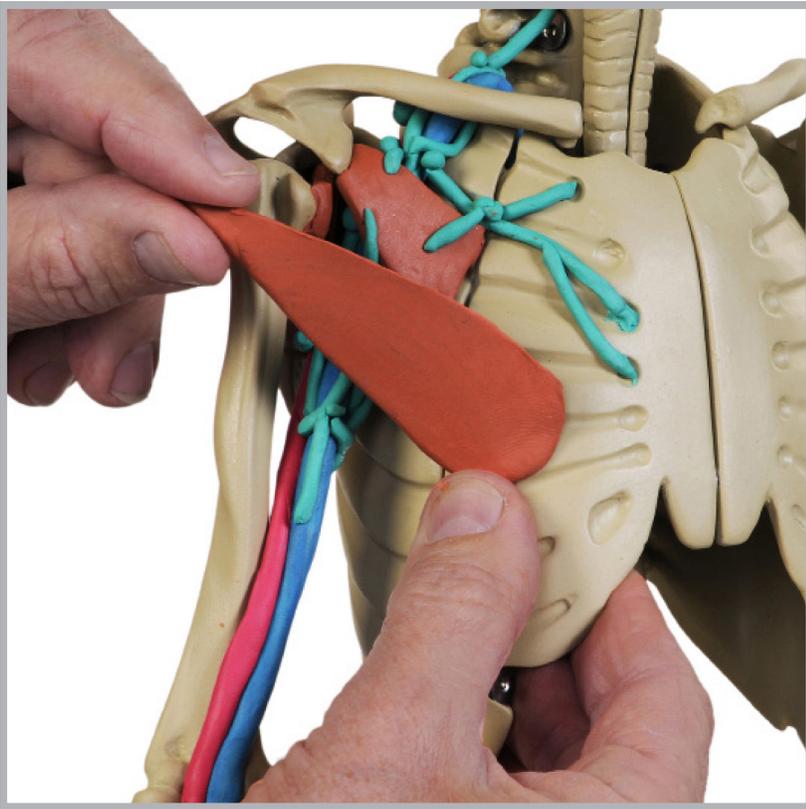
# 15

Note how this thin muscle has spanned over the axilla (armpit). It creates the ventral wall of the axilla through which all these vessels—and the brachial plexus as well—pass distally into the arm.



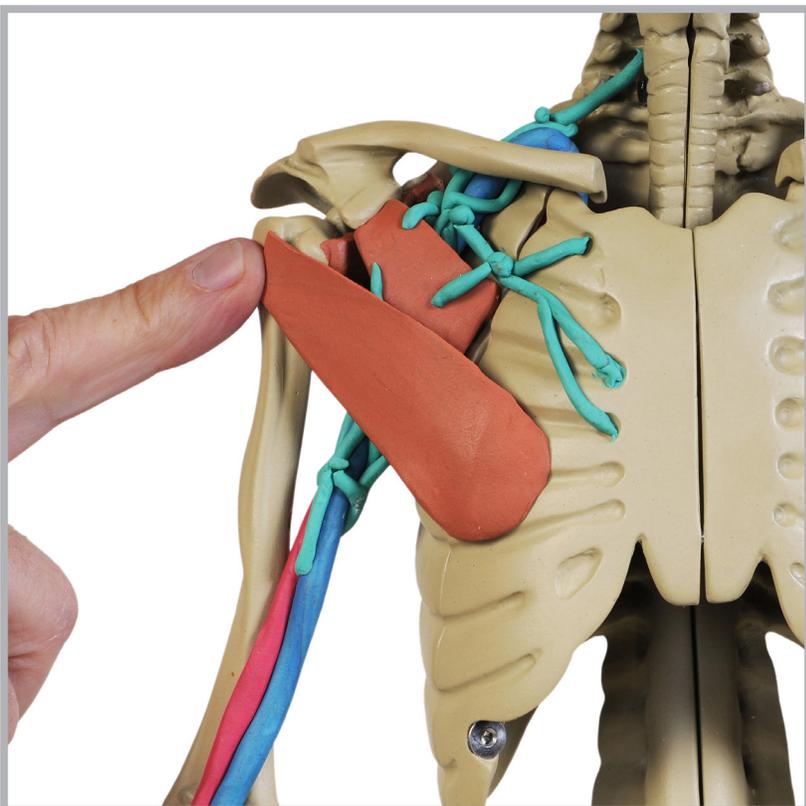
# 16

Roll a few small lymph ducts over the *pectoralis minor* m., wrapping them both from the cranial and the caudal edges.



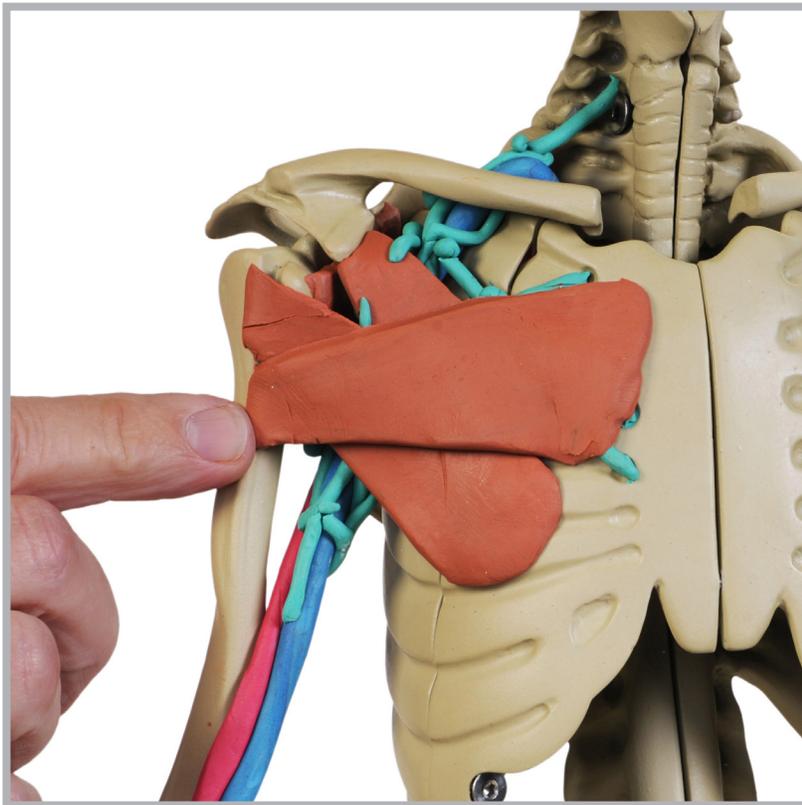
# 17

Form a much larger flattened triangle, similar to the shape of the *pectoralis minor* m. Lay it superficial to the *pectoralis minor* m. and its lymph pathways and nodes. This is the first bundle of *pectoralis major* m.



# 18

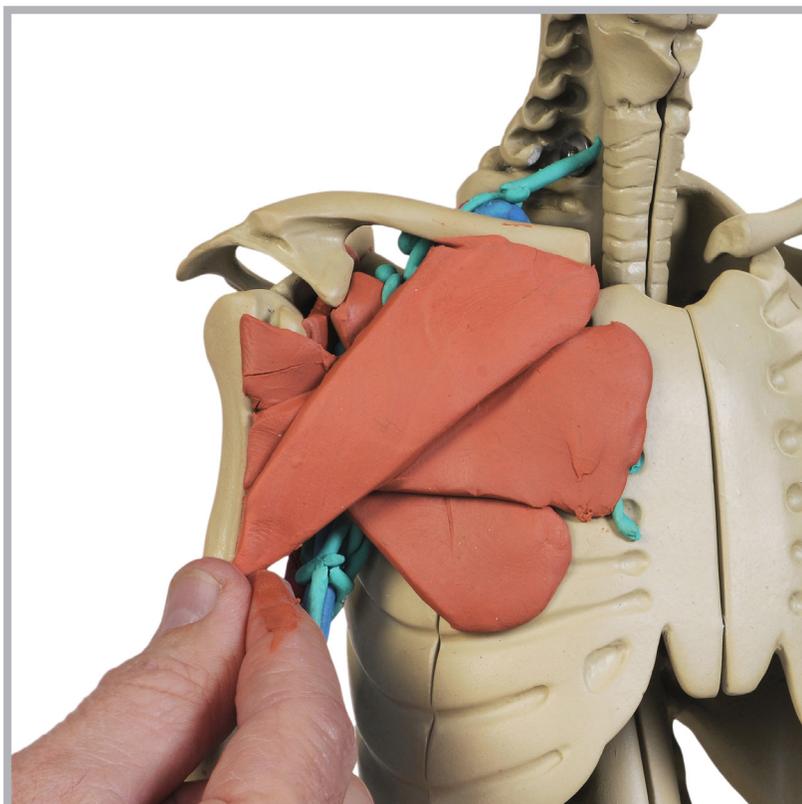
This is the ascending, deep costal head of the *pectoralis major* m. It is sometimes called the abdominal bundle.



# 19

Construct the sternal (or transverse) head of the *pectoralis major* m. This is the second of three bundles making up *pectoralis major* m.

The distal wide tendon crosses the abdominal head at the axilla. Its distal attachment continues along the lip immediately distal to the costal head of *pectoralis major* m.

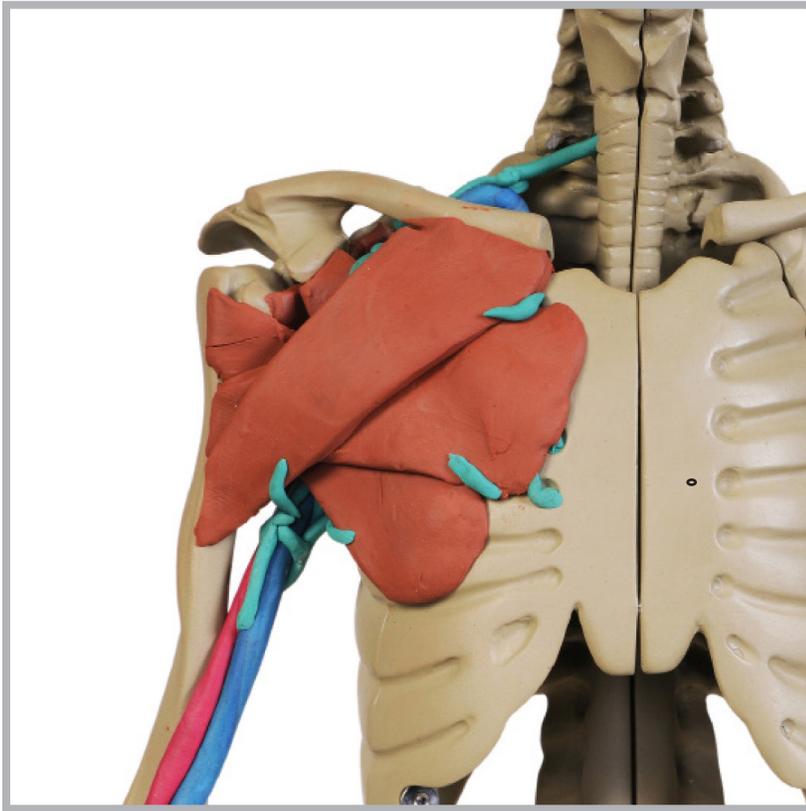


# 20

The last bundle of *pectoralis major* m. is called the clavicular head (or descending head). It also crosses the other parts of the muscle at the axilla.

Trim the medial end of this bundle so that it attaches to the medial one third of the clavicle.

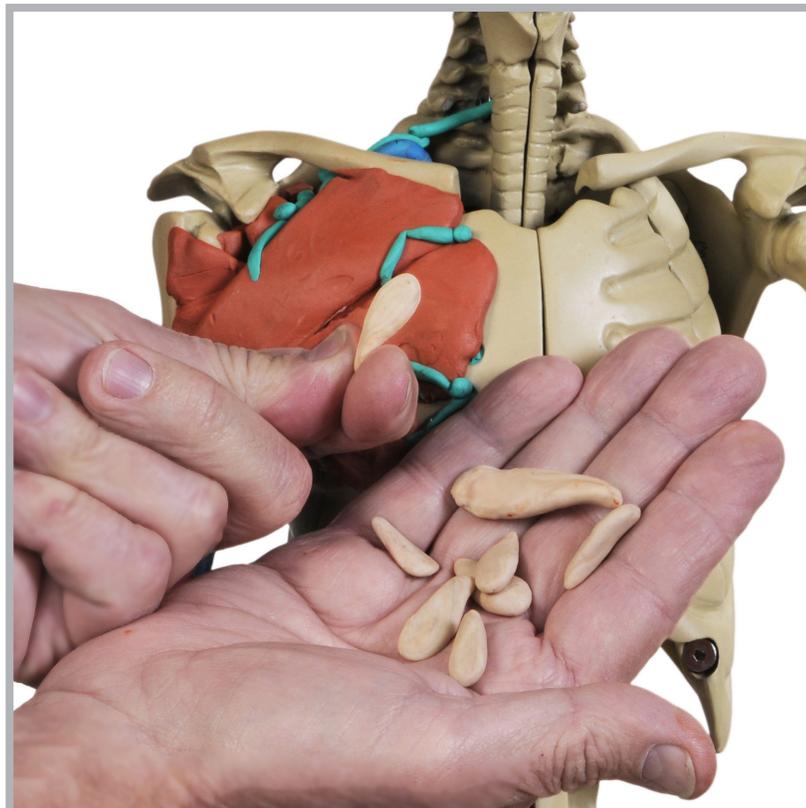
All three of these heads are often described as a single muscle.



# 21

Most of the lymphatic network that drains lymph from this muscle are deep relative to it.

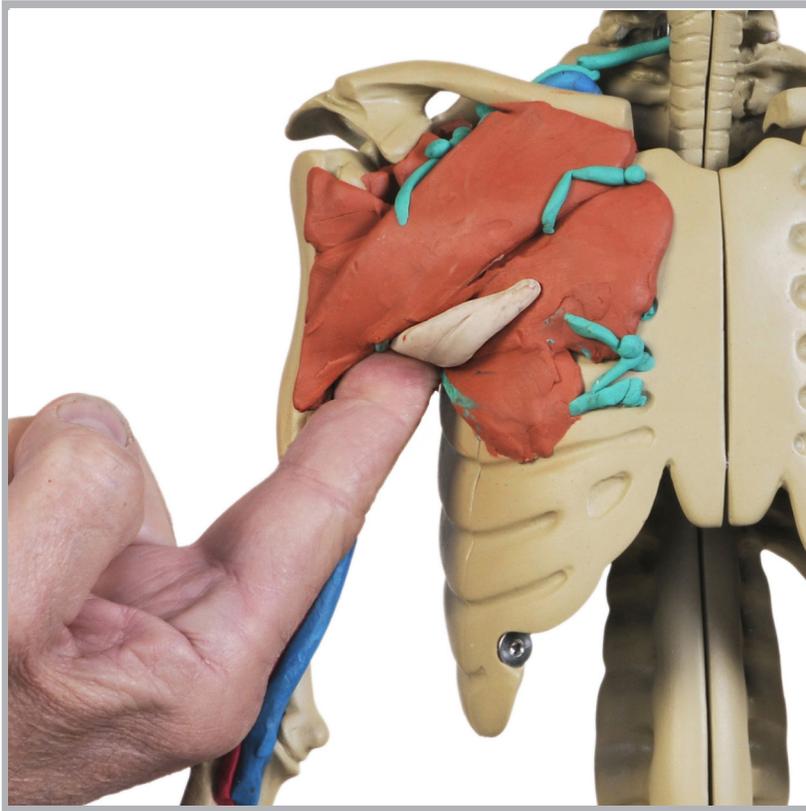
Only rarely are lymph nodes found in the *pectoralis major* m. itself.



# 22

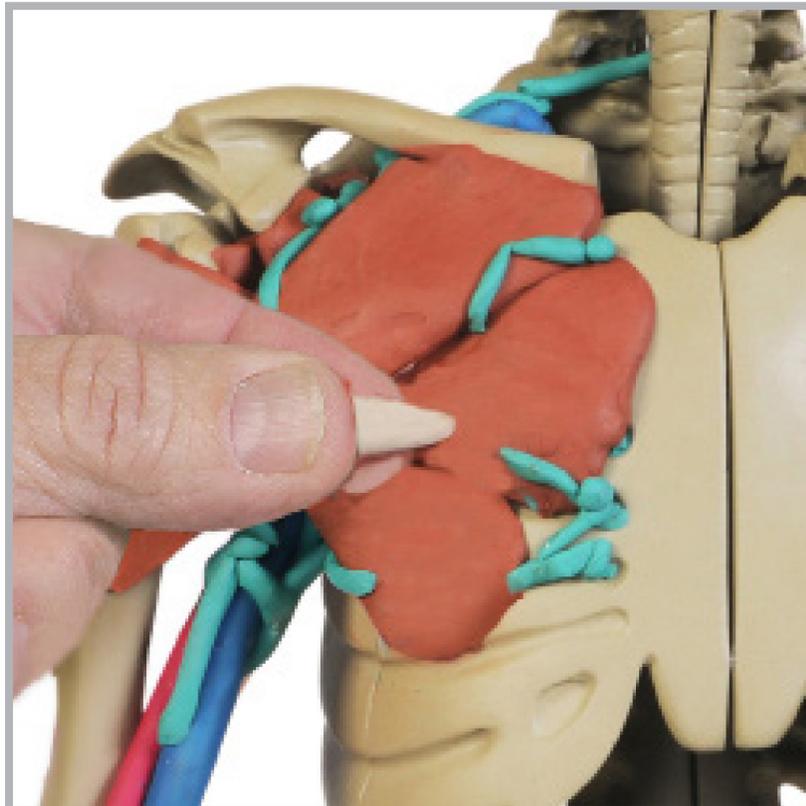
Use beige clay to construct a series of small, flattened teardrop shapes. This is the first of the series of mammary glands that lie atop the pectoralis muscle.

The largest teardrop shown here in the palm will form part of the "tail" of the mammary gland.



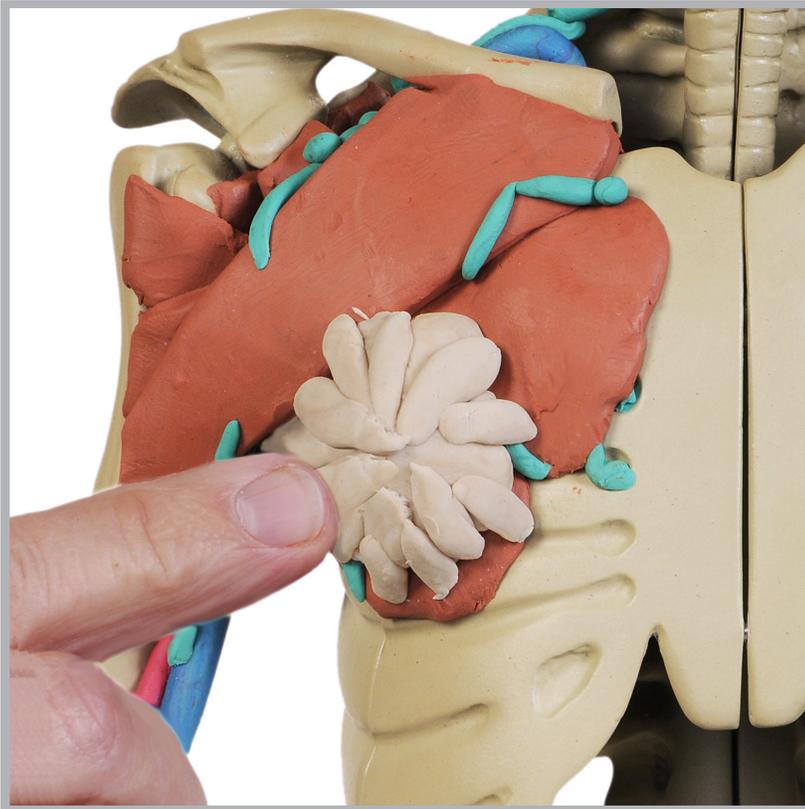
# 23

Press the tail of the mammary gland up into the axilla and against the axillary artery/vein and its accompanying lymphatic network.



# 24

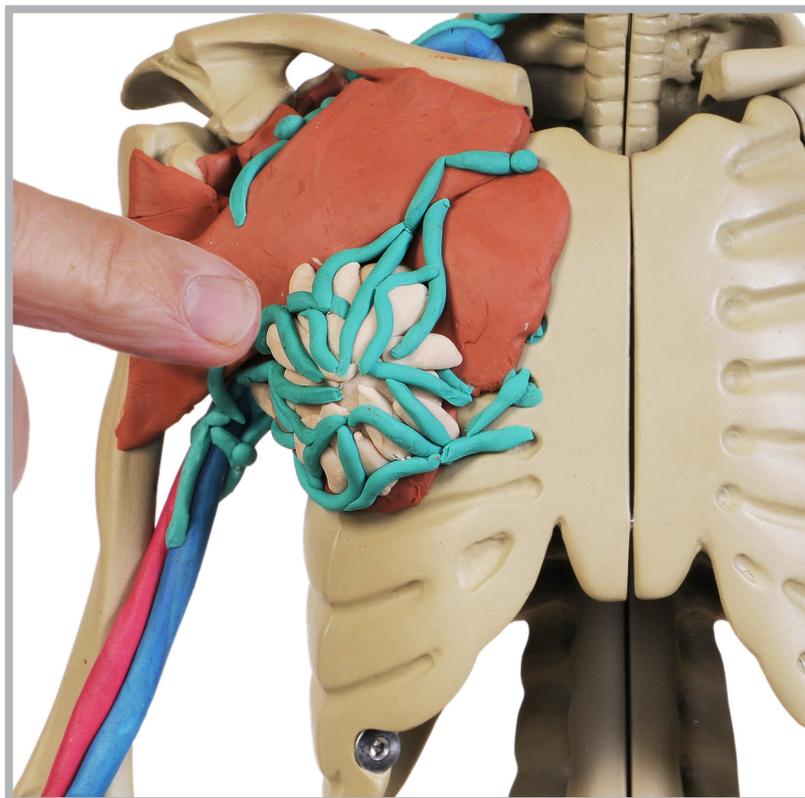
With the other, smaller, teardrops of beige clay made to represent mammary glands, begin to place them over the tail of the mammary and onto the *pectoralis* m. These glands will fan out radially from a center position.



# 25

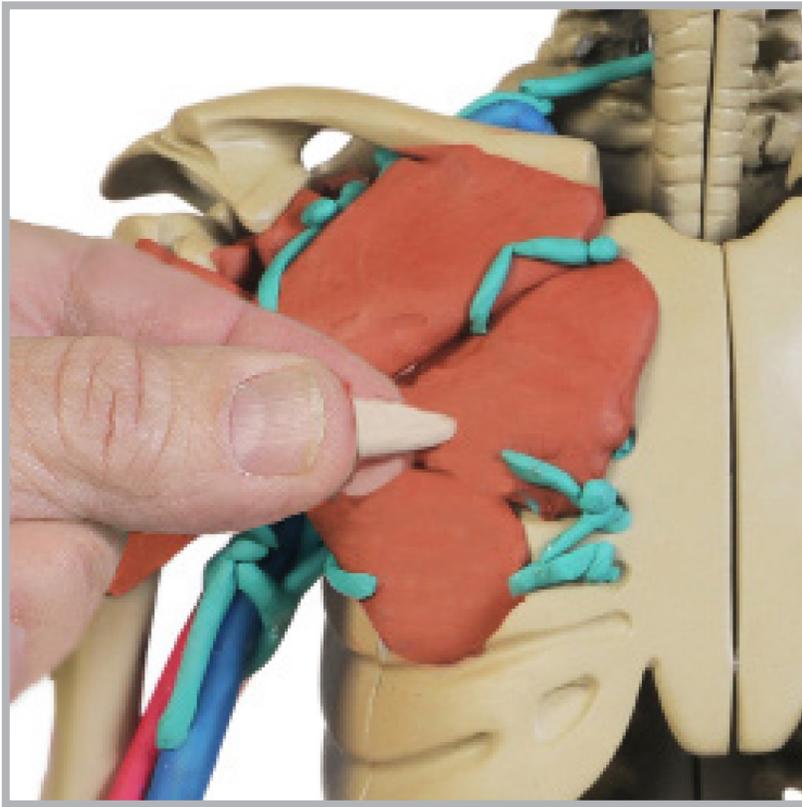
Overlay progressively shorter radial glands, perhaps ten or more, so that they form a cone. The tips meet at the apex of the cone. At this confluence are located the milk ducts that feed into the nipple.

Using your palm, press the cone onto the *pectoralis major* m. so that its costal surface spreads out over it. This surface presents the "footprint" of the breast.



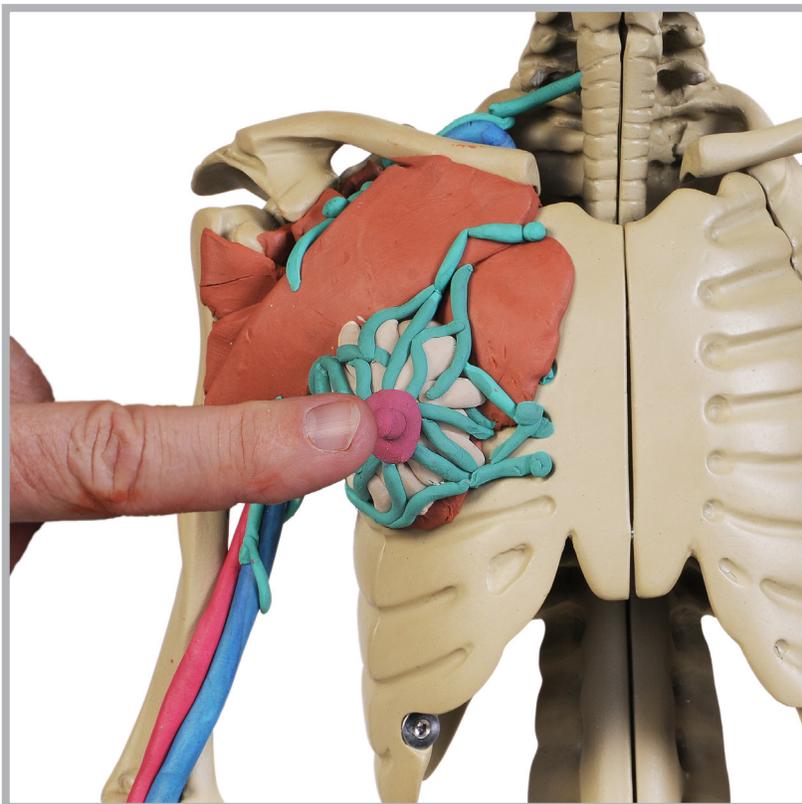
# 26

Construct more small tubules of green clay and place several onto the surface of the breast. These lymph ducts run from nodes inside the axilla and up and around the breast to the margin of the areola.



# 27

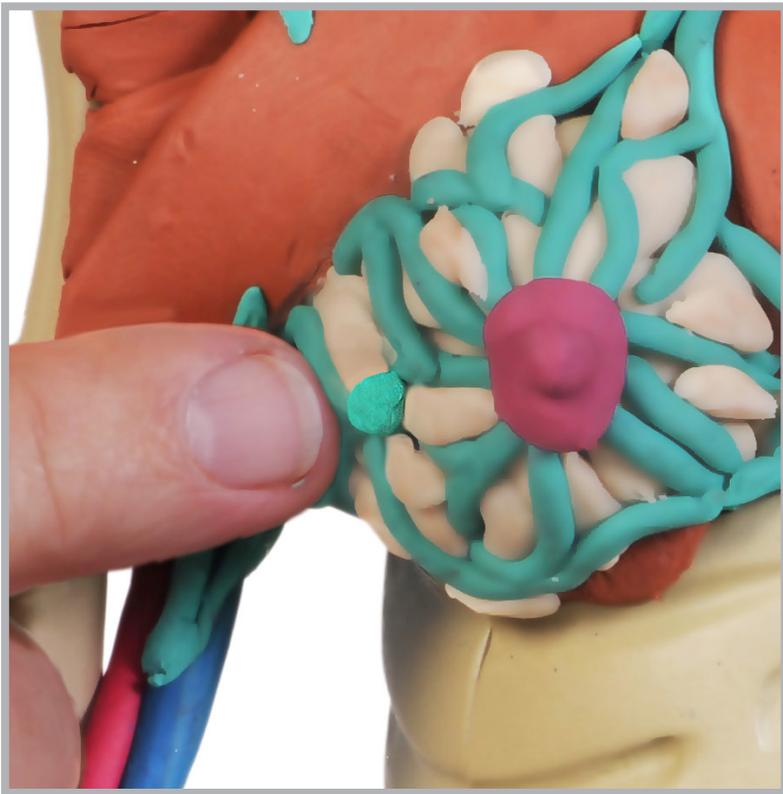
Place smaller teardrop shapes into the spaces between the ducts that form the breast lymphatic mesh. These shapes represent fatty breast tissue which gives the breast much of its form and weight.



# 28

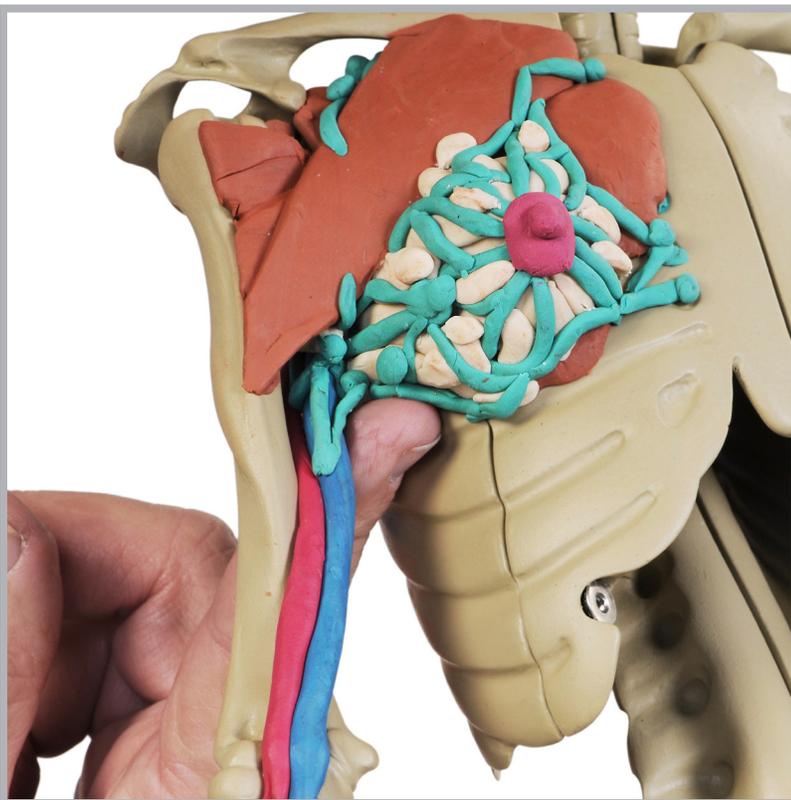
From a small ball of red clay, flatten a disk and attach it at the tip of the breast to form the areola.

Form another small ball into a representative nipple and place it at the center of the areola.



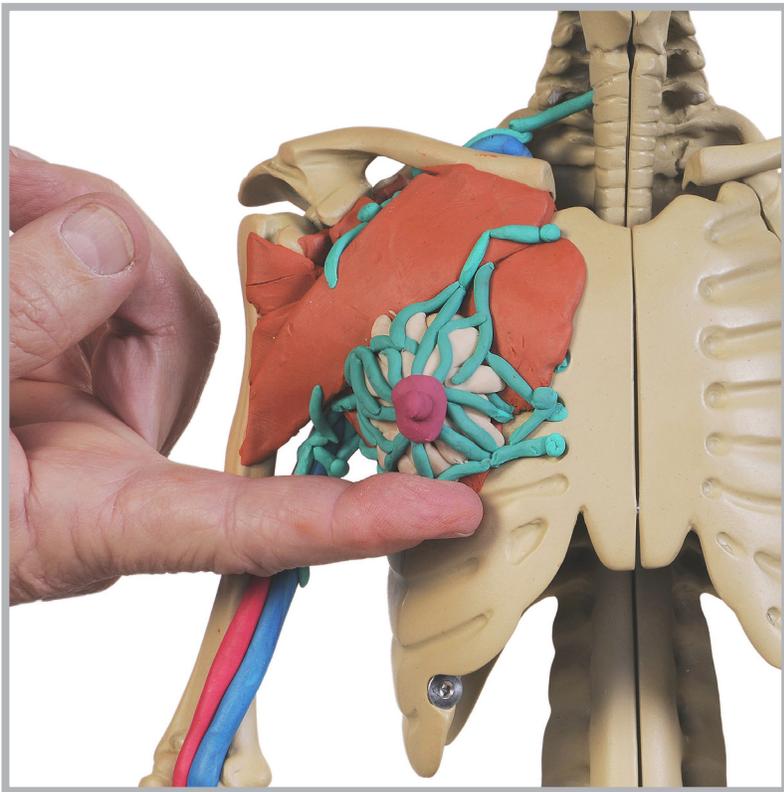
# 29

Construct a lymph node and place it at an intersection on the lateral side of the breast. This is the primary and key lymph node of the main part of the breast, sometimes referred to as the "sentinel" node, and of great importance in diagnostics.



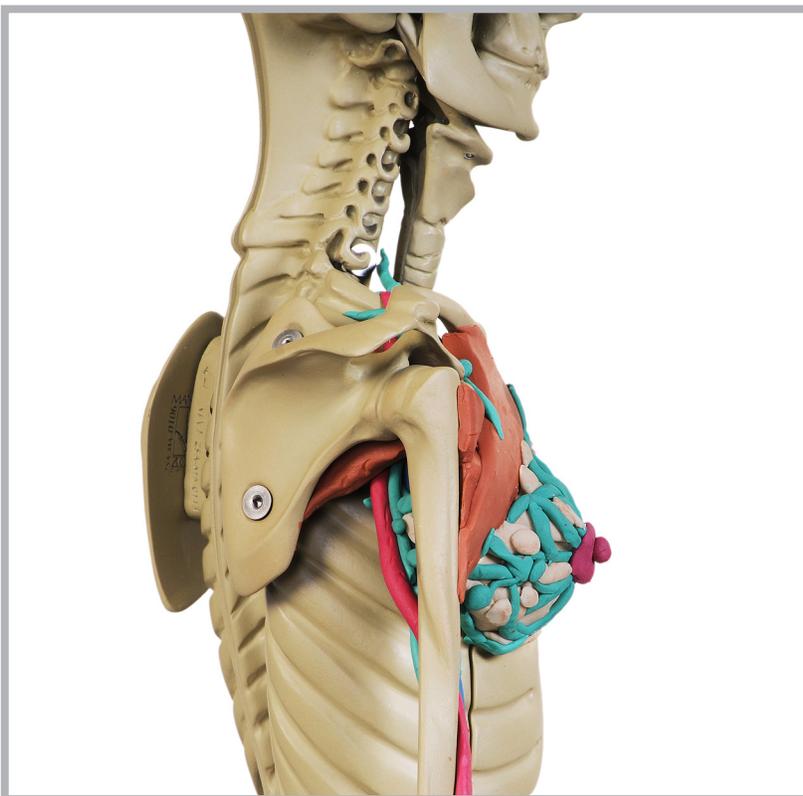
# 30

Make certain that the tail of the breast reaches up into the axilla and contacts its associated lymphatics.



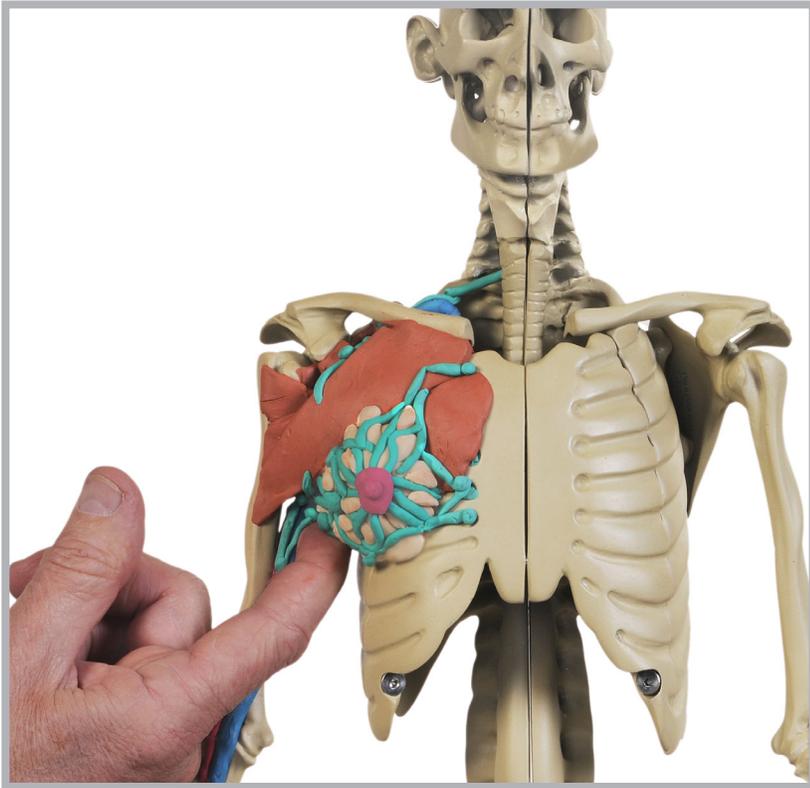
# 31

Push up on the lower, caudal edge of the of the breast to lift it off the surface of the *pectoralis major* m. and rib cage.



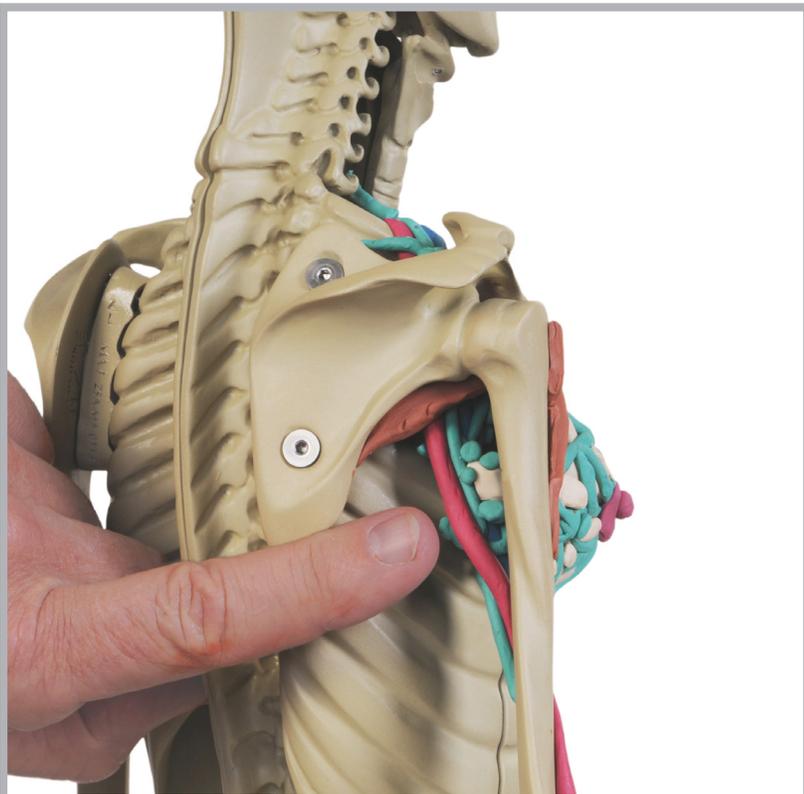
# 32

In the Standard Anatomical Position, the breast hangs from its "footprint" on the chest. The superior (or cranial) edge of the breast rises smoothly from the chest. The lower globe of the breast hangs over it a bit.



# 33

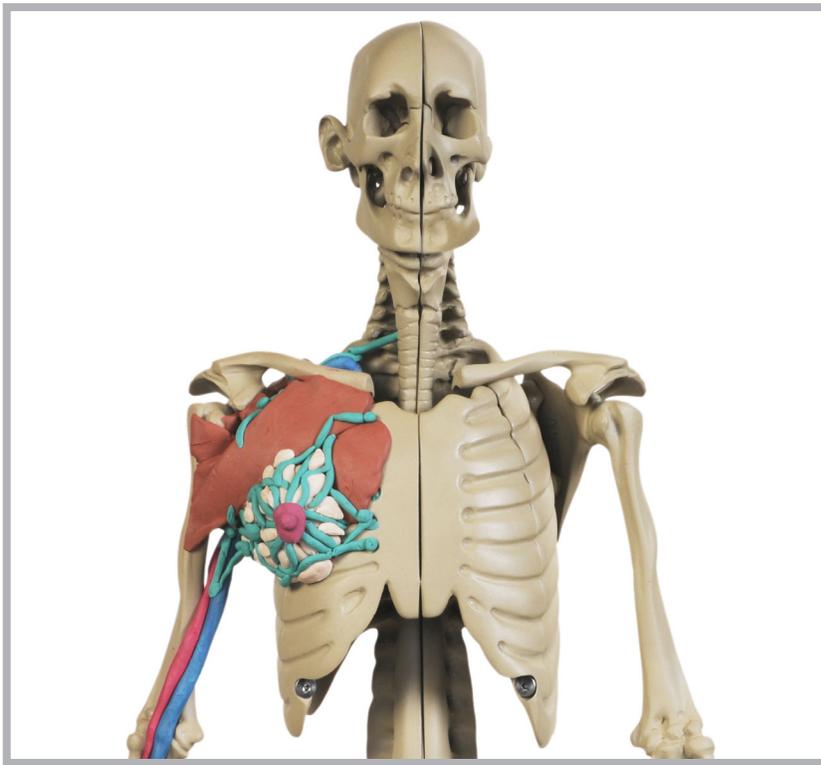
Run your fingertip around the globe of the breast and up into the axilla to butt against the axillary vessels and lymphatics.



# 34

Look at your model from behind. Can you see the tail of the breast? Does the tail of the breast reach into the axilla and contact the vein and its lymphatics?

Remember that many of the ducts and their nodes arise from the axillary vein inside the armpit.



# 35

It should become clear that the tail of the breast is a pathway into the main lymphatic harness. Through this pathway cancer in the breast can metastasize and spread beyond it, ultimately extending throughout the body.

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