

Basic Tactile Anatomy Atlas

Teacher's Instructional
Text, Volume II of II



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& Charles Severin, Ph.D.



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BASIC TACTILE ANATOMY ATLAS

Volume II

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Directions for Use of This Atlas

In anatomy structures are described in their anatomical position (where they are located in your body). For clarity the texts in this atlas will describe structures in the illustrations as you are facing them (where they are located on the page). For example, the liver is on the right side of your abdomen but you will be instructed to look for it on the left side of the illustration. Exceptions to this will be specified in the text.

The title of each diagram is located at the top of the page. Some diagrams contain a key which identifies a specific texture or symbol. These keys will be found at the bottom of the page. A fine label line has been used to connect each label to the structure it identifies.

You should begin your examination of each diagram by scanning the entire illustration to get a general idea of its contents. Next, you should refer to the accompanying text, which will guide you through your exploration and highlight the important features or structures to be identified.

Anterior View of the Heart

As you survey the illustration notice that the large blood vessels associated with the heart, namely the superior vena cava, aorta, and the dotted pulmonary artery, are located on its upper end. The inferior vena cava, located on its lower right border, is the one exception. The heart is divided into four chambers or compartments. In this diagram identify the smooth-walled right atrium. The left atrium is hidden. The right and left ventricles have been textured to indicate the large amount of cardiac muscle associated with each. Realize that most of the heart's front surface is composed of the right ventricle. Notice that it is separated from a small portion of the left ventricle by a groove. Next, trace the superior vena cava from the upper left on the page into the right atrium. Because the pulmonary veins are the furthest back of all the vessels, they are displayed as recessed on this illustration.

Posterior View of Heart

Before examining this diagram, imagine that you have been placed in your chest and are standing behind your heart. In this manner you are able to reach out and feel its back surface. As in the front view, right and left ventricles have been textured to show their cardiac muscle. Note, however, that in this back view, the left ventricle is now more prominent than the right. As in the front view, the ventricles are separated from one another by a groove. Identify the left atrium immediately above the left ventricle. Note that it receives two pairs of pulmonary veins. Return to the right ventricle at the bottom of the diagram and move to its right until you identify the inferior vena cava. Trace it upward until it enters the right atrium. Above the left atrium notice the dotted right and left pulmonary arteries as they are passing to their respective lungs. Above the left pulmonary artery examine the arch of the aorta and its branches. The superior vena cava is shown as a recessed vessel above the right pulmonary artery.

Circulation Through the Heart

The front half of the heart has been removed, exposing its four chambers. Each has been labeled with an abbreviation. The pulmonary artery and the aorta have also had their front walls removed. The superior and inferior venae cavae and the pulmonary veins have a tubular structure. A dashed line has been used to mimic the direction of blood flow. Locate it in the upper left below the label reading "from head and upper limb." Trace the path of deoxygenated blood through the superior vena cava into the RA. Deoxygenated blood also enters the RA from the inferior vena cava. Trace the blood flow from the RA through the tricuspid valve into the RV. From the RV follow the directional line upward, through the semilunar valves into the pulmonary artery. Notice how the artery divides into a right and left branch which pass to each lung respectively. Oxygenated blood returning from the lungs enters the LA via the pulmonary veins. Within the LA find the directional line. Trace this line from the LA through the bicuspid valve into the LV. Blood flows from the LV through another set of semilunar valves into the aorta and then throughout the body.

Arterial Pulse Points

This diagram displays the important arterial pulse points or places where arterial pulsations can best be felt. Examine the key in the bottom left hand corner of the page. This symbol will be found at each pulse point. Now examine the illustration. Notice that within the outline of the human body, major arteries have been drawn. Although most of these vessels are paired, only the arteries on the right side of the drawing which are used to determine the pulse have been labeled. As you move from the head to the foot, locate the pulse points associated with these arteries. In the neck, the carotid. In the upper limb observe the brachial and radial. Finally, in the lower limb the femoral, popliteal, and dorsalis pedis. A pulse is the expansion and elastic recoiling of an artery with each beat of the left ventricle of the heart. Pulses are felt in the above arteries because at these points the artery lies near the surface of the body.

Blood Cells

The circulating blood cells depicted in this diagram are arranged in 3 rows. Top row: Examine the 3 leukocytes referred to as granulocytes. Note the difference in the granules in the cytoplasm of each: two types are present in the neutrophil; large uniform granules are found in the eosinophil; while those in the basophil are medium in size. Trace the raised nuclei and note the constrictions which give them a lobed appearance. Middle row: Examine the two agranular leukocytes. Note there are no prominent granules. Compare the size of the cells and the shape of their nuclei. Note the smaller amount of cytoplasm in the lymphocyte compared to that in the monocyte. Bottom row: Examine the erythrocyte. This cell has no nucleus or granules. The central depression in the cell is actually present on both sides. On the far right locate the platelet, which is a small, granular fragment of cytoplasm.

Lymph Node Regions

Lymph nodes can occur in clusters in specific regions of the body. This diagram shows the major clusters on the right and left sides of the body. Begin at the top of the illustration. Trace the outline of the body noticing that both the right and left upper and lower limbs are shown. Return to the top of the figure and identify the clusters of lymph nodes shown as raised dots. Locate the neck and identify two pairs of cervical nodes. Those nodes on your right are labeled. Move down from the cervical nodes until you feel two separate clusters of nodes on each side of the body. The smaller raised dots are the pectoral nodes while the larger dots are the axillary nodes. The pectoral nodes are found in the chest while the axillary nodes are located in the armpit. These are labeled on the left side of the illustration. From these two groups of nodes move down until you encounter another group of nodes in the inguinal or groin region. These are labeled for you on the right side of the diagram. Finally, move down the lower limbs until you reach the knees and note the popliteal nodes labeled on the left side of the diagram.

Paranasal Sinuses

This diagram shows the sinusses which are lined with a mucous membrane and filled with air. Begin by examining the key at the bottom of the page. Note that a texture has been assigned to each of the sinusses. Now examine the diagram. An outline of the head with ears is represented by a raised line. At the top of the head find the paired frontal sinusses. They are located in the region of the forehead. If they become infected, pain is normally felt in the forehead. Notice that between the eyes you find both the paired ethmoid and sphenoid sinusses. The sphenoid sinusses are normally located deeper than the ethmoid sinusses within the skull. Pain is usually felt behind the eyes when either the ethmoid or sphenoid sinusses are infected. Finally, locate the large paired maxillary sinusses. Notice that the upper teeth extend into the floor of the sinus. This is why the upper teeth often hurt when the maxillary sinus is infected. All of the above sinusses empty into the centrally located nasal cavity.

Superior View of Larynx

This diagram shows two views of the larynx from above. The front is toward the top of the page while the back is toward the bottom. Begin by examining the thyroid cartilage at the front of the larynx. Its label is found beneath the title. Move to the middle of the cartilage and identify the thin ridged lines, which are the vocal cords. On the left notice that these vocal cords spread out from the middle of the thyroid cartilage and pass toward the back to insert on the arytenoid cartilages. These are labeled for you on the diagram. On the right note that the vocal cords do not spread out but pass behind the middle of the thyroid cartilage to attach to the labeled arytenoid cartilages. Beneath the diagram on the left find the label which states (say m). Notice that when we say letters such as m, the vocal cords are open. Beneath the diagram on the right find the label which states (say e). When we say letters such as e, the vocal cords are closed.

Respiratory Passages

This diagram shows the regions of the body which carry air to the lungs. Begin at the top of the diagram and examine the smooth head. The nose is to your left, the back of the head is to your right. In the region of the nose find the label showing the nasal cavity. Trace the label line into the nose. Notice a thick textured plate separating the nasal cavity from the mouth. This is the palate. From the nasal cavity move your finger to the right until you feel a small curved line, the opening of the auditory tube. This is where the pharynx begins. Pass your finger down into the labeled pharynx behind the mouth to the labeled larynx or voice box. The larynx is connected to a long rough tube, the trachea, labeled on the left side of the figure. Notice that as you pass down the trachea it splits into two tubes (bronchi) which enter the lungs. The lungs are shown as large textured organs in this diagram. Between the two lungs and beginning at the split of the trachea find an open smooth pathway, the esophagus, which passes down into the wide stomach. Notice that both food and air pass into the pharynx, but at the larynx they separate to pass into the proper channels.

Interior of the Lung

The lungs, the trachea, and bronchial tree are shown on this diagram. Trace the dotted outline of each lung. Note that the left lung, located on the right side of the page, is slightly narrower than the right. Move to the upper middle of the page and find the labeled trachea, a straight tube composed of rings of cartilage which feel like ridges. Follow it and note as you approach the lungs it divides into two branches called primary bronchi, one entering each lung. The bronchi continue to branch or divide throughout the lung forming the bronchial tree. Small, raised, round sacs called alveoli can be found at the end of the branches in the left lung in this diagram. They are arranged like clusters of grapes. The bronchi in the right lung are smooth because they have been opened up. Once again examine the lungs and note that they contain different textures. The areas textured with widely spaced dots are the superior lobes of the lungs. One inferior lobe has no texture and the other has closely spaced dots. Only the right lung (on your left) has a middle lobe, which is textured with medium-spaced dots.

Lung Alveolus and Capillary

This diagram depicts a lung alveolus and two capillaries as seen using the electron microscope. Considering a face of a clock, find a labeled capillary at the 2 o'clock position. Note its smooth cell wall and small nucleus. Verify it is empty. At the 7 o'clock position is another labeled capillary containing an erythrocyte. These are involved in oxygen exchange. In the middle of the diagram identify an airspace containing oxygen. Notice that it is surrounded by a striped membrane formed by an alveolar cell type 1. The nucleus of this cell is located at the 3 o'clock position. At 12 o'clock notice that the alveolar membrane is interrupted by another labeled cell termed the alveolar cell type 2. This cell produces a fluid called surfactant which is depicted as a thin raised line lining the air space. It helps keep the airspace open so that oxygen can enter. At 8 o'clock notice a large textured cell within the airspace called a phagocyte, labeled in the upper left. It can swallow dust particles which may enter the alveolus.

Nose, Mouth, Pharynx

In this view of the head and neck, the front is to your left. The head and neck have been cut to expose the side wall of the nasal cavity, interior of the oral cavity, and interior of the esophagus and trachea. On the left side of the page beneath the title find the label for the nasal cavity. Notice that the smooth wall of the nasal cavity contains ridges and grooves. Beneath the label for the nasal cavity find the label for the oral cavity. Notice that between the nasal and oral cavities is a raised dotted region representing the palate. On the right side of the diagram in the middle of the page find the label for the pharynx. Note that 3 label lines spread out from the pharynx label with each line ending next to a letter. The n, located behind the nasal cavity, is the nasopharynx. The o behind the oral cavity is the oropharynx. The l immediately below the o represents the laryngopharynx. Trace down from the l and follow a groove. This is the esophagus, which is located behind the trachea. The esophagus is labeled on the right. Immediately in front of the trachea is another raised dot area containing a labeled thyroid gland.

Oral Cavity

The mouth or oral cavity is bordered at the front and sides by the teeth, above by the hard and soft palate, and below by the tongue. In this diagram, the mouth is open. Find the label for the upper lip in the upper right side of the page. The label for the lower lip is in the lower right side of the page. Inside the upper and lower lips find the upper and lower teeth. Above the lower teeth find a smooth raised structure with a furrow in the middle. This is the tongue. Place your finger in the furrow of the tongue and pass toward the back. Note at the edge of the tongue a raised finger-like structure, the uvula. The label for the uvula is above it. This portion of the soft palate moves up when we swallow to prevent food from entering the nose. On either side of the uvula you will find a small raised structure, the palatine tonsil. The palatine tonsil on your left is labeled. The palatine tonsils are often just called "the tonsils." They can become swollen and inflamed when we have a sore throat.

Salivary Glands

This diagram shows the three salivary glands and their location in the head and neck. Although the glands are paired, only the glands on the right side of the head are shown. Begin by examining the raised line outlining the head and neck. Notice that the eyes, nose and mouth are on the right side of the diagram. In the middle of the diagram locate the labeled parotid gland. Note that it is located immediately in front of the ear. It is considered a serous gland. This means it primarily secretes enzymes which help in the digestion of food in the mouth. In the neck locate the label for the submandibular gland. Notice that because of its size, part of this gland is located in the head and a small part in the neck. Although this gland secretes mucous to lubricate the food, it mainly secretes enzymes. Finally, next to the chin locate the label for the sublingual gland. The gland is located in the mouth under the sides of the tongue. Its primary function is to secrete mucous although it does secrete some enzymes.

Structure of a Tooth

An adult has 32 teeth, 16 in the upper jaw and 16 in the lower jaw. The four types of teeth are shown in a row at the top of the diagram. From left to right identify an incisor, canine, pre-molar and molar. An adult has in each jaw 4 incisors, 2 canines, 4 premolars, and 6 molars. The incisors cut food, the canines tear it, and both the premolars and molars grind it. A typical tooth and its parts are shown at the bottom. On either side of the tooth identify the raised line representing the top of the gum. Above the gum is the crown; its smooth enamel surface is labeled on the right. Trace the enamel on both sides downward. It ends at a part of the tooth called the neck. That part of the tooth found in the labeled mandible is called the root. In this diagram there are two roots. Unlike the enamel, the roots are textured. This textured part is called dentin. Dentin surrounds the hollow part of the roots called the pulp. At the bottom of the page find the label showing blood vessels. Trace the blood vessels through the pulp. Although not shown in this diagram, the pulp also contains nerve fibers.

Position of Abdominal Organs

Plates 1 and 2

Plates 1 through 6 teach the location of all the abdominal organs. Each organ is described in its anatomical position. Plate 1 shows the bones which bound the abdominal cavity. Begin at the top of the diagram and note that ribs 5 through 10 are located on the front wall of the abdomen. Move to the midline and feel the bodies of thoracic vertebra 11 through lumbar vertebra 5. Below, observe the somewhat heart-shaped sacrum below lumbar 5, and alongside the sacrum, the pelvis. In plate 2 the ribs have been removed to show the location of the diaphragm, liver, gallbladder, and spleen. The thickened line at the top of the abdominal cavity represents the diaphragm. Immediately beneath it on the right side of the body feel the striped liver. On the lower border of the liver note a raised bump, the gallbladder. Now move to the left side of the body and observe the dotted spleen, also beneath the diaphragm.

Position of Abdominal Organs

Plates 3 and 4

Plate 3 displays the stomach and duodenum. Begin at the top of the diagram at the thickened line representing the diaphragm. Place your fingers in the middle of it and move down. Note the vertebrae and to their left the sac-like stomach. Connected to the stomach is a C-shaped tube, the duodenum. In plate 4 the stomach has been removed and organs on the back wall are displayed. Begin in the middle of the diagram by identifying the C-shaped duodenum. Within the C examine the long pancreas, textured with large dots. To the right of the duodenum locate the striped right kidney, and above it a roughened suprarenal gland. The striped left kidney cannot be seen as well because a small part of the pancreas and spleen lie in front of it (the spleen has closely spaced dots). Note the roughened suprarenal gland above the left kidney. Finally, examine the long tubes termed ureters passing downward from both kidneys toward the pelvis. They end in the urinary bladder, shown as a raised sac in the pelvis.

Position of Abdominal Organs

Plates 5 and 6

In plate 5 locate the four parts of the large intestine. Begin by identifying the thickened diaphragm at the top of the diagram. Move to its middle and pass your fingers down over the four vertebrae. At this point note the smooth structure passing from one side of the abdomen to the other, the transverse colon. Note that at each end of the transverse colon part of the large intestine extends downward. On the right side of the abdomen observe the ascending colon; on the left, the descending colon. At the tip of the ascending colon is the appendix. Curving into the pelvis from the descending colon is the sigmoid colon. Plate 6 shows the organs in their anatomical position. You should now be able to identify the liver, spleen, stomach, pancreas and gallbladder. The small intestine has been added. Note how it occupies most of the abdominal cavity.

Stomach

This diagram shows the stomach, the lower portion of the esophagus, and the beginning of the duodenum. Begin by scanning the diagram and locating the labels for each. Next, starting with the esophagus in the upper center, trace the outline of each organ. Note that the digestive system is like a tube which starts out narrow, spreads out to form the sac-like stomach, and then narrows again. As you examine the outer surface of the esophagus and upper stomach you will note that they feel smooth. The outer wall of the lower part portion of the stomach and the duodenum have been cut away, however, so that you can feel ridges representing their inner lining. These ridges allow for expansion of these organs and increase the digestive surface area. Locate the four labeled regions of the stomach: the cardiac portion near its junction with the esophagus, the fundus on the upper right, the body or major portion of the stomach, and the pylorus where it joins the duodenum. The textured edges of the stomach wall represent its smooth muscle layer.

Biliary Apparatus and Pancreas

This illustration depicts the liver, gallbladder, pancreas and associated ducts, and the interior of the duodenum. Begin by examining the striped liver. Its large right lobe is separated from the smaller left lobe by a vertical ligament in the middle of the organ. The liver has been tilted so you can examine the lower surface, which is depressed to distinguish it from the raised front surface. The sac-like gallbladder (labeled gb) lies on the lower surface of the liver's right lobe. Connected to the gallbladder is a narrow cystic duct which joins the other ducts exiting the liver to form the labeled common bile duct. Examine the pancreas and locate a raised duct coursing through the middle of the gland. This is the main pancreatic duct which joins the common bile duct as it enters the duodenum to form the major duodenal papilla. The common bile duct carries bile, produced in the liver and stored in the gallbladder, to the duodenum; the main pancreatic duct carries digestive enzymes. Within the pancreas are textured areas representing the masses of cells which produce insulin and secrete it into the bloodstream.

Interior of Kidney

When studying this diagram imagine that you have taken a slice of the kidney and placed it on this page. Begin by examining the key on the left at the bottom of the page. Return to the kidney and locate the small dots arranged around its outer border, which is called the cortex. The dots actually represent the microscopic units of the kidney called the nephrons. Notice that the striped renal pyramid is composed of straight tubes which carry urine to the smooth major calyces. In the upper right a major calyx is labeled for you. Urine passes from this area to the ureter. Examine this open tube, labeled in the lower right corner, as it moves downward to carry urine to the bladder. Return to the slice of kidney and locate the dotted regions found between the renal pyramids. These are the renal columns, which contain many blood vessels supplying the kidney. Finally, return to the lower right side of the diagram and locate the labels for the flattened renal vein and the raised renal artery.

Male Pelvis

In this cross-section of the male pelvis, the front is toward the right. Begin in the upper left by locating the sacrum and to its right the opened tubular rectum and anal canal. Move to the bottom of the diagram and locate the testis within the scrotal sac and the textured, raised epididymis. Trace the raised tube called the vas deferens as it moves up into the pelvis, crossing several structures on its way. You will note that it passes the pubic symphysis, labeled ps, and an oval structure with a hollow center called the bladder. The tube delivers sperm into a groove which represents the urethra within the prostate gland, which is represented as a raised area about the size of a walnut located just beneath the bladder. The prostate gland appears to be divided into three regions because the urethra and the duct from the slender, textured seminal vesicles pass through it. Follow the urethra as it passes through the prostate gland to enter the penis. Note the dotted texture on either side of the penile portion of the urethra, representing the erectile tissue.

Female Pelvis

In this cross-section of the female pelvis, the front is to the left. Begin in the center of the diagram and find the raised, oval structure with a hollow center labeled uterus. Trace its hollow center down until you feel it lead into a narrow open passageway called the vagina. The portion of the uterus where it joins the vagina is called the cervix. Find the oviduct extending from the uterus on the left side of the page and follow it until it ends by surrounding the round, textured ovary. Also examine the thin raised structure labeled the round ligament, which passes down as it extends from the uterus to support it. Just beneath the uterus, in front of the vagina, locate an oval hollow organ which is the bladder. This organ is not labeled but you should trace the passageway which carries urine from this organ labeled the urethra. Just in front of the bladder, the label ps represents the pubic symphysis, which joins the bones of the pelvis in front. To the right of the uterus locate the opened rectum and the bony sacrum. Note the relationship of the urethra, vagina, rectum and anal canal to one another.

Female Reproductive System

This diagram shows the following: the uterus, ovaries, ovarian ligaments and Fallopian tubes or oviducts. Begin in the middle of the diagram and examine the uterus, which is shaped like an upside down pear. Its top portion is called the fundus, the mid-portion the body, while its lower part is called the cervix. Note the difference in size of each part. At the base of the cervix locate an indentation which represents the opening into the uterus. Re-examine the fundus and notice that two structures extend from each side, the Fallopian tubes and ovarian ligaments. Trace the upper of the two, labeled the Fallopian tubes. Notice that they curve down toward the ovary. As you reach their widened ends note their finger-like projections, the fimbriae. These help to capture the ovum or egg and direct it into the tube. Next to the fimbriae find the ovaries. Identify the indentations left on their surface from eggs released during ovulation. Each ovary is connected to the uterus by a cord called the ovarian ligament.

Ovulation and Implantation of the Ovum

Beneath the title find the label Fallopian tube and trace its label lines down. On the left side identify the labeled fimbriae. These are like fingers at the far end of the tubes. To the right of the fimbriae find the large raised labeled ovary. Notice that on the right side of this diagram the Fallopian tube, its fimbriae and the ovary have been opened. In the middle of the diagram identify the uterus, which has been opened to show the uterine cavity. Its label is beneath the uterus. The key in the bottom left side of the page contains a raised dot representing the ovum. Return to the ovary on the right and identify within it an ovum. Pass down and to the right and note a labeled ovum outside the ovary. After release from the ovary, the ovum lies outside the uterine tube. Now place your fingers inside the fimbriae and locate the ovum as it enters the tube. As you pass your fingers through the tube, notice how the ovum is moving into the uterine cavity. If the ovum is fertilized in the tube, it will implant in the wall of the uterus. This implantation is shown in the right wall of the uterus.

Fertilization

This diagram shows 4 structures involved in fertilization. In the upper left corner find an unfertilized egg which is surrounded by an outer ring of cells. Inside the cells feel a smooth raised ring which at 6 o'clock contains a small cell called the first polar body. The actual egg with its nucleus is inside this ring. The upper right corner shows a magnified sperm. Identify its head and tail. The head contains a cap called the acrosome. The lower left corner shows many sperm trying to fertilize an egg. Notice that most of the sperm are stuck in the zona pellucida. Only one, located at 8 o'clock, enters and fertilizes the egg. The fertilized egg in the lower right corner shows the chromosomes, shown as small raised lines, beginning to form in the nucleus of the egg and head of the sperm.

Structure of a Chromosome

A chromatid is a structure with a long and short arm connected to each other. A chromosome is composed of two chromatids connected to each other by a small round body called a centromere. In this diagram three chromosomes are shown. The one on the left shows how a chromosome looks under a light microscope in the metaphase stage of mitosis. Note that the centromere separates the labeled short arms, called p arms, from the longer labeled q arms. The chromosome in the middle of the diagram shows that if we looked at a chromosome under high magnification we could see that it appears to be banded. This is depicted by the raised flat areas. These areas are termed genes. A single gene is labeled in one p arm of this chromosome. The chromosome on the right shows that under very high magnification we could see that a chromosome is composed of coils of DNA. Notice that the coils of DNA are labeled in both p arms.

Structure of DNA

In this diagram a segment of a DNA molecule is represented on the left side of the page. On the right side, a key showing nucleotide bases is displayed. DNA is similar to a ladder with two vertical or upright portions composed of sugars and phosphates connected to each other by rungs of nucleotide bases. Notice that the DNA ladder is twisted. Begin at the upper left and trace one side of the ladder as it goes down from left to right. Because of the twist, the middle and bottom of this molecule are raised, illustrating that they are closer to you. Examine the rungs or nucleotide bases. Notice that the bases are paired in a specific manner. Adenine is always paired with thymine, and cytosine always with guanine. These bases are connected or bonded to each other by hydrogen bonds. In the process of DNA replication, these bonds are broken so that the two halves of the ladder separate. Each separated half serves as a guide for the creation of a new half. These two halves once again bond or join to form a new DNA molecule.

Mitosis

Mitosis is a series of stages in which one cell duplicates its chromosomes and divides to eventually form two identical cells. In this diagram a cell and its stages of mitosis are shown in two rows. The top row shows a cell in 3 stages: from left to right they are interphase, prophase, and metaphase. The labeled stages are located below each cell. The anaphase and telophase stages are in the bottom row. In interphase identify the nucleus containing two thin chromosomes, and in the cytoplasm two short raised centrioles. In prophase the centrioles have moved to each end of the cell and the chromosomes have duplicated and thickened. Notice that in metaphase and anaphase the chromosomes have separated and are being pulled toward the centrioles, as indicated by fine textured lines. In telophase two newly formed nuclei and nearby centrioles are present on opposite sides of the cell. Note the indentation in the top and bottom of the cell. This will deepen and eventually separate the cell into two identical cells.



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