HSKN:: Connective tissue scavenger hunt

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Activity Guide

A full guide to this activity that students can follow for self-guided learning or that you can use to prepare a demonstration or set up a lab station

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Activity Guide

Activity Worksheet (Self-guided)

Use the worksheet below for the self-guided activity. If you are setting this activity up as a station, use this worksheet instead.

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Activity Guide

Introduction

Before you start exploring the function of your knee in other activities (e.g., how the knee moves, what each of the ligaments do), you'll need some familiarity with its structure (i.e., its form). This activity will introduce you to the knee's major connective tissues.

The following connective tissue types are included in this activity:

- Bones and their associated landmarks
- Cartilages
- Ligaments
- Tendons

Your challenge for this activity is to find various connective tissue structures of the knee given only hints about their size, shape, and position relative to other structures.

> To learn anatomical structures, your first thought might be to just memorize them. This can work in the short term. But it's boring, time-consuming, and you will quickly forget most of what you memorized. A better way to learn structures is to *interact* with them (e.g., find them, write about them, compare them, make them move, measure them, etc.). This is more efficient (i.e., you'll learn more in less time) and you'll remember more long-term. Resist the temptation to use an anatomy atlas! The more you struggle with finding the structures, the more you'll learn (and remember). You can always use a reference diagram after you've finished to check your work.

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Activity Guide

Materials needed

For this activity you'll need:

1. The worksheet for this activity (either opened in a PDF viewer on a desktop/tablet computer or printed out).



Connective tissue scavenger hunt · v1.0 HSKN1 Worksheet · Page 1

Instructions

In this activity, you'll find all of the structures listed in the wordbank to the right on your knee kit, using the hints in the activity guide (page linked below).

Find the hints at:
guides.3das.us/link/61

Follow the hints in order—they build off each other. Use your physical knee kit in solving the hints; combining the 2D images here with the 3D model will help you learn to recognize each structure from multiple views.

You'll use some names more than once. Each structure has a unique letter associated with it (included with each blank). If two blanks have the same letter, they're the same structure. Use the diagram below to help you with the anatomical directional terms.

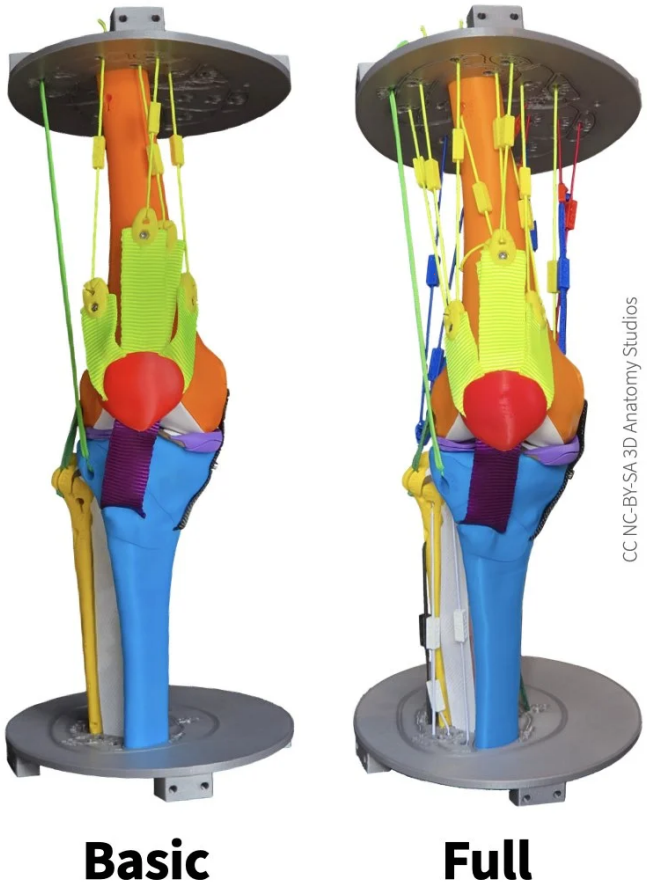
No.	Name
1	Adductor tubercle
2	Anterior border (of fibula)
3	Anterior border (of tibia)
4	Anterior cruciate ligament (ACL)
5	Apex (of fibula)
6	Articular surface
7	Femur
8	Fibula
9	Head (of fibula)
10	Iliotibial (IT) band/tract
11	Intercondylar eminence
12	Intercondylar fossa
13	Interosseus membrane
14	Lateral/Fibular collateral ligament (LCL)
15	Lateral condyle (of femur)
16	Lateral condyle (of tibia)
17	Lateral epicondyle
18	Lateral intercondylar tubercle
19	Lateral meniscus
20	Lateral supracondylar line
21	Linea aspera
22	Medial collateral ligament (MCL)
23	Medial condyle (of femur)
24	Medial condyle (of tibia)
25	Medial epicondyle
26	Medial intercondylar tubercle
27	Medial meniscus
28	Medial supracondylar line
29	Meniscotibial/Coronary ligaments
30	Neck (of fibula)
31	Patella
32	Patellar ligament
33	Popliteal surface
34	Posterior cruciate ligament (PCL)
35	Quadriceps tendons
36	Rectus femoris tendon
37	Shaft (of femur)
38	Soleal line
39	Tibia
40	Tibial tuberosity
41	Vastus intermedius tendon
42	Vastus lateralis tendon
43	Vastus medialis tendon

You can find the guide for this activity at 3das.us/guides/HSKN1

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2. A Human Knee Active Learning Kit (Basic or Full model). You'll need at least the minimal number of muscles attached (left in the image below).

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For this activity, you'll need a knee kit resembling one of the two images above. Your knee can have just a few muscles attached (left), all of the muscles attached (right), or some number in between.

This activity is easier with the minimal muscle set but it’s also possible to do with more muscles attached. Your knee kit may or may not already have stickers attached. If your knee kit doesn’t look like one of the kits in the image above, follow these instructions for assembling or disassembling your kit.

The following are ***optional*** materials for this activity:

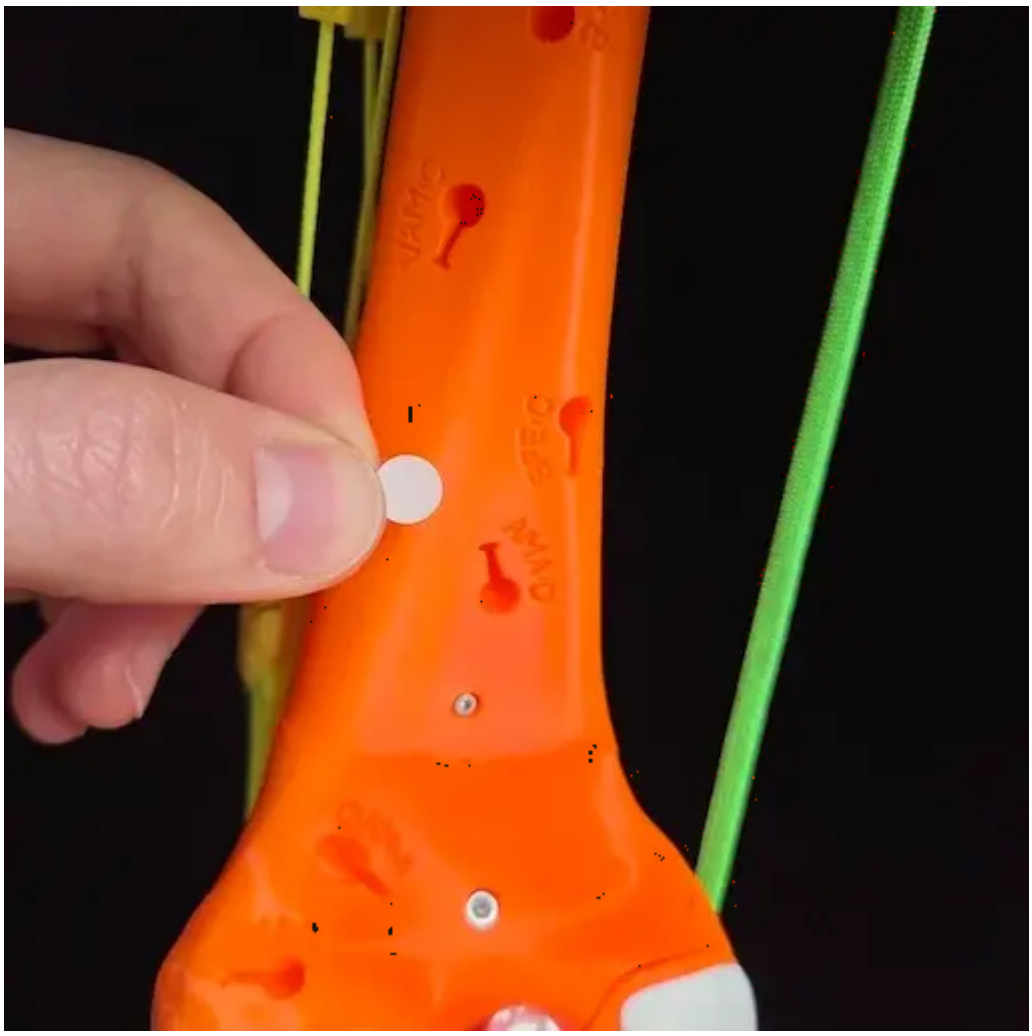
- White circle stickers (not included in your kit but these can be found easily online; 1/4 inch circle/diameter works well for the sticker size)
- A ball point pen or mechanical pencil for writing on the stickers (rollerball or gel pens can smear on the stickers)

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Activity Guide

Pre-marking structures on your kit (Optional)

If your knee kit doesn't already have stickers attached, you can start by marking all of the hunt items on your knee kit with blank stickers.



Attaching stickers to your knee kit

This will help you gain familiarity with the shapes and locations of the structures before you actually start learning their names. You'll also have the option at the end of the activity to write labels on each of the stickers.

To attach the stickers, refer to pages 2-4 of the activity worksheet.

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Starting with structure "A" at the top of page 2, attach stickers onto your knee kit where indicated by each arrow. You can skip structures that are too difficult to attach a sticker to. You only need to attach one sticker for each labeled structure; since the arrows go alphabetically, you'll be able to tell if you reach a structure for which you've already added a sticker.

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Activity Guide

General guide to this scavenger hunt

To complete this scavenger hunt, use the hints in this guide and the wordbank on page 1 of the activity worksheet to fill in the blanks on pages 2-4 of the worksheet. Follow the hints in order- each hint builds off a previous one. Use the images on your worksheet together with your physical knee kit; combining the 2D images with the 3D model will help you recognize each structure from multiple views.

Structure names and letters

There are 43 structure names but more than 43 blanks - you'll use some of the names more than once to help you recognize structures from different views. Each structure has a unique letter associated with it; these letters are included with the blanks on pages 2-4. If two blanks have the same letter (on different pages), that means it's the same structure. This is useful for checking your work afterward but try to avoid using this to help you as you fill in each blank. The more you use the hints in this guide to fill in the blanks, the better you'll remember the structures later.

Anatomical language

The hints make extensive use of anatomical directional terms (e.g., superior, inferior, anterior, etc.) to help you build fluency with this language and anatomical reasoning; use the diagram on page 1 of the worksheet to help you.

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Activity Guide

The Scavenger Hunt

Your hunt starts with the easy stuff: the four bones of the knee.

The bones

Femur: This is the most superior of the bones with two condyles (rounded protuberances) at its inferior (distal) end.

> Write in "Femur" on the worksheet on the corresponding blank(s) (we won't keep repeating this instruction for each hint).

Tibia: The tibia is the bone that articulates with the femur at its two previously mentioned condyles.

Fibula: This bone articulates with the tibia at its (both the tibia's and the fibula's) superior end.

Patella: This is a sesamoid bone (a bone that forms within a tendon) anterior to the femur, tibia, and fibula.

The bony landmarks

Bony landmarks (named structures on bones) are important for describing injuries to bones, specifying locations for surgical interventions, comparing the size and/or shape of the same bone between two individuals, etc.

Shaft (of the femur): This is the (approximately) cylindrical portion of the femur.

Lateral condyle (of the femur): In anatomy, "condyle" refers to a part of a bone that forms an articulation (joint) with another bone. The lateral condyle is the lateral part of the femur that forms the joint with the tibia. How do you know which is lateral and which is medial? Try to figure this out on your own but if you're stuck check out the hint below.

HINT

Being able to recognize the medial versus lateral aspect of the knee will come in handy again and again with these activities. It will help you quickly identify muscles, ligaments, and

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other structures. Without the pelvis or foot to help you, it's surprisingly easy to get turned around. Here, your best friend is the fibula. The fibula is more lateral than the tibia.

Left or right knee: Now that you're oriented to which side is lateral and which side is medial, determine whether your knee kit is a left or a right knee.

HINT

In anatomy, your body is always available as a helpful reference. If you're not sure which side your knee kit is, try holding it up to your own knee to help you.

Medial condyle (of the femur): You've already identified the femur's lateral condyle- this is the other (more medial) one.

Intercondylar fossa: Try finding this bony landmark on the posterior aspect of the femur by interpreting the meaning of the name in Latin.

HINT

"Inter-" in Latin means "between" or "among" and "fossa" means "ditch," "trench," or "channel."

Lateral condyle (of the tibia): It takes (at least) two bones to make a joint so just as the femur has condyles at the femorotibial joint, so does the tibia. This is the lateral of the two condyles at this joint.

Medial condyle (of the tibia): The tibial counterpart to the medial condyle of the femur.

Lateral epicondyle: In Latin, "epi-" means above, so this bony landmark of the femur is above (superior to) the femur's lateral condyle. Look for a small protuberance (bump).

Medial epicondyle: The medial counterpart to the lateral epicondyle, also on the femur.

MORE DETAIL

Bones are living, dynamic tissues that respond to the other tissues around them. Ligaments and tendons attached to bones pull on the bone at their attachment. Over time, this localized

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pulling force literally pulls up the surface of the bone, modeling it like clay and forming a landmark (e.g., bump, ridge, etc.). The epicondyles of the femur are examples of this type of landmark and are formed because of muscles and ligaments that attach to the femur at those sites.

Adductor tubercle: A bump ("tubercle" comes from the Latin for "small swelling") on the femur formed by the tendon of the vertical/hamstring portion of the adductor magnus muscle. You'll find this bump superior to one of the femoral condyles.

HINT

If you're unsure whether the adductor tubercle is superior to the medial or lateral condyle of the femur, note that adductor muscles pull body parts closer to the central axis of the body (as opposed to abductor muscles, which pull them away from the central axis). Knowing this, which makes more sense: medial or lateral?

Lateral supracondylar line: A ridge on the posterior aspect of the femur, superior to ("supra-") the lateral condyle of the femur. This ridge is formed by the tendon sheets of the biceps femoris and vastus lateralis.

Medial supracondylar line: The medial counterpart to the lateral supracondylar line. This ridge is formed by the tendon sheets of the vastus medialis and adductor longus.

Popliteal surface: The area between the medial and lateral supracondylar lines ("popliteal" comes from the Latin for the knee region).

Linea aspera: Find this ridge (linea aspera means "rough line" in Latin) by tracing where the medial and lateral supracondylar lines come together superiorly. This ridge is formed by the tendon sheets of various hamstring and adductor muscles.

Lateral intercondylar tubercle: This is the lateral ridge between ("inter-") the condyles of the tibia at the femorotibial joint.

HINT

To see this landmark well, expose the femorotibial joint by dislocating the patella laterally and fully flexing the knee (see page 3 of the worksheet).

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Medial intercondylar tubercle: The medial counterpart to the lateral intercondylar tubercle.

Intercondylar eminence: This is the raised portion of the tibia between the two condyles, formed by the two intercondylar tubercles.

Tibial tuberosity: Large bump on the anterior aspect of the tibia, formed by tension from the ligament that attaches the patella to the tibia.

Anterior border of the tibia: Follow the tibial tuberosity inferiorly to find this sharp ridge running the remaining length of the tibia.

MORE DETAIL

If you were to cut the tibia in half and look at the cross section, it would look roughly like a triangle. The "corners" of this triangle are referred to as "borders" and run superoinferiorly along the length of the tibia. The borders of the tibia are: anterior, medial, and interosseus; only the anterior border is included in this activity.

Anterior border of the fibula: The fibular counterpart to the anterior border of the tibia. The fibula also has interosseus and posterior borders (not included in this activity).

Soleal line: Ridge on the posterior aspect of the tibia formed by the soleus muscle. This ridge arches from lateral to medial as you trace it from superior to inferior.

Interosseus membrane: "Osseus" comes from the Latin for "bone" and you should already recognize "inter-" from a previous structure.

Neck, head and apex of the fibula: The terms "head" and "neck" are used for multiple long bones of the body (e.g., humerus, femur) to refer to the superior-most structures of these bones. Just as for the head and neck of the body, the head is superior to the neck. For the fibula, the superiormost point of the bone is the apex. There are separate blanks on the worksheet for each of these.

The cartilages

Bone is an excellent tissue for bearing forces and torques (twisting forces) but it is not good at withstanding the wear and abrasion that occurs at surface contacts between moving bones. That's why the contact points between moving bones (i.e., at joints) are always with lined with cartilage (well, healthy joints, at least).

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Articular surface: "Articular" in anatomy refers to anything joint-related (e.g., articulation, articulates with). The articular surface is made up of articular cartilage.

Lateral meniscus: Crescent- or C-shaped cartilage between the lateral condyles of the femur and tibia (meniscus means "little crescent/moon" in Latin).

Medial meniscus: Like the lateral meniscus but medial.

MODEL NOTE

The menisci (plural of meniscus) are composed of a soft, pliable cartilage but are represented in your kit by a harder plastic because most pliable materials would prevent smooth motion between the menisci and bones without some kind of lubrication.

The ligaments

Ligaments connect bone to bone or cartilage to bone. These are represented in your knee kit by ropes or straps that stretch minimally when pulled on.

Meniscotibial/Coronary ligaments: The ligaments that connect the horns of each meniscus (the end points of each crescent) to the tibia.

MORE DETAIL

"Coronary" comes from the Latin for "crown" or "wreath"; that's one name for these ligaments because, together with the menisci, they form a crown around the superior margin of the tibial plateau (the flat "top" of the tibia). There are four of them, named based on lateral vs. medial and anterior vs. posterior:

Lateral anterior meniscotibial ligament
Lateral posterior meniscotibial ligament
Medial anterior meniscotibial ligament
Medial posterior meniscotibial ligament

There are several other ligaments that connect the menisci to the medial collateral ligament, the tendinous sheath surrounding the patella, the tendon of the semimembranosus muscle, the popliteus muscle, the femur, and to each other (Smith et al. 1996); these are not included in this activity or in your kit because they would make the kit difficult to assemble and disassemble.

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Anterior cruciate ligament (ACL): Of the four ligaments that connect the femur and tibia, this one has the most anterior attachment on the tibial plateau (specifically the intercondylar eminence).

Posterior cruciate ligament (PCL): The ligament connecting the femur and tibia with the most posterior attachment on the tibia.

Lateral collateral ligament (LCL): The lateralmost ligament connecting the femur and tibia. Also known as the fibular collateral ligament.

Medial collateral ligament (MCL): The medialmost ligament connecting the femur and tibia. Also known as the tibial collateral ligament.

Patellar ligament: Connects the patella and tibia.

Iliotibial (IT) band/tract: This structure is a mix of a ligament and tendon. It functions as a tendon for the hip abductor muscles and as a ligament connecting the pelvis and tibia. Since your knee kit stops at the middle of the femur, find a ligament originating from a cross section plate and connecting to the tibia.

The tendons

Tendons connect muscle to bone. Like ligaments, these are represented in your knee kit by ropes or straps that stretch minimally when pulled on.

Quadriceps tendons: These tendons connect the four ("quad") anterior thigh muscles to the patella.

Rectus femoris tendon: This tendon is the most central and anterior of the quadriceps tendons.

Vastus lateralis tendon: This is the most lateral of the quadriceps tendons.

Vastus medialis tendon: This is the most medial of the quadriceps tendons.

Vastus intermedius tendon: This tendon is directly posterior to the rectus femoris tendon.

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Activity Guide

Finish labeling your kit (Optional)

If you attached circle stickers to your kit in Premarking the hunt items, now test how well you can identify these structures on your kit.

On each circle sticker that you attached to your kit, write in the number corresponding to that structure from the word bank on page 1 of the activity worksheet. For example, you'd write "1" on the sticker that you have attached to the Adductor tubercle.

If you get stuck, refer to pages 2-4 of the activity worksheet that you completed; but try to avoid this as much as possible.

Once you've finished labeling all of the stickers, check your work against pages 2-4 of the activity worksheet and then remove the stickers to prepare your kit for another activity or for someone else to use.

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Activity Guide

References cited

The following articles/books are references cited in this activity:

- Smith, Laura K et al. Brunnstrom's Clinical Kinesiology. 5th ed. / revised by Laura K. Smith, Elizabeth Lawrence Weiss, L. Don Lehmkuhl. Philadelphia: F.A. Davis, 1996. Print. Chapter 9: Knee Region.
  https://catalog.nlm.nih.gov/permalink/01NLM_INST/vdtut1/alma997938033406676.

Any 3D renderings or animations in this activity were created using Blender.

All anatomical data used to make the kit and activities are from:

- National Library of Medicine. (1995–). *The Visible Human Project* [Digital Data Set]. Bethesda, MD: National Institutes of Health.
  https://www.nlm.nih.gov/research/visible/visible_human.html.

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Activity as a Station

Materials you can use to set up this activity as a station

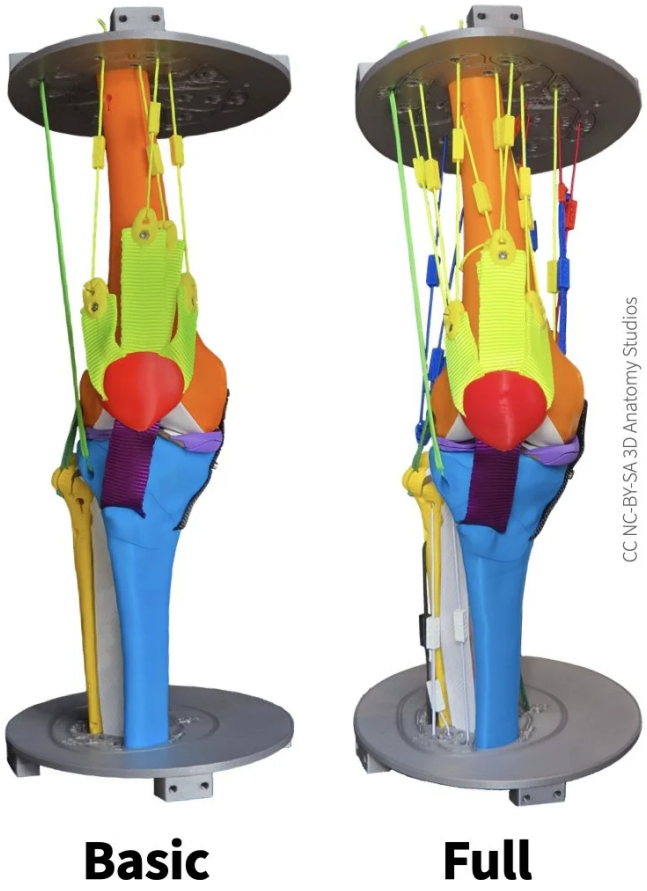
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Activity as a Station

Station setup

To set up this activity as a station, you'll need:

1. The printed station instructions for this activity.
2. A printed station worksheet for each student or group (students can also access a digital PDF of worksheet via a QR code on the station instructions).
3. A Human Knee Active Learning Kit (Basic or Full model) with at least the minimal number of muscles attached (left in the image below).

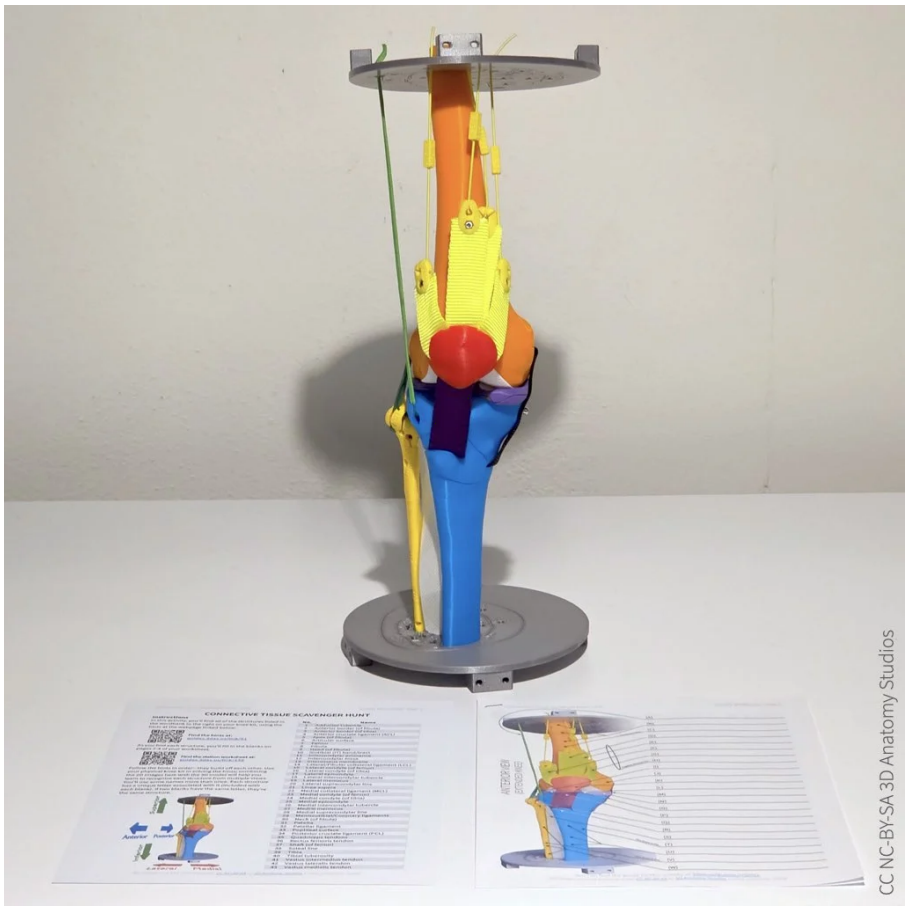


For this activity, you'll need a knee kit resembling one of the two images above. Your knee can have just a few muscles attached (left), all of the muscles attached (right), or some number in between.

This activity is easier with the minimal muscle set but it’s also possible to do with more muscles attached.

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Your station setup should look something like this (in the photo below, the knee kit is the Basic model):



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Activity as a Station

Station instructions

PDF instructions for the station

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Activity as a Station

Station worksheet

Use this worksheet to complete this activity as a station

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Educator Guide

Information that is helpful for using this activity as an educator

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Educator Guide

Activity at a glance

Time to complete	Approximately 1-1.5 hours
Age level	Advanced high school, College, or Professional school
Bloom's level(s)	• BL1 - Remember • BL2 - Understand
Learning objective	After completing this activity, students will be able to **identify** (BL1 - Remember) the connective tissues of the knee, **describe** (BL2 - Understand) their position relative to other structures using anatomical language, and **match** (BL2 - Understand) these structures from a 2D diagram to a 3D physical model.
Assessment	• **Students:** Students can assess their own work by comparing their answers to an anatomical reference text or atlas. • **Educators:** Educators can assess students' work by comparing the completed activity worksheet to the answer key (only visible to educators).
Materials needed	See Materials needed

Systems / Tissue types	• Connective tissues
	  ◦ Bones
	  ◦ Cartilage
	  ◦ Ligaments
	  ◦ Tendons

Core concepts	Not applicable for Bloom's levels 1-2
Competencies	• Integration of 2D and 3D representations • Observation
Activity ID	HSKN1

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Educator Guide

About the kit, viewing answer key, purchasing kits, and more

Why was this kit developed?

The Human Knee Active Learning Kit is a life-size and fully functional reproduction of a real knee designed by 3D Anatomy Studios to engage learners in a deeper understanding of knee structure and function through hands-on activities.

Who made this kit?

The Human Knee Active Learning Kit was designed by 3D Anatomy Studios founder Aaron Olsen, PhD. Aaron is a professional anatomist and designer who has published several peer-reviewed articles on the form, function, and evolution of vertebrates and has taught comparative vertebrate anatomy at the University of Chicago and human gross anatomy at the University of Chicago's Pritzker School of Medicine and Brown University's Warren Alpert Medical School. The kit was designed in the open-source 3D modeling program Blender using public domain data from the NIH Visible Human Project. Every kit is made by hand at the 3D Anatomy Studios workshop in Portland, Oregon.

When was this kit made?

Initial development of the Human Knee Active Learning Kit began in late 2024. Prototypes were exhibited at the Society for Integrative and Comparative Biology annual meetings in January 2025 and January 2026 and the first commercially available version of the kit was completed in May 2026.

Where was this kit made?

The design process for the Human Knee Active Learning Kit began in Pawtucket, Rhode Island (where 3D Anatomy Studios was located prior 2026) and completed in Portland, Oregon (where 3D Anatomy Studios moved in January 2026). As far as manufacturing, although we source the component parts (screws, 3D printer filament, ropes, straps, etc.) from various suppliers, we do all of the remaining manufacturing work (3D printing, cord cutting and preparation, paper part printing and lamination, assembly, etc.) ourselves at our workshop in Portland, Oregon.

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Pawtucket, Rhode Island was once heavily populated by the Pokanoket and Nipmuc tribal nations as well as the Narragansett, Niantic, and Manissean who are the ancestral habitants of the land we now call Rhode Island. Portland, Oregon was once heavily populated by the Multnomah, Wasco, Cowlitz, Kathlamet, Clackamas, Chinook, Tualatin, Kalapuya, Molalla, and numerous indigenous peoples who, for millennia, made their homes along the river basin we now call the Columbia River. We acknowledge the Indigenous peoples who have inhabited and continue to inhabit these lands on which we live and work and we honor with gratitude their historical and cultural relationship to the land.

Where did the anatomical data come from?

The anatomical data used to build the kit were sourced exclusively from the Visible Human Female of the NIH Visible Human Project. These data were first released into the public domain in 1995. Because these data are in the public domain, they can be used for any purpose, including commercial use. Hard tissue data (i.e., bones) were segmented from CT scans and soft tissue data (i.e., muscles, tendons, ligaments, cartilage, etc.) were segmented from cryosection image stacks. All segmentation was performed using the open-source software 3D slicer. Meshes were exported from 3D Slicer and mesh face counts were reduced using the open-source software MeshLab, before importing meshes into Blender.

How is the kit licensed? Can I copy the kit?

3D Anatomy Studios asserts copyright over the Human Knee Active Learning Kit, covering all aspects of the kit design, including packaging, that represent creative expression, beginning with its initial design in 2025. This grants 3D Anatomy Studios exclusive rights to reproduce, distribute, display, or adapt the kit. If you'd like to request permission to reproduce, distribute, display, or adapt the Human Knee Active Learning Kit, please email us at contact@3danatomystudios.com. Requests that are non-commercial may be granted at no cost; commercial requests may require a licensing fee. Please note that while 3D Anatomy Studios asserts copyright over the kit itself, the activity guides for the kit are released with a CC NC-BY-SA license.

How can I use the kit?

The Human Knee Active Learning Kit is designed for hands-on, interactive learning in multiple contexts:

- **Students in human anatomy or biomechanics courses** can use the kit in a lab setting either as a station (set up by an educator) or on their own for self-guided learning by following any of the available activity guides.

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- **Educators teaching human anatomy or biomechanics** can use the kit in a lecture or lab setting to demonstrate knee form and function, muscle coordination, and joint biomechanics, using the available activity guides as a reference, to help prepare a demonstration, or to help set up a station.
- **Clinicians working with patients who have knee injuries** can use the kit with patients to clearly explain how the knee works, how the patient's knee was injured, and the reasoning behind a particular course of treatment without needing to use complicated jargon, using the available activity guides as a reference and for assembly and disassembly instructions.
- **Clinical educators in the fields of sports medicine and orthopedics** can use the kit to demonstrate to students and trainees in the healthcare profession the complex mechanics of the knee and the effects of particular injuries through knockout experiments, using the available activity guides as a reference and for assembly and disassembly instructions.
- **Physical therapists working specifically with high-performing athletes** can use the kit to help athletes understand how to improve their performance and reduce the risk of injury, using the available activity guides as a reference and for assembly and disassembly instructions.

How are the activity guides structured?

Every activity guide for the kit follows the same structure:

- **Activity Guide:** A step-by-step guide through the activity with hints, self-assessments, and a worksheet. This can be used by students for self-guided learning or by educators and clinicians as a reference.
- **Activity as a Station:** Materials that educators can use to set up the activity as a station, such as in a lab setting, including an instruction sheet and a modified worksheet ideal for use as a station.
- **Educator Guide:** An overview of the activity for educators and answer key.

How do I view the answer keys?

The activity answer keys will only be visible to logged in users who have been given educator permissions and have purchased one or more Human Knee Active Learning Kits. Once you've been granted access, you can find the answer keys in the "Educator Guide" section of each activity. If you've purchased one or more kits, you should have received an email to access your Educator account. If you need us to resend this email or have any other issues accessing your account, please email us at contact@3danatomystudios.com.

Can I share and/or edit the activity guides?

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All of the activity guides for the kit are released under a CC NC-BY-SA license. This allows you to share and edit this module as long as you (1) do not sell the module or module derivatives ("NC"), (2) attribute the author(s) of all the content, including preserving text and graphic attributions ("BY"), and (3) share the module under the same license ("SA").

How were these activity guides made?

These activity guides were created by professional anatomists and educators at 3D Anatomy Studios using the open-source wiki software Bookstack. You can see the author of each activity by seeing who it was created by (on the main page of the activity). The guides are all hosted online at the domain guides.3das.us, which is maintained by 3D Anatomy Studios.

Was AI (artificial intelligence) used to make these guides?

No. *None* of the content on this site (text, images, videos, etc.) was generated by AI.

How can I purchase kits?

To purchase Human Knee Active Learning Kits, please send us an email at contact@3danatomystudios.com.

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