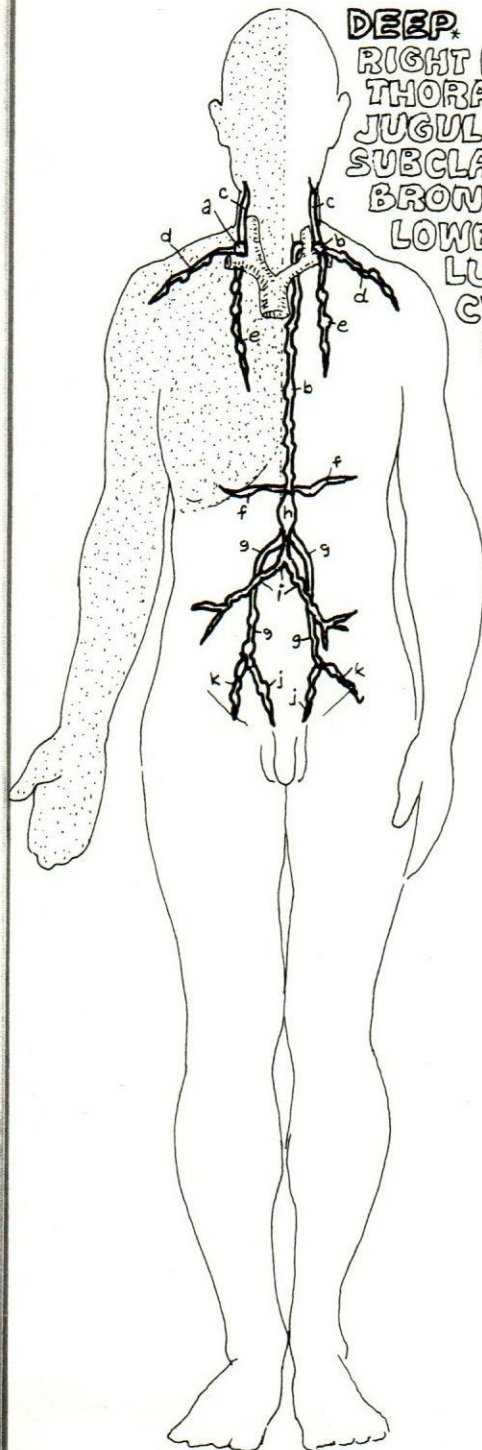


# LYMPHATIC SYSTEM DEEP & SUPERFICIAL CHANNELS OF LYMPH DRAINAGE\*

CN 14

1. Color the deep lymphatic vessels in the figure on the left. Use colors used for same structures on Plate 67, even though letter identification may differ.
2. In both figures, color the upper right quadrant of the body (the dotted area) gray. This area generally drains into the right lymph duct.
3. Color in the three superficial drainage areas on the left side of the body in the figure at right by coloring the nodes and their respective arrows. If you wish, you can lightly color in the entire area in the same color.

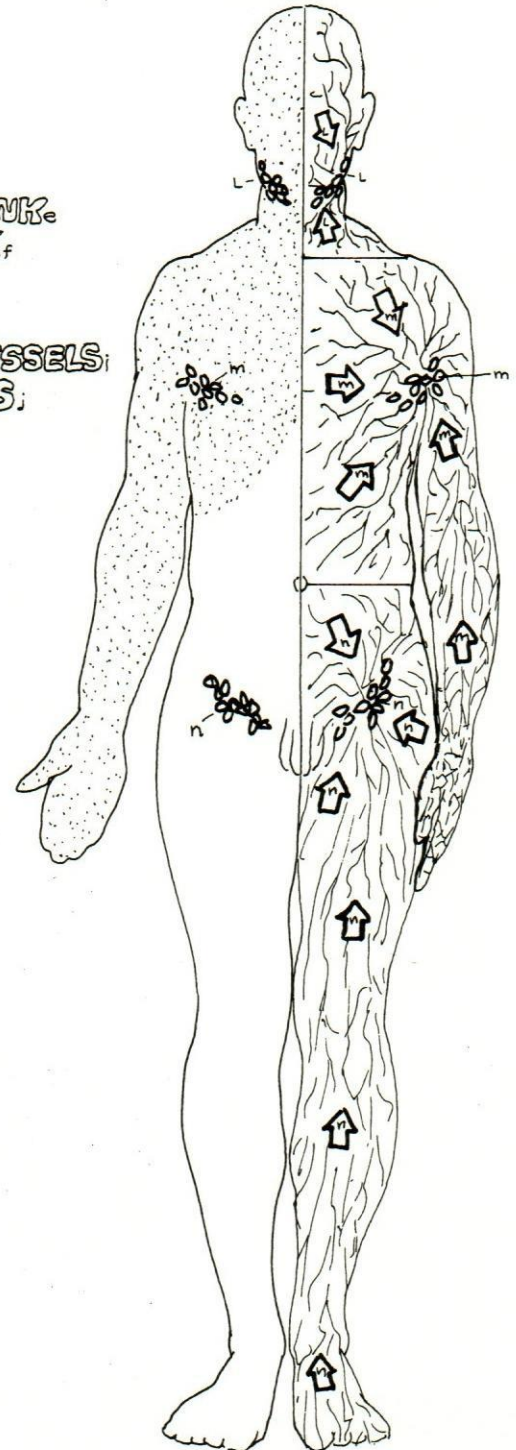
## SUPERFICIAL\* CERVICAL NODES<sub>L</sub> AXILLARY NODES<sub>m</sub> INGUINAL NODES<sub>n</sub>



**DEEP\***  
RIGHT LYMPHATIC DUCT<sub>a</sub>  
THORACIC DUCT.  
JUGULAR TRUNK.  
SUBCLAVIAN TRUNK.  
BRONCHOMEDIASTINAL TRUNK.  
LOWER INTERCOSTAL TRUNK<sub>f</sub>  
LUMBAR TRUNK.  
CYSTERNA CHYLI<sub>h</sub>  
INTESTINAL TRUNKS/VESSELS;  
VESSELS FROM PELVIS;  
FROM LOWER LIMB<sub>k</sub>

The lymph vascular system has both deep and superficial vessels. The deep vessels generally follow the deep veins, which often travel with companion arteries and nerves. The superficial vessels travel through the superficial fascia, and their related lymph nodes are usually found where large superficial veins flow into the deeper veins. Certain areas are devoid of lymphatic vessels/nodes, such as the brain, spinal cord, bone marrow, and structures generally without blood vessels that receive their nutrition by diffusion (cartilage, epidermis, etc.) In the upper limb, both deep and superficial lymphatic vessels reach for the *axillary nodes*. In the lower limb, both deep and superficial vessels flow into the *inguinal nodes*. In the neck, lymph vessels pass into *cervical nodes* in a variety of places, ultimately passing to deep cervical nodes near the large lymph ducts. The deeper patterns of lymph flow have been described in Plate 67 but are repeated here to enhance perspective of the entire system of vessels.

On the body surface, three sets of lymph nodes can be felt (see figure on right). Occasionally a node or two may be felt behind the knee or at the elbow. Lymph nodes enlarge when an infection is present in their area of drainage, due to a proliferation of lymphocytes in the germinal centers. Thus, enlarged superficial nodes signal that an infectious process may be underway. Lymph nodes may also enlarge when cancer cells migrate in from various lymph channels (metastases) and begin rapidly dividing.

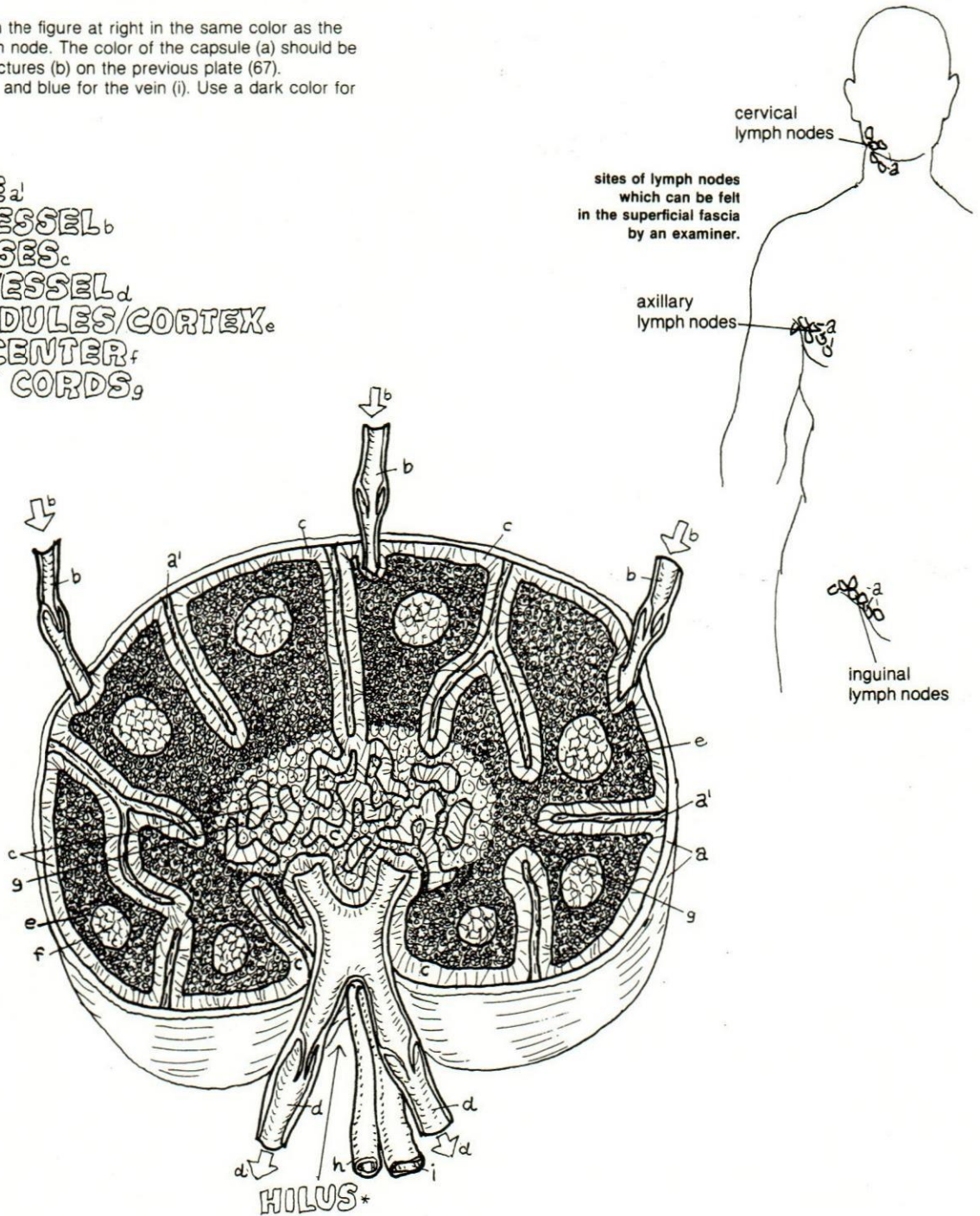


# LYMPHATIC SYSTEM ANATOMY OF A LYMPH NODE.

CN 10

1. Color the various nodes in the figure at right in the same color as the capsule (a) in the large lymph node. The color of the capsule (a) should be the same color used for structures (b) on the previous plate (67).
2. Use red for the artery (h), and blue for the vein (i). Use a dark color for the cortical nodules (e).

**CAPSULE**,  
**TRABECULAE**,  
**AFFERENT VESSEL**,  
**LYMPH SINUSES**,  
**EFFERENT VESSEL**,  
**CORTICAL NODULES/CORTEX**,  
**GERMINAL CENTER**,  
**MEDULLARY CORDS**,  
**ARTERY**,  
**VEIN**,



In addition to a network of vessels, the lymphatic system includes a variety of organs generally characterized by a basic unit of structure: lymphocytes and related cells (e.g., macrophages) attached to or free within a delicate framework of reticular fibers and cells. Such masses, ranging from simple to complex in organization, constitute lymphatic tissue. *Lymph nodes*, along with the spleen, thymus, tonsils, nodules, and diffuse lymphatic tissue, make up the lymphatic organs. Normally the size of small kidney beans, lymph nodes are generally found in groups near veins. Small lymph vessels may be seen entering and leaving each node. These lymph filtering devices are organized in the following way. Lymph enters a node through *afferent vessels* that open into the *lymph sinuses* just deep to the *capsule*. These sinuses are a maze of spaces within a net of fine reticular fibers. Lymph percolates through these sinuses, reaching ultimately for the *efferent vessel*. As you can see, the sinuses are supported by *trabeculae* of connective tissue fibers projecting inward from the capsule. In the outer

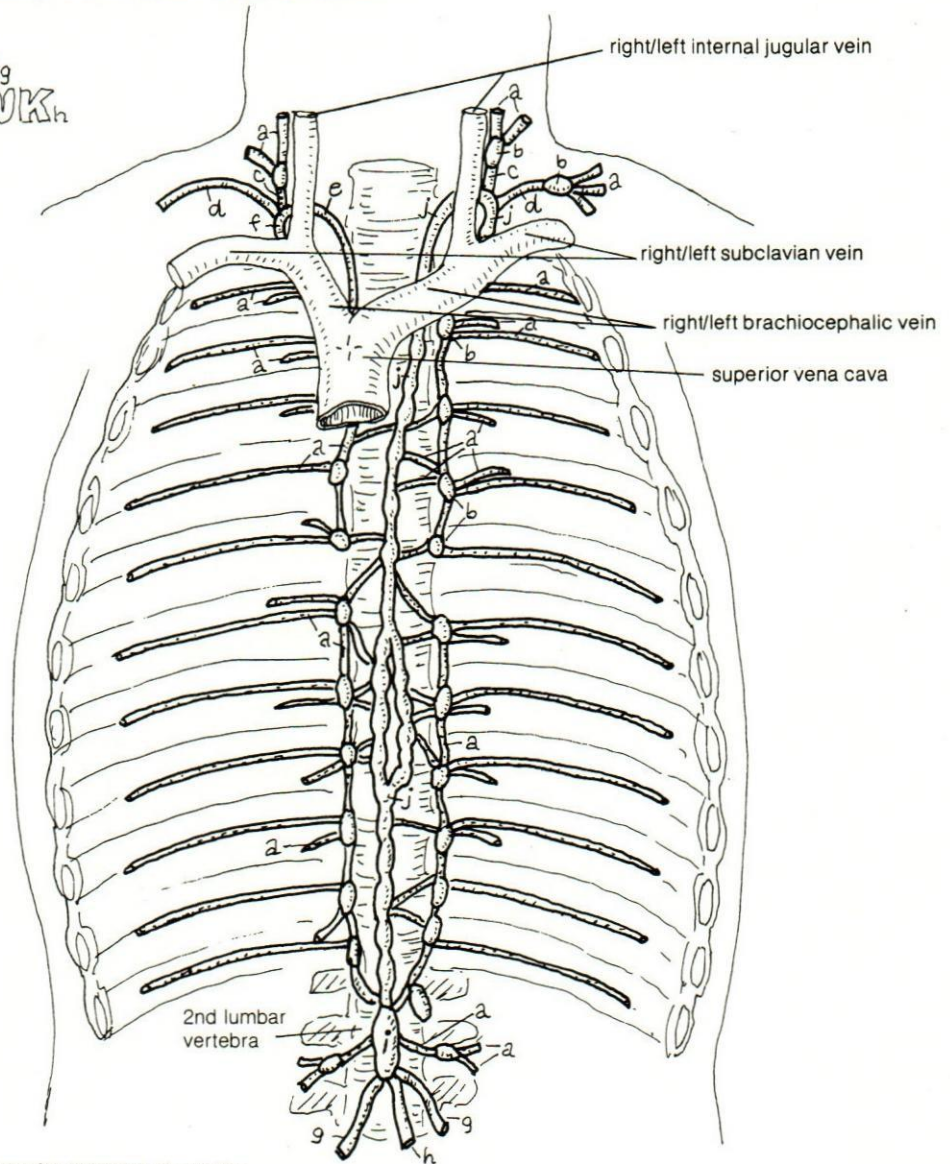
part of the node, masses of tightly fitted cells (*nodules of the cortex*) surround the lymph sinuses. In the center of these nodules are areas of lighter density, called *germinal centers*, where lymphocytes multiply and proliferate. The inner part of the node is the medulla consisting of lymph sinuses surrounded by cords of cells (*medullary cords*). These cells are largely macrophages, which rapidly absorb such microorganisms as bacteria. These cells, in effect, "strain" the lymph in the sinuses. The cells of the cortical nodules are largely lymphocytes capable of creating complex proteins (antibodies), which, coupled with phagocytic (macrophage) activity, suppress the growth and activity of microorganisms. High concentrations of certain bacteria in the lymph stimulate rapid division of lymphocytes in the germinal centers. Secretion of antibodies by these cells brings about the demise of these bacteria by specific neutralization. Thus, lymph nodes make up an important part of the body defense system, and their enlargement may be an indication of an ongoing disease process.

# LYMPHATIC SYSTEM THORACIC DUCT & TRIBUTARIES \*

CN 10

1. Color in all lymph vessels (a) and nodes (b) even where not labeled.

LYMPH VESSELS<sub>a</sub>  
 LYMPH NODES<sub>b</sub>  
 JUGULAR TRUNK<sub>c</sub>  
 SUBCLAVIAN TRUNK<sub>d</sub>  
 R. BRONCHOMEDIASTINAL TRUNK<sub>e</sub>  
 R. LYMPH DUCT<sub>f</sub>  
 LUMBAR TRUNKS<sub>g</sub>  
 INTESTINAL TRUNK<sub>h</sub>  
 CYSTERNA CHYLI<sub>i</sub>  
 THORACIC DUCT<sub>j</sub>



The body is largely fluid. Fluids of the body require constant circulation, and the pump that maintains this circulation is largely the heart (tissue diffusion pressures can also cause a shift in fluids). The heart drives the fluid of the blood vascular system, and all extravascular fluids of the body must ultimately return to the vascular system to return to the heart. Veins are in the business of returning blood to the heart, thus special fluid "compartments" (of the eye, brain, ear, etc.) generally drain into veins. The lymphatic system of vessels constitutes such a compartment. Arising from veins in the developing embryo and closely associated with veins throughout most parts of the body, *lymphatic vessels* assist veins in their function by draining many of the body tissues and thus increasing the amount of fluid return to the heart. The lymph vascular system does not form a closed loop system like the blood vascular system. Lymph vessels begin as tiny, colorless, unconnected capillaries in the connective tissues. These merge to form progressively larger vessels which are interrupted at various sites by small filtering stations called *lymph nodes*. Lymph vessels ultimately drain into the two principal lymph vessels: *thoracic* and *right lymph ducts*.

Looking like small veins, these ducts pour about 2 liters of lymph into the brachiocephalic veins every 24 hours. The lymph vascular system has no heart of its own, and lymph flow largely depends upon the kneading action of neighboring skeletal muscles alternately contracting and relaxing.

This plate shows the major lymph vessels and their immediate tributaries. Lymphatics of the lower limb, pelvis, perineum and those of the abdominal viscera reach for the *cysterna chyli* via the *lumbar trunks* and *intestinal trunk*, respectively. Just below the diaphragm, the *cysterna chyli* narrows to become the *thoracic duct*, which itself drains the *left thorax*. Major tributaries of this duct drain the left upper limb (*subclavian trunk*) and head and neck (*jugular trunk*). The right lymph duct and its immediate tributaries drain the right half of the thorax, upper limb, head, and neck. This lymphatic network has tremendous clinical significance. Interruption of lymph drainage in an area generally creates considerable swelling (edema) due to accumulation of fluids. In addition, the lymph vessels offer a variety of routes for cancer cells to move from one site to another (metastases).

# TERMINOLOGY

CN 12

1. Color the four body planes in quiet, pastel colors.
2. Color the anatomical directions (arrows) in bright or dark colors for emphasis.
3. The body itself is not to be colored.

A precise set of terms and planes have evolved to describe positions, relationships, and directions within the human body. To avoid confusion, they must always be related to the standard *anatomical position*: standing erect, palms of the hands forward.

*Planes* are fixed lines of reference along which the body is often divided (sectioned) to facilitate the viewing of structure. By studying a region from sagittal, transverse, and frontal planes of reference, a 3-dimensional perspective can be obtained.

Terms of *position* and *direction* describe the position of one organ relative to another, usually along one of the three major body planes.

## BODY PLANES\*

### MEDIAN<sub>a</sub>

The midline plane dividing the body into left/right halves.

### SAGITTAL<sub>b</sub>

The plane dividing the body into unequal left and right parts and parallel to the median plane. The terms medial and lateral relate to this plane.

### CORONAL, FRONTAL<sub>c</sub>

The plane dividing the body into equal/unequal front and back parts. The terms anterior/posterior relate to this plane.

### TRANSVERSE, CROSS HORIZONTAL<sub>d</sub>

The horizontal plane divides the body into upper (cranial) and lower (caudal) parts. Cross/transverse sections are perpendicular to the long axis of the body or other structure and may not be horizontal.

## ANATOMICAL DIRECTIONS/POSITIONS\*

### CRANIAL, SUPERIOR<sub>e</sub>

These terms refer to a structure being closer to the head or higher than another structure in the body.

### CAUDAL, INFERIOR<sub>f</sub>

These terms refer to a structure being closer to the feet or lower than another structure in the body.

### ANTERIOR, VENTRAL<sub>g</sub>

These terms refer to a structure being more in front than another structure in the body.

### POSTERIOR, DORSAL<sub>h</sub>

These terms refer to a structure being more in back than another structure in the body.

### MEDIAL<sub>i</sub>

This term refers to a structure being closer to the median plane than another structure in the body.

### LATERAL<sub>j</sub>

This term refers to a structure being further away from the median plane than another structure in the body.

### PROXIMAL<sub>k</sub>

Employed with reference to the limbs only, this term refers to a structure being closer to the median plane or root of the limb than another structure in the limb. Such a structure would ordinarily be superior to the other.

### DISTAL<sub>l</sub>

Employed with reference to the limbs only, this term refers to a structure being further away from the median plane or root of the limb than another structure in that limb. Such a structure would ordinarily be inferior to the other.

