Histology

Histology is the study of tissues. As a massage therapist you might be asking yourself, “Why is it important for me to understand the structure and function of tissues?” You might think that the only tissue that is important for you to know about is muscle tissue. While it is important to understand the structure and function of muscle tissue, the fact is, connective tissues and nervous tissue are more greatly impacted by massage work than is muscle tissue. Having a strong understanding of tissue structure and function is very important to the good massage therapist. For example, if you are massaging a person with significant edema (swelling) what should be your concerns? Where is this fluid buildup occurring and why? As you begin to learn about the structure of tissues, the functional aspects of these tissues will become much clearer and more apparent. One of the most important tissues, of which the massage therapist should have a strong knowledge, is the collagenous connective tissue family. This is the principal building material of the skin, fascia, ligaments, tendons, joint capsules, and believe it or not, muscles. In this chapter, you will begin to establish a strong foundation knowledge of tissues, which you will continue to build upon throughout the course.
Introduction to Tissues
Four principal tissues

Epithelium
epithelium = upon + thle = nipple

General structure and function
Tightly packed cells functioning as covering and lining tissues

General distribution
Always found as a surface tissue

Connective tissue

General structure and function
Few cells with lots of extracellular material; many functions

General distribution
Wide distribution — bone, tendon, fat, blood, cartilage

Muscle

General structure and function
Elongated cells specialized to shorten

General distribution
The skeletal muscles of the body and many body organs

Nervous tissue

General structure and function
Wirelike cells specialized for conduction of electrical signals

General distribution
Brain, spinal cord, and nerves
Epithelial Tissues
Classification and Function

Classification of epithelial tissues

Cell shape
- Squamous (Flat)
  \textit{squala = scale}

- Cuboidal
  \textit{cubus = a cube + eidos = shape}

- Columnar

Number of layers
- Simple

- Stratified

Functions of epithelial tissues

Exchange surfaces
- Secretion
- Absorption
- Excretion

Protection
Epithelial Tissues
Structure, Distribution, and Function

Simple Epithelial Tissues
Structure
Thin lining and covering layers

Relationship to connective tissue blood vessels

Distribution

Functions
**Simple Epithelia**

**Simple squamous epithelium**
This tissue consists of a single layer of flat cells having a very smooth appearance when viewed with the unaided eye. It is primarily found in two major locations throughout the body. It forms the inner lining of the cardiovascular system, lining blood vessels, the chambers of the heart, and lymphatic vessels. Therefore, it is the tissue that the blood is always in contact with as it moves through the body. A second area it is commonly found is lining the cavities that house the heart, lungs, and abdominal organs. In addition, the outside of these organs is covered with this simple epithelium. These are the two major areas of distribution for this tissue. Additionally, it is found in the walls of the smallest air spaces of the lungs, forming the walls of some small urinary tubes within the kidney.

**Simple cuboidal epithelium**
This tissue is a single layer of polygonal cubed cells. It is often referred to as glandular epithelium because of its prominent distribution in the lining of many glands of the body.

**Simple columnar epithelium**
This tissue consists of a single layer of tall columnar shaped cells. In some locations within the body the surface of the cells is covered with small hairlike processes termed cilia. The major site of distribution of this tissue in the body is the inner lining surface of the digestive tract from the beginning of the stomach to the anus. Throughout this location it has no cilia. It is found as a cilia covered surface lining the bronchi of the lungs and the uterine tubes.

**Pseudostratified columnar epithelium**
This is an interesting tissue that fooled anatomists until the resolution of microscopes had evolved considerably. It is a simple epithelium but, as its name suggests, it looks stratified. All the cells attach to the basal lamina, but they do not all reach the surface. This gives the tissue the appearance of having cells stacked in multiple layers. This is the tissue forming the inside lining of the upper respiratory tract. In these areas the surface is covered with cilia.
Stratified Epithelial Tissues

Structure
Thick lining and covering layers

Relationship to connective tissue blood vessels

Distribution

Functions
**Stratified Epithelia**

**Stratified squamous epithelium**
This tissue, comprised of many cell layers, is the thickest epithelial tissue in the body. The bottom layer of cells have a cuboidal shape but as the cells progress towards the surface they become thin and flat. It is the many flat layers of surface cells from which the tissue derives its name. This thick protective layer of cells forms the covering of the body called the epidermis. It can also be found lining the inside of the mouth and nose, lining the esophagus and anus, and covering the surface of the eye.

**Stratified columnar epithelium**
This is not a very common tissue in the body. It is found in a few isolated places and has no general area of distribution. For example, it can be found in certain regions of the larynx (voice box) and pharynx (throat) as well as lining the large excretory ducts of some glands.

**Transitional (stratified cuboidal) epithelium**
Study of this tissue by the early anatomists revealed that the structure of the tissue appeared to undergo changes. Sometimes the cells looked more cuboid and multilayered, while other times the tissue appeared thinner. This resulted from the stretching or distension of the tissue at its site of distribution — the lining of the urinary system. Because of its distribution as a lining of the urinary system from the large urinary tubules of the kidney through the ureter, bladder, and urethra, this tissue is often referred to as urinary epithelium.
**Overview of Connective Tissues**

Four basic types

**General structure**

- Extracellular material forms greater percentage of tissue than cells

**Functions**

- Varied functions usually related to the extracellular material

**Connective tissue proper**

- Soft connective tissue

**Cartilage**

- Firm to rubbery connective tissue

**Bone**

- Hard connective tissue

**Blood**

- Fluid connective tissue
Connective Tissue Proper

Building Blocks

Cells — first building block

Fixed cells

Fibrocyte [Fibroblasts]

*fibra* = fiber + *-cyto* = cell

Cells that produce extracellular fibers

Adipose cells

*adeps, adip* = fat

Cells specialized to store lipid energy reserves

Wandering cells

Body defense and repair cells of the white blood cell lineage
Connective Tissue Proper

Building Blocks

Extracellular matrix — second basic building block

Interfibrillar substance

Water with various suspended molecules between the fibers

Fibers

Collagen fibers

kolla = glue + genere = to bear, carry

String-like proteins

Great tensile strength

Importance in connective tissue

Relevance to massage therapy

Elastic fibers

String-like or sheetlike branched proteins

Stretchability
Connective Tissue Proper
Function and Classification

General functions of connective tissue proper

Classification of connective tissue proper
Named after the most prominent feature of the tissue and the arrangement of that feature in the tissue.

Collagenous fibers
Loose mesh of collagen

Dense mesh of collagen
  Dense irregular meshes

Dense regular bands

Elastic fibers

Adipose cells
Connective Tissue Proper
Structure, Distribution, and Function

Collagenous connective tissues
Loose collagenous connective tissue
  Structure
  Distribution
  Function

Dense irregular collagenous connective tissue
  Structure
  Distribution
  Function

Dense regular collagenous connective tissue
  Structure
  Distribution
  Function
Elastic tissue
Structure

Distribution

Function

Adipose tissue
Structure

Distribution

Function
**Cartilage**

**Building Blocks and Classification**

**Introduction**

Lacks internal blood supply

Important skeletal and joint tissue

**Building blocks**

**Cells**

Chondrocytes

chondros = cartilage + -cyto = cell

**Extracellular matrix**

**Interfibrillar substance**

Proteoglycans

**Fibers**

Collagen

Elastic

**Classification**

**Collagen fibers**

Few fibers = hyaline cartilage

Many fibers = fibrocartilage

**Elastic fibers**

Elastic fibers = elastic cartilage
**Types of Cartilage**

Anatomists designate three forms of cartilage, again based on the type and distribution of fiber in the ground substance. The three forms are hyaline cartilage (fewer collagen fibers), fibrocartilage (many collagen fibers), and elastic cartilage (elastic fibers).

**Hyaline Cartilage**

*hyalos = glasslike + cartilago = gristle*

Hyaline cartilage is the most common cartilage in the body, and all other cartilages are a modification of this cartilage type. It consists of thin meshworks of collagen in a rubbery substrate. Hyaline cartilage forms the majority of the embryonic skeleton and after birth it persists as the skeleton of the external nose, anterior ends of the ribs, in the walls of the upper respiratory passageways, and as growth plates in the long bones.

**Elastic Cartilage**

Elastic cartilage does not occur in many places throughout the body. As its name implies, it differs from hyaline cartilage because as a result of the thick meshworks of elastic fibers present in its matrix. This highly elastic tissue forms the skeleton of the epiglottis (the flap-like door that covers the respiratory passageways when you swallow) and the skeleton of the external ear.

**Fibrocartilage**

Fibrocartilage receives its name from the large number of thick collagen fibers that are densely distributed in the rubbery matrix. The fibers are so densely packed in the tissue that there is little evidence of the surrounding matrix. Fibrocartilage forms the strong intervertebral discs that separate the vertebrae. They also form articular discs, such as the menisci of the knee joint. These strong cartilages function as effective shock absorbers between bones.