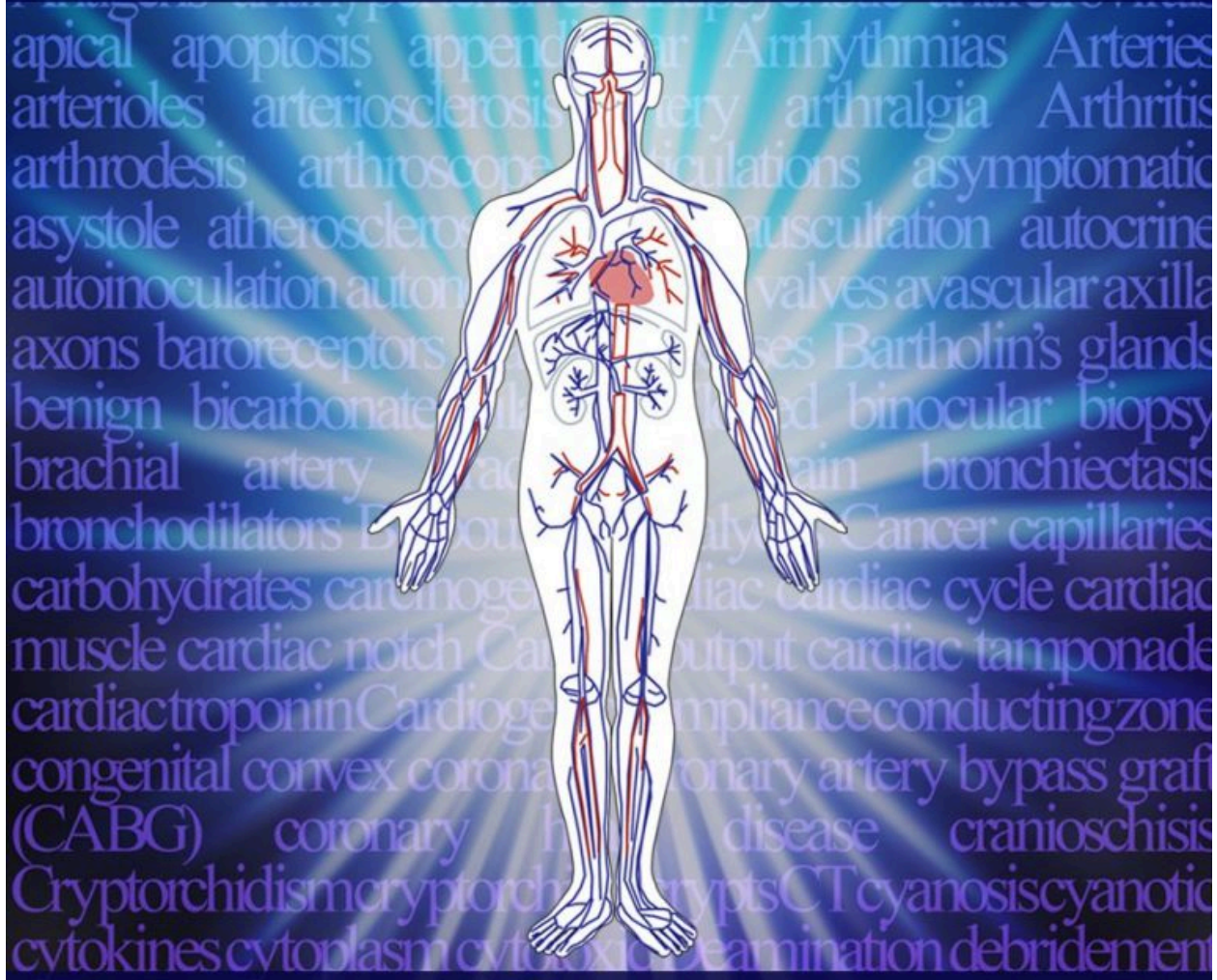


BUILDING A
MEDICAL TERMINOLOGY
FOUNDATION
SECOND EDITION



KIMBERLEE CARTER MARIE RUTHERFORD CONNIE STEVENS



 **Georgian**

 **CONESTOGA**

Sheridan

Building a Medical Terminology Foundation 2e

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GEORGIAN COLLEGE
TORONTO, ONTARIO



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Accessing and Using Building a Medical Terminology Foundation 2e

This resource is an Open Educational Resource (OER). An Open Educational Resource is a learning material intentionally created and licensed to be available to the user with little or no cost involved.

In this resource, you will work through each body system, learning word parts, whole medical terms, and common abbreviations associated with that particular body system. Interactive content is built into each chapter. At the end of each chapter is a vocabulary list of associated terms related to that body system. The interactive reinforcement activities require you to click, drag and drop, listen and repeat, flip, and test yourself.

Never used an Open Educational Resource (OER) before? Check out our [Using OER Textbooks: Student Guide](#).

Accessibility

This textbook is designed to be [accessible](#) using standard web browsers, mobile devices, screen readers, and other assistive technology. You can access the book in several formats. Requirements, tools, and suggestions for navigating and using the book are listed on this page. If you encounter any issues in accessing the book, please connect with your course professor.

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- To reduce printing costs, consider printing in black & white and refer to the webbook or PDF for any diagrams that require colour.
- Ask about binding or 3-hole punching when you order, as this is usually low cost and will make your textbook easier to use.

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Introduction

Welcome to ***Building a Medical Terminology Foundation 2e***. Medical terminology is a language that is used in health care settings. Medical terms are built from Greek and Latin word parts and, in addition, include **acronymns**, **eponyms**, and **modern-day language terms**.

Learning a new language can be a daunting task. In this resource, we offer a method for breaking down medical words that takes that daunting task and makes it manageable. What is required from you is a commitment to memorizing the word parts, learning the rules, and identifying the **rebels**. Once you meet that commitment, we will show you how to apply the rules to the word parts you have memorized. As you memorize the language components of medical terminology, it is important to support that learning with the context of anatomy and physiology. Consider where in the body the medical term is referencing and then how it works within the body. This will build a medical terminology foundation that you can continue to grow in your future healthcare courses.

Additional Resources Accompanying this Edition

[Building a Medical Terminology Foundation 2e – Student Companion Workbook](#)

[Building a Medical Terminology Foundation 2e – Anatomical Colouring Book](#)

Please note: this OER provides examples of medical documentation to enhance your learning of medical terms. These reports are not intended to represent or demonstrate Association for Health Documentation Integrity (AHDI) formatting standards.

Our first edition of edition of *Building a Medical Terminology Foundation* laid the groundwork for this second edition. From the outset, this resource resonated with students and educators in healthcare programs, where possessing medical terminology knowledge is an essential skill. The feedback we received from the first edition influenced and inspired us and paved the way forward to the new edition. A special thank you to all who contributed their insights and comments. Now, as we turn the page to our new edition, we are excited to highlight what is new in this edition:

- Layout: chapters are divided into subchapters, making it easier for the reader to navigate and focus on a key segment of the chapter content.
- New chapters: **Chapter 18 Oncology** and **Chapter 19 Mental Health** expand our comprehensive coverage and knowledge areas.
- Updated interactive activities: interactive chapter dialogue cards are expanded to include more terminology and additional audio pronunciation recordings.
- Text versions of interactives: H5P activities now contain textual versions to support and enhance greater accessibility and offline user experience.
- Added: solutions for the H5P activities have been placed in the footnotes section and will appear at the bottom of the page in the webbook or at the end of the page/chapter for the PDF version.

- Updated content weblinks: chapter links are updated to ensure relevancy and current standards, where relevant and applicable.
- Updated colour theme of the textbook for a consistent look and feel.
- New supplementary resources:
 - [Building a Medical Terminology Foundation 2e – Student Companion Workbook](#) accompanies each chapter of learning for enhanced learner reinforcement. Chapter worksheets and activities in Word files to practice medical terminology development are available within the workbook.
 - [Building a Medical Terminology Foundation 2e – Anatomical Colouring Book](#) – many diagrams and illustrations found in chapters throughout the main text are now available in colouring book format. Learners are directed to identify and colour anatomical structures for an enhanced learning experience.

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Acknowledgements

Land Acknowledgement

We wish to acknowledge and honour indigenous history and in the spirit of reconciliation, we convey our respect to First Nations, Métis, and Inuit people.

Conestoga College is located on the traditional territory of the Anishnaabe, Haudenosaunee, and Neutral peoples. Georgian College campuses are situated on the traditional land of the Anishnaabeg people. The Anishnaabeg include the Odawa, Ojibwe, and Pottawatomi nations, collectively known as the Three Fires Confederacy. Sheridan campuses reside on traditional land territory of the Mississaugas of the Credit First Nations, Anishinaabe Nation, Huron-Wendat, and the Haudenosaunee Confederacy.

How It Began...

In the Spring of 2018, I (Kimberlee) attended a workshop on building OER (Open Educational Resources) for high impact in first year courses. I was moved by the student speaker's plea over the rising costs of textbooks and motivated to learn more about the ability to customize OER. In health office administration programs, customization is important because we are a combination of health and business. I attended a Pressbooks webinar, signed up for an account, and started plugging away. I will be honest, the task was daunting to do alone.

Marie and I met in the Winter of 2019 as participants in the Ontario Extend eCampus Ontario MOOC and went on to become Empowered Educators. Through this program, we learned about Creative Commons licensing and were inspired to create OER. In the fall of 2019, I shared what I had been working on with Marie and this led to a collaborative partnership that snowballed into this OER. We advocated for support, found collaborators, and ultimately crowdsourced this OER. Please read below to learn about the amazing collaborative support we had for this OER, for which we are truly grateful.

Kimberlee Carter B.Ed., M.A., Conestoga College ITAL

Thank you Kimberlee for inviting me to partake and share this adventure with you. The opportunity to create a resource for learners in this OPEN format has been a wonderful and collaborative endeavour.

Marie Rutherford, Dip., Nursing, LD., BGS., Georgian College CAAT

The Journey Continues...

I have been excited to see this second edition of Building a Medical Terminology Foundation come to fruition. I am so grateful to Marie Rutherford and the team from Georgian for picking up the mantel to lead this second edition, and to Connie Stevens and the faculty subject matter experts from Sheridan, who collaborated with Marie to complete chapters that we were not able to get to in the first edition. Marie and Connie, I am truly grateful for your

passion for Open Education, medical terminology, and learners. I would like to thank the Open Learning team at Conestoga College for providing wrap-around editorial and design support. I have so much gratitude to our student-OER assistants for their contributions and for reminding us of the importance of students' voices in classroom resources.

Kimberlee Carter, OER Consultant, Open Learning, Library and Learning Services at Conestoga College

The healthcare field constantly evolves with new research, changing environments, and advancing technology. The second edition of *Building a Medical Terminology Foundation* is designed to stay in step with these ongoing advancements. I am privileged to contribute to our learning materials' continuous improvement and relevance and Open Educational Resource updates. I am ever grateful for the continuous improvement and collaboration with many knowledge expert colleagues. Thank you to my co-authors, Marie Rutherford and Kimberlee Carter, who are tireless advocates for OERs, and for impacting our students.

Connie Stevens, Faculty, RN, BScN, MA, PhD. Sheridan College ITAL

The second edition of this resource was developed through the efforts and inspiration of many talented and dedicated individuals. In the pages of the second edition, I am humbled by the brilliance and unwavering commitment of those who joined on this journey. To the editors who polished and worked through the book identifying any issues and resolving them: thank you. With boundless admiration, I am thankful for the wraparound support and design insights provided from the OER Design Studio at Georgian College and Open Learning at Conestoga College. No words are enough to convey heartfelt thanks. A special thank-you to my co-authors, Connie Stevens, and Kimberlee Carter, who remain the catalyst and the driver of innovation to bring the first edition and second edition from concept to completion.

Marie Rutherford, Dip., Nursing, LD., BGS., Georgian College CAAT

Thanks and Gratitude

Our thanks and gratitude listings are a combination of individuals who were instrumental in the development of this resource and include recognition of the first and second edition contributors.

We wish to thank our partner institutions involved in the development of this edition who are champions of Open Learning practices: the Open Learning team at Conestoga College, the OER Design Studio team at Georgian College, and Sheridan College.

Thanks to **Gary Hallam**, Vice President of Research & Executive Dean of the School of Business at Conestoga College ITAL, for sharing his dream for OER and championing our project to other business heads in the Ontario College System. His encouragement and resource support led to the expansive collaboration team that saw this project through to publishing.

We also extend our gratitude to **Pavla Kazda**, Dean from Georgian College CAAT, for her support, encouragement and resource allocation.

We wish to recognize the work of our **students**, whose dedication, creation of activities, and commitment to reviewing interactive activities throughout the development of this resource was invaluable. Additional thanks

for examining content and providing feedback from the student perspective. Thank you for paying it forward for future students.

- Tiffany Hunt BSc., Conestoga College ITAL
- Heather Scudder, Georgian College CAAT
- Gisele Tuzon, Georgian College CAAT
- Alyssa Arsenault, Conestoga College ITAL
- Tania Deane, Conestoga College ITAL
- David McCuaig, Conestoga College ITAL
- Hana You, Conestoga College ITAL
- Benny Baby, Georgian College CAAT
- Val Hrynyk, Georgian College CAAT

To our amazing subject matter experts who continued with a backpack full of responsibilities to author content in the first edition and helped to crowdsource this OER, as well as those who assisted with the revisions for the new edition:

- Ellen Dilgert BSc, BEd, RTNM, RTMR, Conestoga College ITAL
- Sheila Bellefeuille, Conestoga College ITAL
- Connie Stevens RN, BScN, MA, PhD (c). Sheridan College ITAL
- Catherine Statton, R. Kin., CHE, BSc, MA, University of Guelph & Sheridan College ITAL
- Shanta Doobay MSc, OCT, Fanshawe College CAA
- Ermelinda Kapo, Sheridan College ITAL
- Jacqueline De Paula, MD, MMSc, DBA, Sheridan College ITAL
- Crystal Frenette MA BScN RN, Sheridan College ITAL
- Kadeem Sampath, MD, Centennial College CAAT
- Saeedeh Akram, PhD, Conestoga College ITAL
- Jennifer Ethier, BScH, MSc, Georgian College CAAT

A special thank you to **Jesslyn Wilkinson** (OCT, M.Ed candidate, BEd, Hons. BA), Educational Technology Officer, Teaching & Learning at Conestoga College ITAL, for her infectious enthusiasm for OER, support for H5P technology, and asking the question, “are you ready to sprint?”

A load of gratitude to **Cecile Michniewicz**, Instructional Designer from the Open Learning team at Conestoga College. Cecile designed the cover art for this edition and brought a wealth of creativity, copy editor skills, and instructional design experience to this project.

An immense thank you to **Jen Booth**, OER Librarian, and **Jessica Jones**, Library Technician from the OER Design Studio at Georgian College, for their tireless hours of assistance in redeveloping and modifying our H5P interactives, tagging the H5P activities, and for managing the accessible textual versions of these activities. Thank you also for your talents in copy editing, proofing, and ensuring accessibility compliance with the second edition.

A big shout out to **Holly Ashbourne**, our first edition copy editor, and the Library team for their tireless work in copy editing, copyright proofing, accessibility compliance, and their continuous championing of OER. You are, truly, the quiet leaders that make students’ lives better.

- Holly Ashbourne, copy editor, Dipl. LIT, Hon. BA, MLIS, Conestoga College ITAL
- James Yochem, Hon. BA, MLIS, Conestoga College ITAL
- Michelle Doadt, MLIS, Conestoga College ITAL
- Antonina Gousseva, BA, Dipl. LIT, Conestoga College ITAL
- Chris Woodley, BEd, MLIS, Conestoga College ITAL
- Juliet Conlon, MLS, Conestoga College ITAL
- Jen Booth, BA, MEd, Georgian College CAAT
- Jessica Jones, MLIS, Georgian College CAAT
- Cecile Michniewicz, B.A. (Hons), MEd, Conestoga College ITAL

This OER was greatly enhanced by the leadership, support, and contributions of the following **colleagues**:

- Lisa Koster OCT, MBA, BMath, BEd, Conestoga College ITAL
- Peggy French BEd, MLIS, MET, Mohawk College CAAT
- Sandra Neubauer BA, MAdEd, Fanshawe College CAAT

Special thanks to **eCampusOntario** for the work that they do putting collaborators together, supporting OER through the Open library, Open Publishing Infrastructure, Ontario Extend Professional Learning for Educators, and answering countless Pressbooks questions. Thank you to:

- Lillian Hogendoorn, Hon. BA, MI
- Emily Carlisle-Johnston, MLIS
- Lena Patterson, BA, MA

Book Acknowledgement

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For Educators

Faculty and teaching staff: while this OER was curated and created for Health Office Administration and Health Services students in the first year of college, our hope is that you will take this OER and customize it for your program and share again.

Resources Accompanying this Edition

One of the areas we are most proud of with this edition is the inclusion of ancillaries for educators, student activity worksheets, and the [Building a Medical Terminology Foundation 2e – Student Companion Workbook](#). The Student Companion is an additional educational resource designed to accompany our main text and provides access to:

- Interactive H5P activities and text solutions for increased accessibility
- Reinforcement activities in Word file formats
- Worksheets in Word file format

[Building a Medical Terminology Foundation 2e – Anatomical Colouring Book](#)

Instructor ancillaries include:

- Assignments in Word file format
- Instructor Planning Manual
- Chapter slide decks [PowerPoint]

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- If students need to navigate beyond the exact page you've linked to, you may need to adjust the link to open in a new window/tab.

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Accessibility Features of the Web Version of this Resource

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- It has been optimized for people who use screen-reader technology.
 - All content can be navigated using a keyboard.
 - Links, headings, and tables are formatted to work with screen readers.
- Images in this OER are described through the use of text around the image, alt-text, captions or in the image description section for complex images.
 - Due to the complex visual nature of anatomy images and diagrams, alt text description may be longer than typically considered best practice. This allows for a more effective description of the information being conveyed by image/size/colour/labels.
 - If there are errors or concerns, please contact OER[at]georgiancollege.ca
- Information is not conveyed by colour alone.
- Pressbooks has built-in features such as the ability to change font size.

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This book's adapters have attempted to improve upon existing features from the original sources and improve these materials for all users.

While we strive to ensure that this resource is as accessible and usable as possible, we might not always get it right. Any issues we identify will be listed below. If you encounter issues with this text, please notify your professor.

List of Known Accessibility Issues

Location of Issue	Need for Improvement	Timeline	Work Around
Video captioning	All videos have closed captions & transcripts via YouTube or other provider, but may not have transcripts that fully describe non-speech content	Unknown	Current provisions meet AODA requirements
Interactive activities (H5P)	H5Ps containing images may not be fully accessible	On going	Text version of interactive activities with alt text provided
PDF version of book	PDF version of book generated by the Pressbooks export system may not be fully accessible	On going	Use webook for the most accessible version of the content
Footnotes (used for activity solutions)	Questions/answers may not be optimized in ordered lists due to limitations of the footnote tool	Unknown	Ordered lists have been used when possible; some footnote/answers will read as a sentence with answers
Merged/split tables	Some tables may have some repetitive content as merged cells were split for improved accessibility	Unknown	Work is on going
Downloadable Word worksheets/activities	Worksheets contain lists and tables to be completed by students, and may pose some accessibility issues. Heading structure has been added, but the nature of the tasks associated with identifying and labeling anatomical images is difficult may persist.	On going	Students are encouraged to work with their adaptive technologist if problems persist.
Complex images	Many complex images are used throughout the text to help students better understand anatomy, and identify different systems and how they function. This is a very visual process, and may not translate effectively into descriptive text.	On going	Accessibility features have been added where possible. Work is on going.

Accessibility Standards

The web version of this resource has been designed to meet [AODA requirements](#), along with the [Web Content Accessibility Guidelines 2.0](#), level AA. In addition, it follows all guidelines in [Appendix A: Checklist for Accessibility](#) of the [Accessibility Toolkit – 2nd Edition](#).

This statement was last updated on August 2, 2024.

Attribution & References

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CHAPTER I: INTRODUCTION TO MEDICAL TERMS

Building a Medical Terminology Foundation 2e by Kimberlee Carter; Marie Rutherford; and Connie Stevens

- [1.1 – Identifying Word Parts in Medical Terms](#)
- [1.2 – Medical Language Rules](#)
- [1.3 – Prefix](#)
- [1.4 – Suffix](#)

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Please visit the web version of [Building a Medical Terminology Foundation 2e](#) to access the complete book, interactive activities and ancillary resources.

I.I - Introduction - Word Parts in Medical Terms

Learning Objectives

- Outline the elements used to build medical terms
- Analyze, identify, and construct medical words using applicable medical language component parts
- Explore medical language rules

Word Parts

Medical terms are built from word parts. Those word parts are **prefix**, **word root**, **suffix**, and **combining form vowel**. When a **word root** is combined with a **combining form vowel**, the word part is referred to as a **combining form**.

Word Parts

Word Parts (Text Version)

Make sure you understand key parts of medical terminology. Fill in the blanks using the following words:

- Suffix
- Prefix
- Combining Form
- Word Root

1. _____ [Blank 1] word part at the beginning of the term that changes meaning
2. _____ [Blank 2] word part at the end of the term that changes meaning
3. _____ [Blank 3] foundational meaning of a word
4. _____ [Blank 4] used to join word parts to ease pronunciation

Check your answers: ¹

Activity Source: Key Terms by PFrench, licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). /Text version added.

Identifying Word Parts in Medical Terms

By the end of this resource, you will have identified hundreds of word parts within medical terms. Let's start with some common medical terms that many non-medically trained people may be familiar with.

Examples

Osteoarthritis

Oste/o/arthr/itis - Inflammation of bone and joint.

Oste/o is a **combining form** that means bone

arthr/o is a **combining form** that means joint

-itis is a **suffix** that means inflammation

Intravenous

Intra/ven/ous - Pertaining to within a vein.

Intra- is a **prefix** that means within

ven/o - is a **combining form** that means vein

-ous is a **suffix** that means pertaining to

Notice, when breaking down words that you place slashes between word parts and a slash on each side of a combining form vowel.

Language Rules

Language rules are a good place to start when building a medical terminology foundation. Many medical terms are built from word parts and can be translated **literally**. At first, literal translations sound awkward. Once you build a medical vocabulary and become proficient at using it, the awkwardness will slip away. For example, suffixes will no longer be stated and will be assumed. The definition of *intravenous* then becomes *within the vein*.

Since you are at the beginning of building your medical terminology foundation, stay literal when applicable. It should be noted that, as with all language rules, there are always exceptions and we refer to those as **rebels**. So, let's begin by analyzing the language rules for medical terminology.

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Notes

1. 1. Prefix, 2. Suffix, 3. Word Root, 4. Combining Form

I.2 - Medical Language Rules

Language Review

Before we begin analyzing the rules, let's complete a short language review that will assist with pronunciation and spelling. In class, you will practice pronunciation with your instructor.

Short Vowels

a, e, i, o, u, and sometimes y are indicated by lower case.

Long Vowels

A, E, I, O, U are indicated by upper case.

Consonants

Consonants are all of the other letters in the alphabet. b, c, d, f, g, h, j, k, l, m, n, p, q, r, s, t, v, w, x, and z.

Language Rules for Building Medical Terms

1. When combining two **combining forms**, you **keep** the **combining form vowel**.
2. When combining a **combining form** with a **suffix** that begins with a consonant, you **keep** the **combining form vowel**.

Examples

Gastr/o/enter/o/logy - The study of the stomach and the intestines

- Following **rule 1**, when we join combining form gastr/o (meaning stomach) with the combining form enter/o (meaning intestines), we keep the combining form vowel o.
- Following **rule 2**, when we join the combining form enter/o (meaning intestines) with the suffix -logy (that starts with a suffix and means the study of), we keep the combining form vowel o.

3. When combining a **combining form** with a **suffix** that begins with a vowel, you **drop** the combining form

vowel.

4. A **prefix** goes at the beginning of the word, and **no combining form vowel** is used.

Examples

Intra/ven/ous – Pertaining to within the vein

- Following **rule 3**, notice that when combining the combining form ven/o (meaning vein) with the suffix -ous (that starts with a vowel and means pertaining to), we drop the combining form vowel o.
- Following **rule 4**, the prefix intra- (meaning within) is at the beginning of the medical term with no combining form vowel used.

5. When defining a medical word, start with the suffix first and then work left to right stating the word parts. You may need to add **filler** words. As long as the **filler** word does not change the meaning of the word, you may use it for the purpose of building a medical vocabulary. Once you start to apply the word in the context of a sentence, it will be easier to decide which **filler** word(s) to choose.

Examples

Intra/ven/ous – Pertaining to within the vein or Pertaining to within a vein.

- Following **rule 5**, notice that I start with the suffix -ous (that means pertaining to), then we work left to right, starting with the prefix Intra- (meaning within) and the combining form ven/o (meaning vein).
- Notice that we have used two different definitions that mean the same thing.
- In these examples we do not have the context of a full sentence. For the purpose of building a medical terminology foundation, either definition is accepted.

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I.3 - Prefix

Prefixes are located at the beginning of a medical term. The prefix alters the meaning of the medical term. It is important to spell and pronounce prefixes correctly.

Many prefixes that you find in medical terms are common to English language prefixes. A good technique to help with memorization is the following:

- Start by reviewing the most common prefixes.
- Consider common English language words that begin with the same prefixes.
- Compare them to the examples of use in medical terms.

Prefix 'A' Medical Terms

Prefix	Meaning	Example of use in medical terms
a-, an	No, not, without, negates the meaning	atypical, anoxia
ab-	away from; from	abduction
ad-	toward, at, increase, on, toward	adduction
ante-	before	anteartum
anti-	against, opposing	antipsychotic

Prefix 'B' Medical Terms

Prefix	Meaning	Example of use in medical terms
bi-,bin-	two, twice, double	bilateral, binocular
brady-	slow	bradycardia

Prefix 'D' Medical Terms

Prefix	Meaning	Example of use in medical terms
de-	from, down, away from	dehydrate
dia-	through, complete	dialysis
dys-	painful, abnormal, difficult, laboured	dysphagia

Prefix 'E' Medical Terms

Prefix	Meaning	Example of use in medical terms
endo-	within, in	endotracheal
epi-	on, upon, over	epidermis
eu-	normal, good	eupnea

Prefix 'H' Medical Terms

Prefix	Meaning	Example of use in medical terms
hemi-	half	hemicolectomy
hyper-	above, excessive	hyperthyroidism
hypo-	below, incomplete, deficient, under	hypoglycemia

Prefix 'I' Medical Terms

Prefix	Meaning	Example of use in medical terms
inter-	between	intercostal
intra-	within, in	intramuscular

Prefix 'M' Medical Terms

Prefix	Meaning	Example of use in medical terms
macro-	large, long	macrocephalus
meta-	after, beyond, change	metacarpal bones
micro-	small	microscope
multi-	many	multipara

Prefix 'N' Medical Terms

Prefix	Meaning	Example of use in medical terms
neo-	new	neonate
nulli-	none	

Prefix 'P' Medical Terms

Prefix	Meaning	Example of use in medical terms
pachy-	thick, thickening, thickened	pachyderma
pan-	all, total	pancytopenia
para-	beside, beyond, around, abnormal	parathyroid glands
per-	through	percutaneous
peri-	surrounding (outer)	peripheral vision
poly-	many, much	polymyositis
post-	after	postpartum
pre-	before	prenatal
pro-	before	prognosis

Prefix 'S' Medical Terms

Prefix	Meaning	Example of use in medical terms
sub-	below, under	subcutaneous
supra-	above	suprascapular
sym-, syn-	together, joined	symphysis

Prefix ‘T’ Medical Terms

Prefix	Meaning	Example of use in medical terms
tachy-	fast, rapid	tachycardia
trans-	through, across, beyond	transdermal
tri-	three	triceps

Prefix ‘U’ Medical Terms

Prefix	Meaning	Example of use in medical terms
uni-	one	unilateral

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I.4 - Suffix

Suffixes are word parts that are located at the end of words. Suffixes can alter the meaning of medical terms. It is important to spell and pronounce suffixes correctly.

Suffixes in medical terms are common to English language suffixes. Suffixes are not always explicitly stated in the definition of a word. It is common that suffixes will not be explicitly stated when defining a medical term in the workplace. However, when transcribing or reading medical reports, the suffix is always clearly written. In order to properly spell and pronounce medical terms, it is helpful to learn the suffixes.

Suffix 'A' Medical Terms

Suffix	Meaning	Example of use in medical terms
-a	noun ending, no meaning	leukoderma
-ac	pertaining to	cardiac
-ad	toward	dorsad
-al	pertaining to	lateral
-algia	condition of pain	myalgia
-amnios	amnion, amniotic fluid	oligohydramnios
-apheresis	separate	plasmapheresis
-ar	pertaining to	appendicular
-ary	pertaining to	coronary
-asthenia	weakness	Myasthenia gravis

Suffix 'C' Medical Terms

Suffix	Meaning	Example of use in medical terms
-carcinoma	cancerous tumour	adenocarcinoma
-cele	hernia, protrusion, swelling	hydrocele
-centesis	surgical puncture to aspirate fluid	amniocentesis
-crine	to secrete	exocrine
-cyesis	pregnancy	pseudocyesis
-cyte	cell	leukocyte

Suffix 'D' Medical Terms

Suffix	Meaning	Example of use in medical terms
-desis	surgical fixation, fusion	arthrodesis
-drome	run, running	syndrome

Suffix 'E' Medical Terms

Suffix	Meaning	Example of use in medical terms
-e	noun ending, no meaning	neonate
-eal	pertaining to	esophageal
-ectasis	stretching out, dilation, expansion	bronchiectasis
-ectomy	excision, surgical removal, cut out	gastrectomy
-emesis	vomiting	hematemesis
-emia	in the blood	anemia
-sis	condition	diuresis

Suffix 'G' Medical Terms

Suffix	Meaning	Example of use in medical terms
-gen	substance or agent that produces or causes	teratogen
-genic	producing, originating, causing	carcinogenic
-gram	the record, radiographic image	electrocardiogram
-graph	instrument used to record; the record	electrocardiograph
-graphy	process of recording, radiographic imaging	electrocardiography

Suffix 'I' Medical Terms

Suffix	Meaning	Example of use in medical terms
-ia	condition of, diseased state, abnormal state	tachycardia
-iasis	condition	choledocholithiasis
-iatrist	specialist	psychiatrist
-iatry	specialty, treatment	psychiatry
-ic	pertaining to	toxic
-ictal	seizure, attack	postictal
-ior	pertaining to	anterior
-ism	state of	hyperthyroidism
-itis	inflammation	colitis

Suffix 'L' Medical Terms

Suffix	Meaning	Example of use in medical terms
-logist	specialist who studies and treats	oncologist
-logy	study of	cardiology
-lysis	separating, loosening, dissolution	thrombolysis

Suffix 'M' Medical terms

Suffix	Meaning	Example of use in medical terms
-malacia	softening	chondromalacia
-megaly	enlarged, enlargement	gastromegaly
-meter	instrument used to measure	thermometer
-metry	measuring, process of measuring	spirometry

Suffix 'O' Medical Terms

Suffix	Meaning	Example of use in medical terms
-oid	resembling	lipoid
-oma	tumour, swelling	melanoma
-opia	vision	diplopia
-opsy	viewing, process of viewing	biopsy
-sis	abnormal condition, increased number (blood)	erythrocytosis
-ous	pertaining to	intravenous

Suffix 'P' Medical Terms

Suffix	Meaning	Example of use in medical terms
-paresis	slight paralysis	hemiparesis
-pathy	disease	polyneuropathy
-penia	abnormal reduction in number	erythrocytopenia
-pepsia	digestion	dyspepsia
-pexy	surgical fixation, suspension	colpopexy
-phagia	swallowing, eating	dysphagia
-phobia	aversion, abnormal fear	photophobia
-physis	growth	symphysis
-plasia	formation, development, growth	hyperplasia
-plasm	growth, substance, formation	cytoplasm
-plasty	surgical repair	rhinoplasty
-plegia	paralysis	ophthalmoplegia
-pnea	breathing	dyspnea
-poiesis	formation	leukopoiesis
-ptosis	prolapse, drooping	nephroptosis

Suffix 'R' Medical Terms

Suffix	Meaning	Example of use in medical terms
-rrhage	excessive bleeding	hemorrhage
-rrhagia	excessive bleeding,	rhinorrhagia
-rrhaphy	repairing, suturing	cholecystorrhaphy
-rrhea	discharge, flow	rhinorrhea
-rrhexis	rupture	amniorrhexis

Suffix 'S' Medical Terms

Suffix	Meaning	Example of use in medical terms
-salpinx	fallopian tube, uterine tube	pyosalpinx
-sarcoma	malignant tumour in connective tissue	rhabdomyosarcoma
-schisis	split, fissure	cranioschisis
-sclerosis	condition of hardening	arteriosclerosis
-scope	instrument used for visual examination	hysteroscope
-scopic	pertaining to visual examination	pelviscopic
-scopy	process of visually examining	gastroscopy
-spasm	sudden, involuntary contraction of muscle	vasospasm
-stasis	condition of stop, control, standing	hemostasis
-stenosis	constriction, condition of narrowing	ureterostenosis
-stomy	creation of artificial opening	nephrostomy

Suffix 'T' Medical Terms

Suffix	Meaning	Example of use in medical terms
-thorax	chest cavity, chest	hemothorax
-tocia	condition of labour, birth	dystocia
-tome	instrument used to cut	dermatome
-tomy	incision, cut into	laparotomy
-tripsy	surgical crushing	cholecystolithotripsy
-trophy	nourishment, development	hypertrophy

Suffix 'U' Medical Terms

Suffix	Meaning	Example of use in medical terms
-um	structure	endocardium
-uria	urine, urination	nocturia
-us	no meaning	microcephalus

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CHAPTER 2: MEDICAL LANGUAGE WITHIN THE CONTEXT OF ANATOMY AND PHYSIOLOGY

Building a Medical Terminology Foundation 2e by Kimberlee Carter; Marie Rutherford; and Connie Stevens

- [2.1 – Levels of Organization](#)
- [2.2 – Anatomical Position](#)
- [2.3 – Body Cavities and Serous Membranes](#)
- [Check Your Knowledge](#)
- [References](#)

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2.1 - Levels of Organization

Learning Objectives

- Connect medical language learning to the context of anatomy and physiology
- Introduce the basic architecture and levels of organization of the human body
- Evaluate the anatomical position, regional terms, directional terms, body planes, and body quadrants for anatomical positioning
- Describe body cavities and the functions of associated membranes

As you memorize the language components of medical terminology, it is important to support that learning within the context of anatomy and physiology. Proceeding through the body system chapters, you will learn word parts, whole medical terms, and common abbreviations. It is important to put into context where in the body the medical term is referencing, and then consider how it works within the body.

Anatomy focuses on structure and **physiology** focuses on function. Much of the study of physiology centers on the body's tendency toward **homeostasis**.

Consider the structures of the body in terms of fundamental levels of organization that increase in complexity: subatomic particles, atoms, molecules, organelles, cells, tissues, organs, organ systems, organisms, and biosphere ([Figure 2.1](#)).

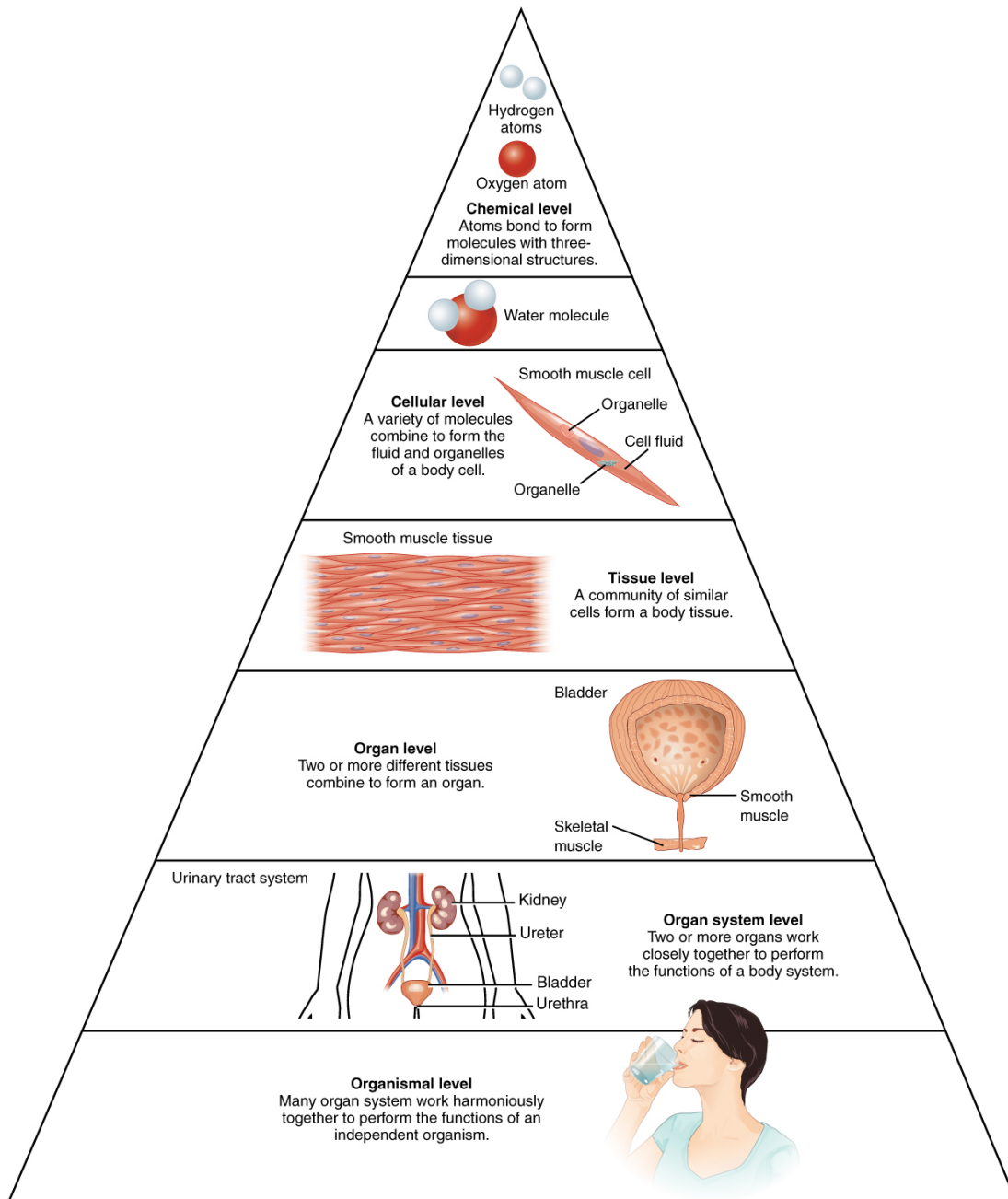


Figure 2.1 Levels of Structural Organization of the Human Body. The organization of the body often is discussed in terms of six distinct levels of increasing complexity, from the smallest chemical building blocks to a unique human organism. From Betts et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [[Fig. 2.1 Image description.](#)]

The Levels of Organization

All matter in the universe is composed of one or more unique pure substances called **elements**; familiar examples are hydrogen, oxygen, carbon, nitrogen, calcium, and iron.

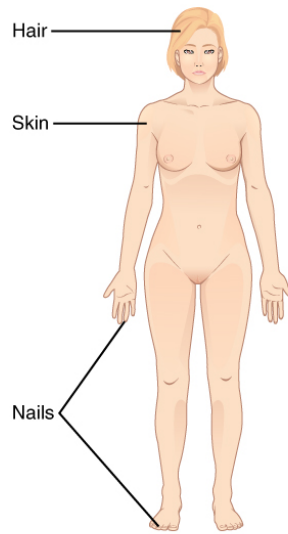
- The smallest unit of any of these pure substances (elements) is an **atom**.
 - Atoms are made up of subatomic particles such as the proton, electron, and neutron.
- Two or more atoms combine to form a **molecule**, such as the water molecules, proteins, and sugars found in living things.
 - **Molecules** are the chemical building blocks of all body structures.
- A **cell** is the smallest independently functioning unit of a living organism.
 - Even bacteria, which are extremely small, independently-living organisms, have a cellular structure. Each bacterium is a single cell. All living structures of human anatomy contain cells, and almost all functions of human physiology are performed in cells or are initiated by cells
 - A human cell typically consists of flexible membranes that enclose cytoplasm, a water-based cellular fluid, together with a variety of tiny functioning units called **organelles**. In humans, as in all organisms, cells perform all functions of life.
- A **tissue** is a group of many similar cells (though sometimes composed of a few related types) that work together to perform a specific function.
- An **organ** is an anatomically distinct structure of the body composed of two or more tissue types. Each organ performs one or more specific physiological functions.

An **organ system** is a group of organs that work together to perform major functions or meet the physiological needs of the body.

Did You Know?

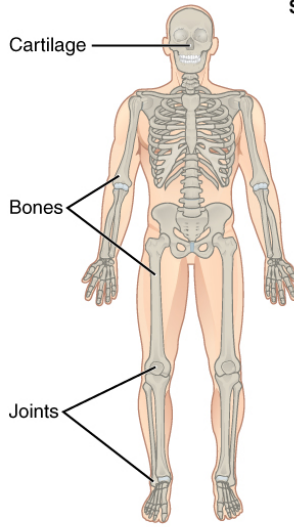
- Organs are very collaborative and work with multiple body systems.
- For example, the heart (cardiovascular system) and lungs (respiratory system) work together to deliver oxygen throughout the body and remove carbon dioxide from the body.

Consider the breakdown into eleven distinct organ systems in the human body ([Figure 2.2](#) and [Figure 2.3](#)). Assigning organs to organ systems can be imprecise, since organs that “belong” to one system can also have functions integral to another system. In fact, most organs contribute to more than one system.



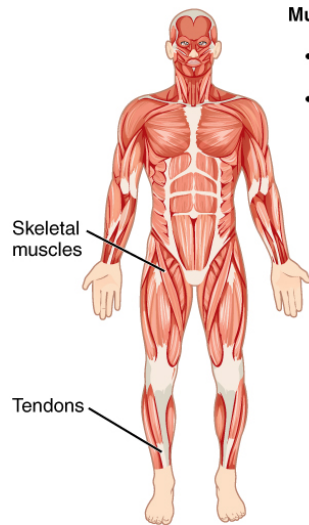
Integumentary System

- Encloses internal body structures
- Site of many sensory receptors



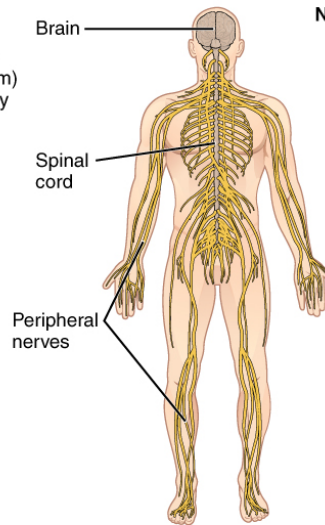
Skeletal System

- Supports the body
- Enables movement (with muscular system)



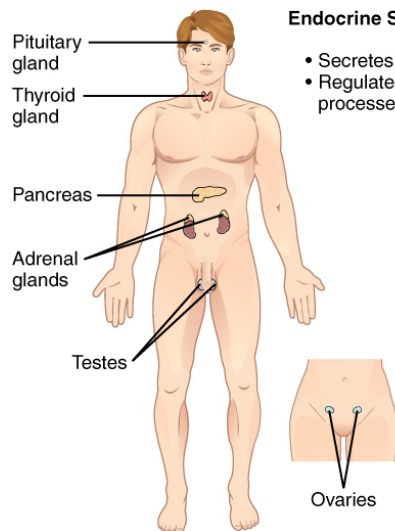
Muscular System

- Enables movement (with skeletal system)
- Helps maintain body temperature



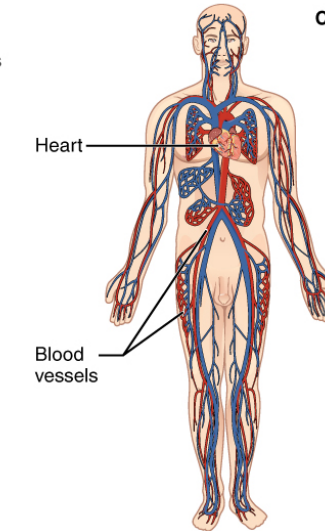
Nervous System

- Detects and processes sensory information
- Activates bodily responses



Endocrine System

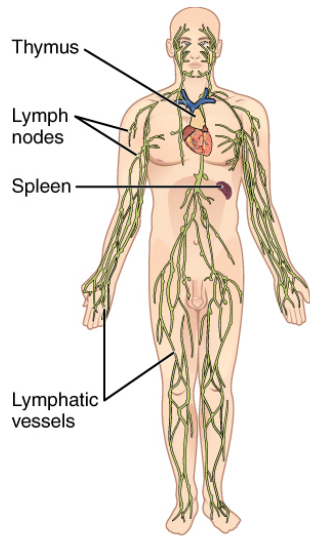
- Secretes hormones
- Regulates bodily processes



Cardiovascular System

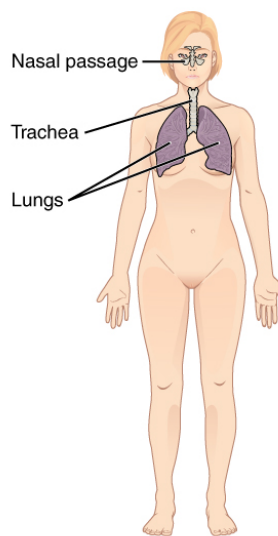
- Delivers oxygen and nutrients to tissues
- Equalizes temperature in the body

Figure 2.2. Organ Systems of the Human Body. Organs that work together are grouped into organ systems. From Betts et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [\[Fig 2.2 Image description.\]](#)



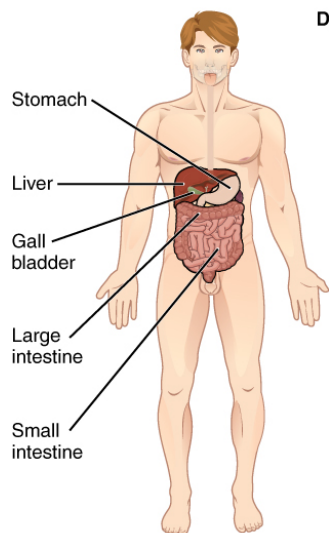
Lymphatic System

- Returns fluid to blood
- Defends against pathogens



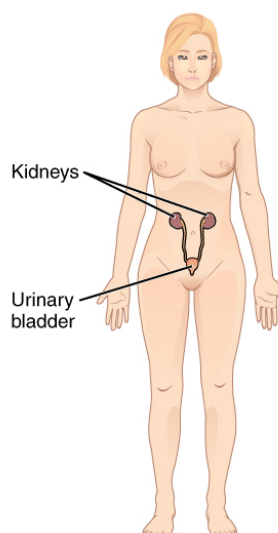
Respiratory System

- Removes carbon dioxide from the body
- Delivers oxygen to blood



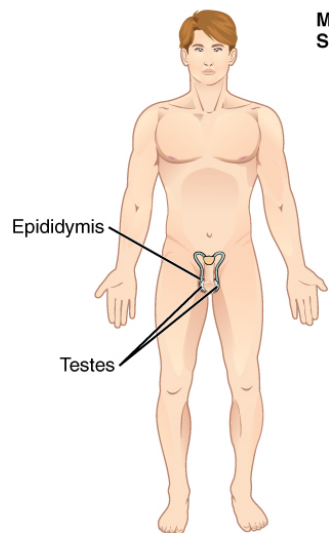
Digestive System

- Processes food for use by the body
- Removes wastes from undigested food



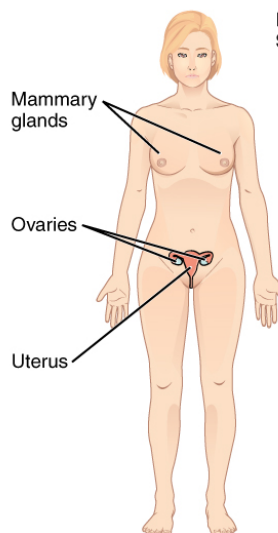
Urinary System

- Controls water balance in the body
- Removes wastes from blood and excretes them



Male Reproductive System

- Produces sex hormones and gametes
- Delivers gametes to female



Female Reproductive System

- Produces sex hormones and gametes
- Supports embryo/fetus until birth
- Produces milk for infant

Figure 2.3. Organ Systems of the Human Body (continued). Organs that work together are grouped into

The **organism** level is the highest level of organization. An organism is a living being that has a cellular structure and that can independently perform all physiologic functions necessary for life. In multicellular organisms, including humans, all cells, tissues, organs, and organ systems of the body work together to maintain the life and health of the organism.

Image Descriptions

Figure 2.1 image description: This illustration shows biological organization as a pyramid. The chemical level is at the apex of the pyramid where atoms bond to form molecules with three dimensional structures. An example is shown with two white hydrogen atoms bonding to a red oxygen atom to create water. The next level down on the pyramid is the cellular level, as illustrated with a long, tapered, smooth muscle cell. At this level, a variety of molecules combine to form the interior fluid and organelles of a body cell. The next level down is the tissue level. A community of similar cells forms body tissue. The example given here is a section of smooth muscle tissue, which contains many smooth muscle cells closely bound side by side. The next level down is the organ level, as illustrated with the bladder and urethra. The bladder contains smooth muscle while the urethra contains skeletal muscle. These are both examples of muscle tissues. The next level down is the organ system level, as illustrated by the entire urinary system containing the kidney, ureters, bladder and urethra. At this level, two or more organs work closely together to perform the functions of a body system. At the base of the pyramid is the organismal level illustrated with a woman drinking water. At this level, many organ systems work harmoniously together to perform the functions of an independent organism. [[Return to Figure 2.1](#)].

Figure 2.2 image description: This illustration shows eight silhouettes of a human female, each showing the components of a different organ system. The integumentary system encloses internal body structures and is the site of many sensory receptors. The integumentary system includes the hair, skin, and nails. The skeletal system supports the body and, along with the muscular system, enables movement. The skeletal system includes cartilage, such as that at the tip of the nose, as well as the bones and joints. The muscular system enables movement, along with the skeletal system, but also helps to maintain body temperature. The muscular system includes skeletal muscles, as well as tendons that connect skeletal muscles to bones. The nervous system detects and processes sensory information and activates bodily responses. The nervous system includes the brain, spinal cord, and peripheral nerves, such as those located in the limbs. The endocrine system secretes hormones and regulates bodily processes. The endocrine system includes the pituitary gland in the brain, the thyroid gland in the throat, the pancreas in the abdomen, the adrenal glands on top of the kidneys, and the testes in the scrotum of males as well as the ovaries in the pelvic region of females. The cardiovascular system delivers oxygen and nutrients to the tissues as well as equalizes temperature in the body. The cardiovascular system includes the heart and blood vessels. [[Return to Figure 2.2](#)].

Figure 2.3 image description: The lymphatic system returns fluid to the blood and defends against pathogens. The lymphatic system includes the thymus in the chest, the spleen in the abdomen, the lymphatic vessels that spread throughout the body, and the lymph nodes distributed along the lymphatic vessels. The respiratory system removes carbon dioxide from the body and delivers oxygen to the blood. The respiratory system includes the nasal passages, the trachea, and the lungs. The digestive system processes food for use by the body and

removes wastes from undigested food. The digestive system includes the stomach, the liver, the gall bladder (connected to the liver), the large intestine, and the small intestine. The urinary system controls water balance in the body and removes and excretes waste from the blood. The urinary system includes the kidneys and the urinary bladder. The reproductive system of males and females produce sex hormones and gametes. The male reproductive system is specialized to deliver gametes to the female while the female reproductive system is specialized to support the embryo and fetus until birth and produce milk for the infant after birth. The male reproductive system includes the two testes within the scrotum as well as the epididymis which wraps around each testis. The female reproductive system includes the mammary glands within the breasts and the ovaries and uterus within the pelvic cavity. [\[Return to Figure 2.3\]](#)

Attribution

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2.2 - Anatomical Position

Watch [Introduction to Anatomy & Physiology: Crash Course Anatomy & Physiology #1 \(11 min\) on YouTube](#)

Anatomical Position

Anatomists and health care providers use terminology for the purpose of precision and to reduce medical errors. For example, is a scar “above the wrist” located on the forearm two or three inches away from the hand? Or is it at the base of the hand? Is it on the palm-side or back-side? By using precise anatomical terminology, we eliminate ambiguity. Anatomical terms derive from ancient Greek and Latin words.

To further increase precision, anatomists standardize the way in which they view the body. Just as maps are normally oriented with north at the top, the standard body “map,” or **anatomical position**, is that of the body standing upright, with the feet at shoulder width and parallel, toes forward. The upper limbs are held out to each side, and the palms of the hands face forward as illustrated.

Using this standard position reduces confusion. It does not matter how the body being described is oriented, the terms are used as if it is in anatomical position. For example, a scar in the “anterior (front) carpal (wrist) region” would be present on the palm side of the wrist. The term “anterior” would be used even if the hand were palm down on a table.

Did You Know?

Terminology is used for the purpose of precision and reduction of medical error.

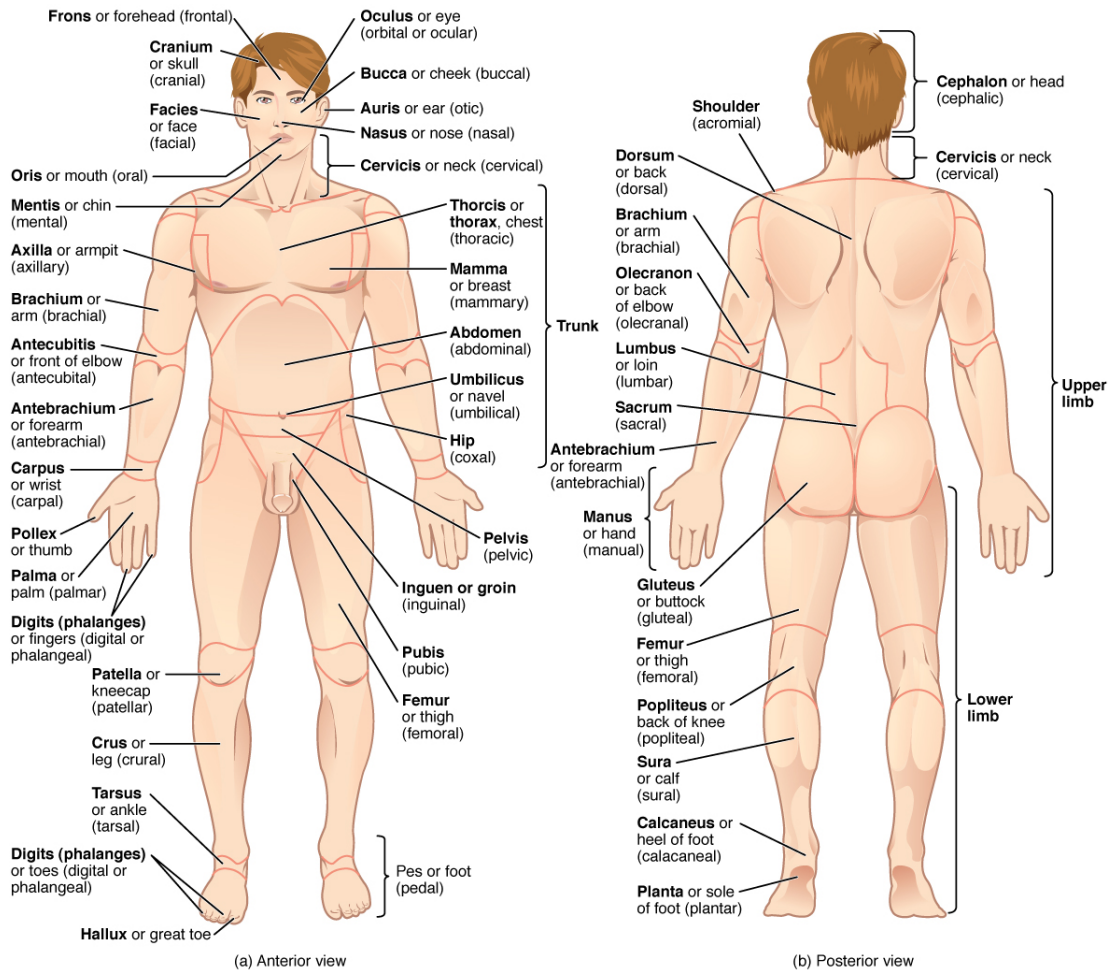


Figure 2.4. Regions of the Human Body. The human body is shown in anatomical position in an (a) anterior view and a (b) posterior view. The regions of the body are labeled in boldface. From Betts et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [Fig. 2.4 Image description.]

A body that is lying down is described as either **prone** or **supine**. These terms are sometimes used in describing the position of the body during specific physical examinations or surgical procedures.

Regional Terms

The human body's numerous regions have specific terms to help increase precision. Notice that the term "brachium" or "arm" is reserved for the "upper arm" and "antebrachium" or "forearm" is used rather than "lower arm." Similarly, "femur" or "thigh" is correct, and "leg" or "crus" is reserved for the portion of the lower limb between the knee and the ankle. You will be able to describe the body's regions using the terms from the anatomical position.

Directional Terms

Directional terms are essential for describing the relative locations of different body structures. For instance, an anatomist might describe one band of tissue as “inferior to” another or a physician might describe a tumor as “superficial to” a deeper body structure. Commit these terms to memory to avoid confusion when you are studying or describing the locations of particular body parts.

- **Anterior** (or **ventral**) describes pertaining to the front or direction toward the front of the body. The toes are anterior to the foot.
- **Posterior** (or **dorsal**) describes pertaining to the back or direction toward the back of the body. The popliteus is posterior to the patella.
- **Superior** (or **cranial**) describes pertaining to the position above or higher than another part of the body proper. The orbits are superior to the oris.
- **Inferior** (or **caudal**) describes a position pertaining to below or lower than another part of the body proper; near or toward the tail (in humans, the coccyx, or lowest part of the spinal column). The pelvis is inferior to the abdomen.
- **Lateral** describes the side or direction pertaining to toward the side of the body. The thumb (pollex) is lateral to the digits.
- **Medial** describes the middle or direction pertaining to toward the middle of the body. The hallux is the medial toe.
- **Proximal** describes a position pertaining to a limb that is nearer to the point of attachment or the trunk of the body. The brachium is proximal to the antebrachium.
- **Distal** describes a position pertaining to a limb that is farther from the point of attachment or the trunk of the body. The crus is distal to the femur.
- **Superficial** describes a position pertaining to closer to the surface of the body. The skin is superficial to the bones.
- **Deep** describes a position farther from the surface of the body. The brain is deep to the skull.

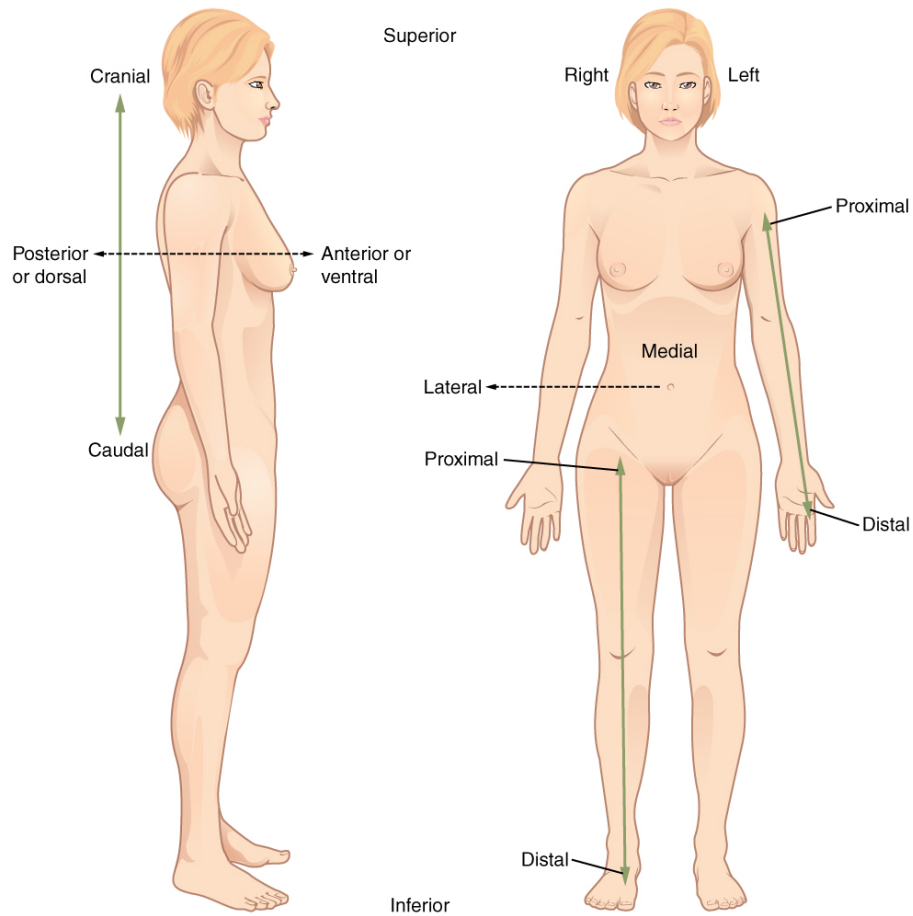


Figure 2.5. Directional Terms Applied to the Human Body. Paired directional terms are shown as applied to the human body. From Betts et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [Fig. 2.5 Image description.]

Medical Language within the Context of Anatomy and Physiology Directional Terms

Practice these directional terms.

Medical Language with the Context of Anatomy and Physiology Directional Terms (Text version)

1. Cranial Cavity

- KRĀ-nē-āl kah-vi-tē

- The space formed inside the skull that the brain occupies.

2. Homeostasis

- HŌ-mē-ō-STĀ-sis
- Biological process that results in stable equilibrium

3. Posterior (or Dorsal)

- pŏs-TĒ-rē-or(Original Term)
- Describes the back or direction toward the back of the body.

4. Anterior (or Ventral)

- an-TĒR-ē-ŏr (Original Term)
- Describes the front or direction toward the front of the body.

5. Deep

- DĒP (Original Term)
- Describes a position farther from the surface of the body.

6. Distal

- DIS-tāl (Original Term)
- Describes a position in a limb that is farther from the point of attachment or the trunk of the body.

7. Inferior (or Caudal)

- in-FĒR-ē-ŏr (Original Term)
- Describes a position below or lower than another part of the body proper; near or toward the tail.

8. Lateral

- LĀT-ēr- āl (Original Term)
- Describes the side or direction toward the side of the body.

9. Medial

- MĒD-ē-āl (Original Term)
- Describes the side or direction toward the side of the body.

10. Peritoneum

- (per-it-ŏ-NĒ-ŭm)
- Serous membrane surrounding several organs in the abdominopelvic cavity. This reduces friction between the abdominal and pelvic organs and the body wall.

11. Proximal

- PROK-sĭ-măĭ (Original Term)
- Describes a position in a limb that is nearer to the point of attachment or the trunk of the body.

12. **Superficial**

- SOO-pĕr-FISH-ăĭ (Original Term)
- Describes a position in a limb that is nearer to the point of attachment or the trunk of the body.

13. **Superior (or Cranial)**

- soo-PĒ-rĕ-or(Original Term)
- Describes a position above or higher than another part of the body proper.

Activity Source: Medical Language with the Context of Anatomy and Physiology Directional Terms from [Medical Terminology](#) by Grimm et al., licensed under [CC BY 4.0](#)./Re-recording of some H5P audio by Tania Deane and David McCuaig and text version added.

Concept Check

- Find a partner and take turns choosing two body parts on your or your partner's body.
- Using directional terms, describe the location of those body parts relative to one another.

Image Descriptions

Figure 2.4 image description: This illustration shows an anterior and posterior view of the human body. The cranial region encompasses the upper part of the head while the facial region encompasses the lower half of the head beginning below the ears. The eyes are referred to as the ocular region. The cheeks are referred to as the buccal region. The ears are referred to as the auricle or otic region. The nose is referred to as the nasal region. The chin is referred to as the mental region. The neck is referred to as the cervical region. The trunk of the body contains, from superior to inferior, the thoracic region encompassing the chest, the mammary region encompassing each breast, the abdominal region encompassing the stomach area, the coxal region encompassing the belt line, and the pubic region encompassing the area above the genitals. The umbilicus, or

naval, is located at the center of the abdomen. The pelvis and legs contain, from superior to inferior, the inguinal or groin region between the legs and the genitals, the pubic region surrounding the genitals, the femoral region encompassing the thighs, the patellar region encompassing the knee, the crural region encompassing the lower leg, the tarsal region encompassing the ankle, the pedal region encompassing the foot and the digital/phalangeal region encompassing the toes. The great toe is referred to as the hallux. The regions of the upper limbs, from superior to inferior, are the axillary region encompassing the armpit, the brachial region encompassing the upper arm, the antecubital region encompassing the front of the elbow, the antebrachial region encompassing the forearm, the carpal region encompassing the wrist, the palmar region encompassing the palm, and the digital/phalangeal region encompassing the fingers. The thumb is referred to as the pollux. The posterior view contains, from superior to inferior, the cervical region encompassing the neck, the dorsal region encompassing the upper back and the lumbar region encompassing the lower back. The regions of the back of the arms, from superior to inferior, include the cervical region encompassing the neck, acromial region encompassing the shoulder, the brachial region encompassing the upper arm, the olecranal region encompassing the back of the elbow, the antebrachial region encompasses the back of the arm, and the manual region encompassing the palm of the hand. The posterior regions of the legs, from superior to inferior, include the gluteal region encompassing the buttocks, the femoral region encompassing the thigh, the popliteus region encompassing the back of the knee, the sural region encompassing the back of the lower leg, and the plantar region encompassing the sole of the foot. Some regions are combined into larger regions. These include the trunk, which is a combination of the thoracic, mammary, abdominal, naval, and coxal regions. The cephalic region is a combination of all of the head regions. The upper limb region is a combination of all of the arm regions. The lower limb region is a combination of all of the leg regions. [\[Return to Figure 2.4\].](#)

Figure 2.5 image description: This illustration shows two diagrams: one of a side view of a female and the other of an anterior view of a female. Each diagram shows directional terms using double-sided arrows. The cranial-distal arrow runs vertically behind the torso and lower abdomen. The cranial arrow is pointing toward the head while the caudal arrow is pointing toward the tail bone. The posterior/anterior arrow is running horizontally through the back and chest. The posterior or dorsal arrow is pointing toward the back while the anterior, or ventral arrow, is pointing toward the abdomen. On the anterior view, the proximal/distal arrow is on the right arm. The proximal arrow is pointing up toward the shoulder while the distal arrow is pointing down toward the hand. The lateral-medial arrow is a horizontal arrow on the abdomen. The medial arrow is pointing toward the navel while the lateral arrow is pointing away from the body to the right. Right refers to the right side of the woman's body from her perspective while left refers to the left side of the woman's body from her perspective. [\[Return to Figure 2.5\].](#)

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2.3 - Body Cavities and Serous Membranes

Body Planes

A section is a two-dimensional surface of a three-dimensional structure that has been cut. Modern medical imaging devices enable clinicians to obtain “virtual sections” of living bodies. We call these scans. Body sections and scans can be correctly interpreted, however, only if the viewer understands the plane along which the section was made. A plane is an imaginary two-dimensional surface that passes through the body. There are three planes commonly referred to in anatomy and medicine:

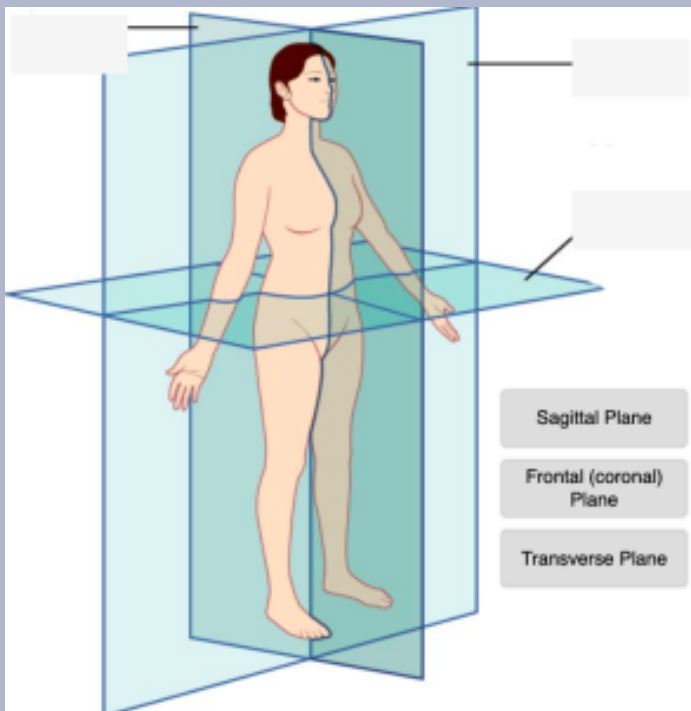
- The **sagittal plane** is the plane that divides the body or an organ vertically into right and left sides. If this vertical plane runs directly down the middle of the body, it is called the midsagittal or median plane. If it divides the body into unequal right and left sides, it is called a parasagittal plane or, less commonly, a longitudinal section.
- The **frontal plane** is the plane that divides the body or an organ into an anterior (front) portion and a posterior (rear) portion. The frontal plane is often referred to as a coronal plane (“corona” is Latin for “crown”).
- The **transverse plane** is the plane that divides the body or organ horizontally into upper and lower portions. Transverse planes produce images referred to as cross sections.

Can You Locate the Planes?

Body Planes (Text Version)

Label the diagram with correct words listed below:

1. Sagittal Plane
2. Frontal (coronal) Plane
3. Transverse Plane



Body Planes Diagram (Text Version)

This illustration activity shows the human body standing upright in the anatomical position. Three anatomical planes are illustrated with transparent lines identifying the location of the three planes: the _____[Blank 1] which divides the left and right side of the body, the _____[Blank 2] dividing front and back portions of the body, and the _____[Blank 3] dividing top and bottom portion of the body.

Check your answers: ¹

Activity source: Medical language with the Context of Anatomy and Physiology Body by Tiffany Hunt, illustration from [Anatomy and Physiology \(OpenStax\)](#) licensed under [CC BY 4.0](#)./ Text version added.

Body Cavities and Serous Membranes

The body maintains its internal organization by means of membranes, sheaths, and other structures that separate compartments. The **dorsal (posterior) cavity** and the **ventral (anterior) cavity** are the largest body compartments ([Figure 2.6](#)). These cavities contain and protect delicate internal organs, and the ventral cavity allows for significant changes in the size and shape of the organs as they perform their functions. The lungs, heart, stomach, and intestines, for example, can expand and contract without distorting other tissues or disrupting the activity of nearby organs.

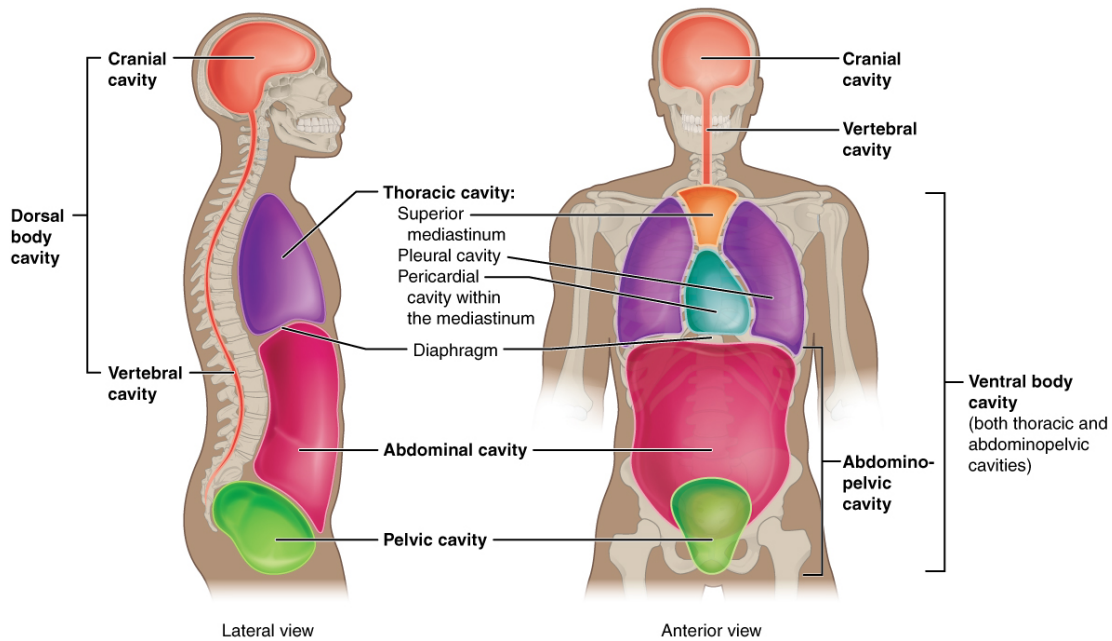


Figure 2.6. Dorsal and Ventral Body Cavities. The ventral cavity includes the thoracic and abdominopelvic cavities and their subdivisions. The dorsal cavity includes the cranial and spinal cavities. From Betts et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [[Fig. 2.6 Image description.](#)]

Subdivisions of the Posterior (Dorsal) and Anterior (Ventral) Cavities

The posterior (dorsal) and anterior (ventral) cavities are each subdivided into smaller cavities.

The posterior (dorsal) cavity has two main subdivisions:

- In the posterior (dorsal) cavity, the cranial cavity houses the brain.
 - Protected by the bones of the skulls and **cerebrospinal** fluid.
- The spinal cavity (or vertebral cavity) encloses the spinal cord.
 - Protected by the vertebral column and **cerebrospinal** fluid.

The anterior (ventral) cavity has two main subdivisions:

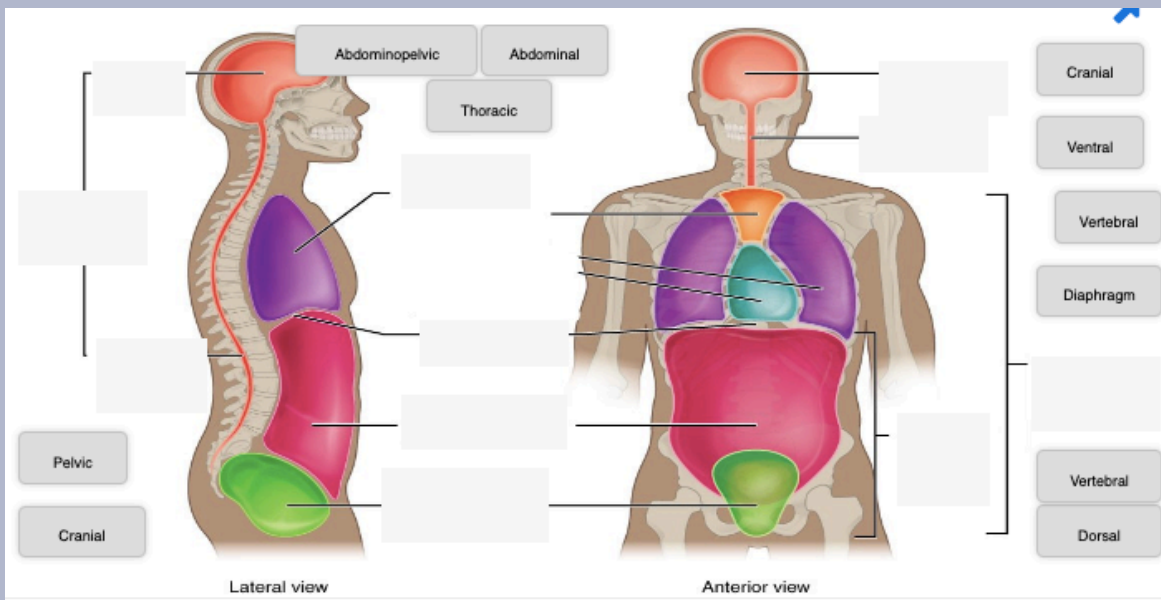
- The **thoracic cavity** is the more superior subdivision of the anterior cavity, and it is enclosed by the rib cage.
 - The thoracic cavity contains the lungs and the heart, which is located in the mediastinum.
 - The diaphragm forms the floor of the thoracic cavity and separates it from the more inferior abdominopelvic cavity.
- The **abdominopelvic cavity** is the largest cavity in the body.
 - No membrane physically divides the abdominopelvic cavity.
 - The abdominal cavity houses the digestive organs, the pelvic cavity, and the reproductive organs.

Practice Locating Cavities

Body Cavities (Text Version)

Label the diagram with correct words listed below:

- | | | |
|-------------------|--------------|---------------|
| 1. Abdominopelvic | 5. Cranial | 9. Dorsal |
| 2. Abdominal | 6. Ventral | 10. Cranial |
| 3. Thoracic | 7. Vertebral | 11. Vertebral |
| 4. Pelvic | 8. Diaphragm | |



Body Cavities Diagram (Text Version)

This diagram activity shows two views of the human head and torso. The right image shows the lateral view, and the left image shows an anterior view of the human head and torso. The image is highlighting the several cavities or hollowed out spaces where organs and structures are positioned. The lateral view show four cavities: the head cavity known as the _____ [Blank 1], the upper back cavity known as the _____ [Blank 2], the lower back area known as the _____ [Blank 3], and the chest cavity known as the _____ [Blank 4] cavity. Adjoining lines for both views identify the _____ [Blank 5] which is a muscular partition dividing the lungs from the location below it known as the _____ [Blank 6] and followed by the lower _____ [Blank 7]. The anterior view identifies the _____ [Blank 8], _____ [Blank 9], _____ [Blank 10], _____ [Blank 11] cavities, and sections.

Check your answers: ²

Activity source: Medical language with the Context of Anatomy and Physiology Dorsal by Tiffany Hunt, illustration from [Anatomy and Physiology \(OpenStax\)](#) licensed under [CC BY 4.0](#). /Text version added.

Abdominal Regions and Quadrants

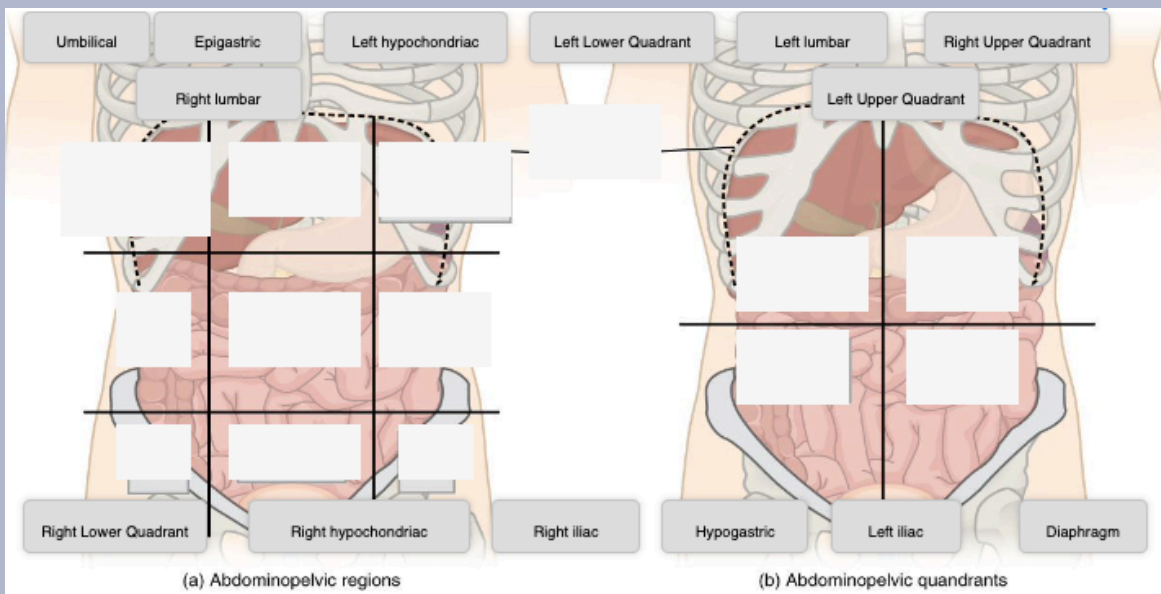
To promote clear communication, for instance about the location of a patient's abdominal pain or a suspicious mass, health care providers typically divide up the cavity into either nine regions or four quadrants.

Practice Locating the Quadrants

Locating the quadrants (Text Version)

Label the diagram with correct words listed below:

- | | | |
|-------------------------|--------------------------|-------------------------|
| 1. Umbilical | 6. Right Hypochondriac | 11. Left Upper Quadrant |
| 2. Epigastric | 7. Right Iliac | 12. Hypogastric |
| 3. Left Hypochondriac | 8. Left Lower Quadrant | 13. Left Iliac |
| 4. Right Lumbar | 9. Left Lumbar | 14. Diaphragm |
| 5. Right Lower Quadrant | 10. Right Upper Quadrant | |



Locating the quadrants Diagram (Text version)

This diagram activity shows two views of the abdominopelvic region. Image A shows the abdominopelvic region divided in nine sections with nine boxes. Image B shows the abdominopelvic region divided in four sections known as quadrants with a line dividing the four sections for each quadrant. For image A at the top are three white boxes identified working from right to left labeled as _____[Blank 1], followed by _____[Blank 2], and _____[Blank 3] region. The middle three boxes working from right to left identified as _____[Blank 4], followed by the _____[Blank 5], and _____[Blank 6] region. The three lower boxes working from right to left is the _____[Blank 7], followed by _____[Blank 8], and _____[Blank 9] region. Image B

shows two upper white boxes and are from right to left is the _____[Blank 10] followed by the _____[Blank 11]. The two lower boxes from right to left is the _____[Blank 12] followed by _____[Blank 13].

Check your answers: ³

Activity source: Medical language with the Context of Anatomy and Physiology Dorsal by Tiffany Hunt, illustration from [Anatomy and Physiology \(OpenStax\)](#) licensed under [CC BY 4.0](#)./Text version added.

Tissue Membranes

A **tissue membrane** is a thin layer or sheet of cells that covers the outside of the body (for example, skin), the organs (for example, pericardium), internal passageways that lead to the exterior of the body (for example, abdominal mesenteries), and the lining of the movable joint cavities. There are two basic types of tissue membranes: connective tissue and epithelial membranes ([Figure 2.7](#)).

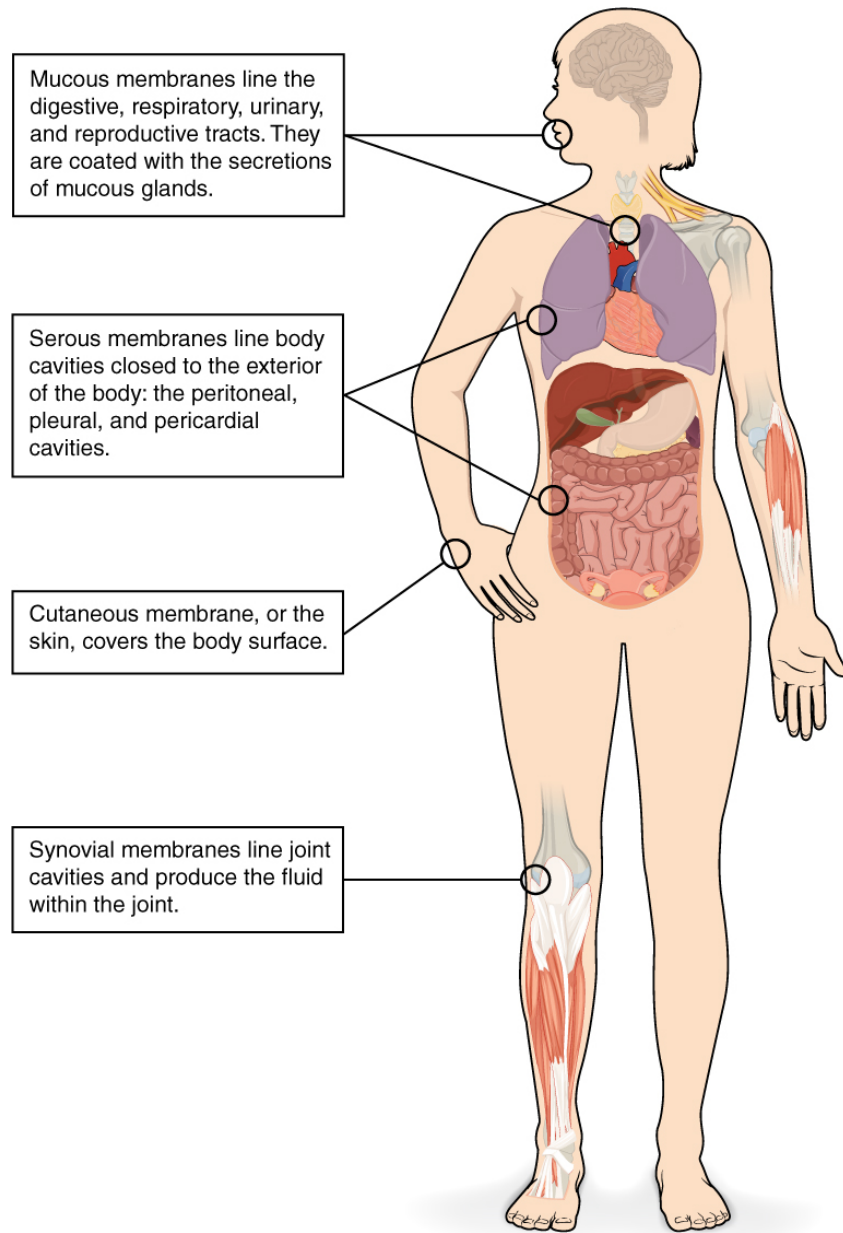


Figure 2.7. Tissue Membranes. The two broad categories of tissue membranes in the body are (1) connective tissue membranes, which include synovial membranes, and (2) epithelial membranes, which include mucous membranes, serous membranes, and the cutaneous membrane, in other words, the skin. From Betts et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [[Fig. 2.7 Image description.](#)]

Did You Know?

Synovial membranes line cavities which hold synovial fluid.

Synovial fluid lubricates the joints for movement.

Connective Tissue Membranes

- The **connective tissue membrane** is formed solely from connective tissue.
- These membranes encapsulate organs, such as the kidneys, and line our movable joints.
- A **synovial membrane** is a type of connective tissue membrane that lines the cavity of a freely movable joint.
- For example, synovial membranes surround the joints of the shoulder, elbow, and knee.

Epithelial Membranes

- The **epithelial membrane** is composed of epithelium attached to a layer of connective tissue.
 - For example, your skin.
- The **mucous membrane** is also a composite of connective and epithelial tissues.
 - Sometimes called mucosae, these epithelial membranes line the body cavities and hollow passageways that open to the external environment, and include the digestive, respiratory, excretory, and reproductive tracts.
 - Mucus, produced by the epithelial exocrine glands, covers the epithelial layer.
 - The underlying connective tissue, called the **lamina propria** (literally “own layer”), help support the fragile epithelial layer.
- The skin is an epithelial membrane also called the **cutaneous membrane**.
 - It is a stratified squamous epithelial membrane resting on top of connective tissue. The apical surface of this membrane is exposed to the external environment and is covered with dead, keratinized cells that help protect the body from desiccation and pathogens.

Membranes of the Anterior (Ventral) Body Cavity

- A **serous membrane** (also referred to as serosa) is an epithelial membrane composed of mesodermally derived epithelium called the mesothelium that is supported by connective tissue. These membranes line the **coelomic** cavities of the body and they cover the organs located within those cavities. They are essentially membranous bags, with mesothelium lining the inside and connective tissue on the outside.
 - **Parietal layers:** line the walls of the body cavity.
 - **Visceral layer:** covers the organs (the viscera).
 - Between the parietal and visceral layers is a very thin, fluid-filled **serous space**.

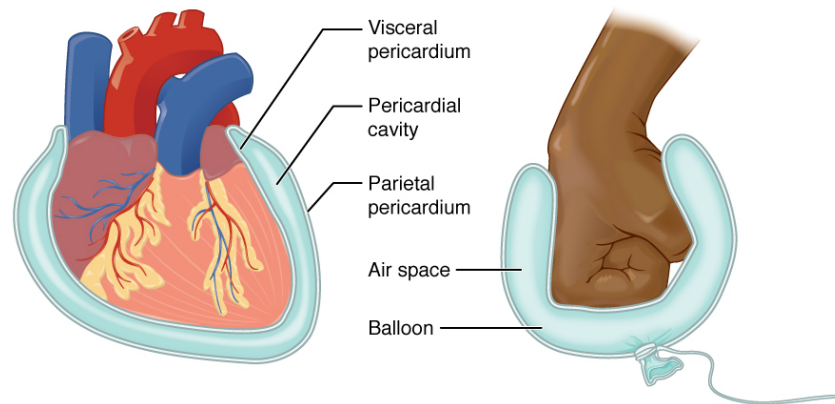


Figure 2.8. Serous Membrane. Serous membrane lines the pericardial cavity and reflects back to cover the heart—much the same way that an underinflated balloon would form two layers surrounding a fist. From Betts et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 2.8 Image description.](#)]

There are three serous cavities and their associated membranes. Serous membranes provide additional protection to the viscera they enclose by reducing friction that could lead to inflammation of the organs.

- **Pleura:** surrounds the lungs in the pleural cavity and reduces friction between the lungs and the body wall.
- **Pericardium:** surrounds the heart in the pericardial cavity and reduces friction between the heart and the wall of the pericardium.
- **Peritoneum:** surrounds several organs in the abdominopelvic cavity. The peritoneal cavity reduces friction between the abdominal and pelvic organs and the body wall.

Image Descriptions

Figure 2.6 image description: This illustration shows a lateral and anterior view of the body and highlights the body cavities with different colors. The cranial cavity is a large, bean-shaped cavity filling most of the upper skull where the brain is located. The vertebral cavity is a very narrow, thread-like cavity running from the cranial cavity down the entire length of the spinal cord. Together the cranial cavity and vertebral cavity can be referred to as the dorsal body cavity. The thoracic cavity consists of three cavities that fill the interior area of the chest.

The two pleural cavities are situated on both sides of the body, anterior to the spine and lateral to the breastbone. The superior mediastinum is a wedge-shaped cavity located between the superior regions of the two thoracic cavities. The pericardial cavity within the mediastinum is located at the center of the chest below the superior mediastinum. The pericardial cavity roughly outlines the shape of the heart. The diaphragm divides the thoracic and the abdominal cavities. The abdominal cavity occupies the entire lower half of the trunk, anterior to the spine. Just under the abdominal cavity, anterior to the buttocks, is the pelvic cavity. The pelvic cavity is funnel shaped and is located inferior and anterior to the abdominal cavity. Together the abdominal and pelvic cavity can be referred to as the abdominopelvic cavity while the thoracic, abdominal, and pelvic cavities together can be referred to as the ventral body cavity. [\[Return to Figure 2.6\].](#)

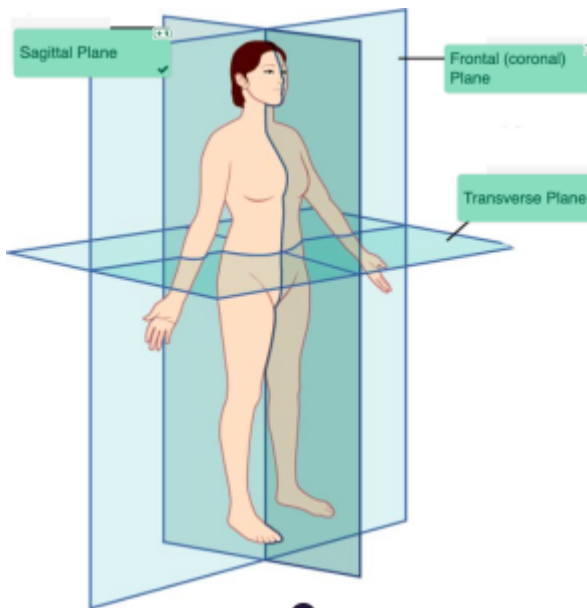
Figure 2.7 image description: This illustration shows the silhouette of a human female from an anterior view. Several organs are shown in her neck, thorax, abdomen, left arm, and right leg. Text boxes point out and describe the mucous membranes in several different organs. The topmost box points to the mouth and trachea. It states that mucous membranes line the digestive, respiratory, urinary, and reproductive tracts. They are coated with the secretions of mucous glands. The second box points to the outside edge of the lungs as well as the large intestine and states that serous membranes line body cavities that are closed to the exterior of the body, including the peritoneal, pleural, and pericardial cavities. The third box points to the skin of the hand. It states that cutaneous membrane, also known as the skin, covers the body surface. The fourth box points to the right knee. It states that synovial membranes line joint cavities and produce the fluid within the joint. [\[Return to Figure 2.7\]](#)

Figure 2.8 image description: This diagram shows the pericardium on the left next to an analogy of a hand punching a balloon on the right. The pericardium is a two-layered sac that surrounds the entire heart except where the blood vessels emerge on the heart's superior side. The pericardium has two layers because it folds over itself in the shape of the letter U. The inner layer that borders the heart is the visceral pericardium while the outer layer is the parietal pericardium. The space between the two layers is called the pericardial cavity. The heart sits in the cavity much like a fist punching into a balloon. The balloon surrounds the lower part of the fist with a two-layered sac, with the top of the balloon, where it contacts the fist, being analogous to the visceral pericardium. The bottom of the balloon, where it is tied off, is analogous to the parietal pericardium. The air within the balloon is analogous to the pericardial cavity. [\[Return to Figure 2.8\].](#)

Attribution

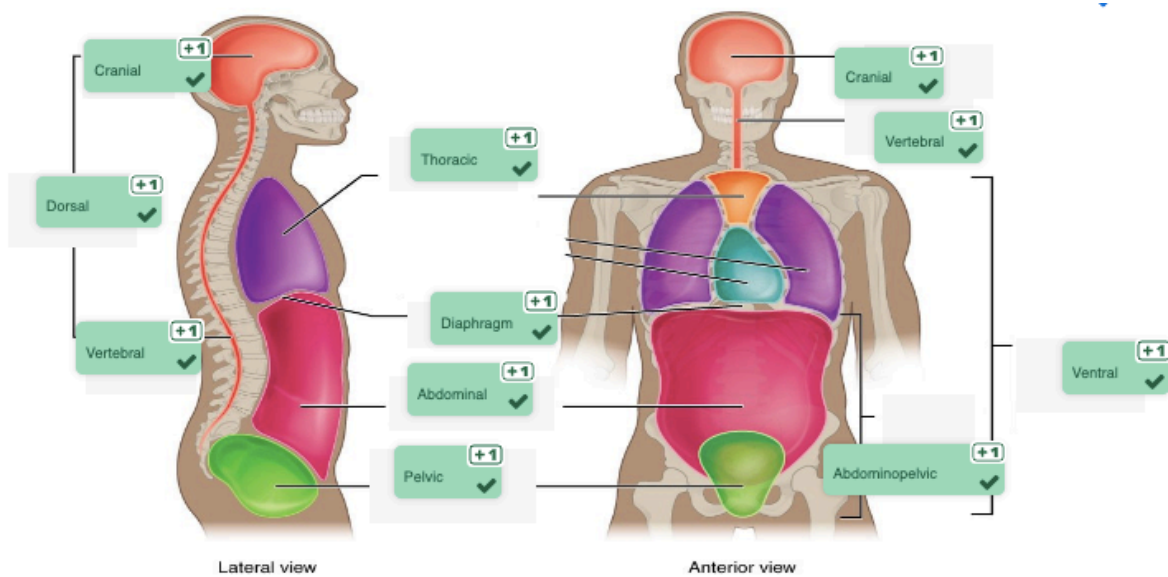
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Notes



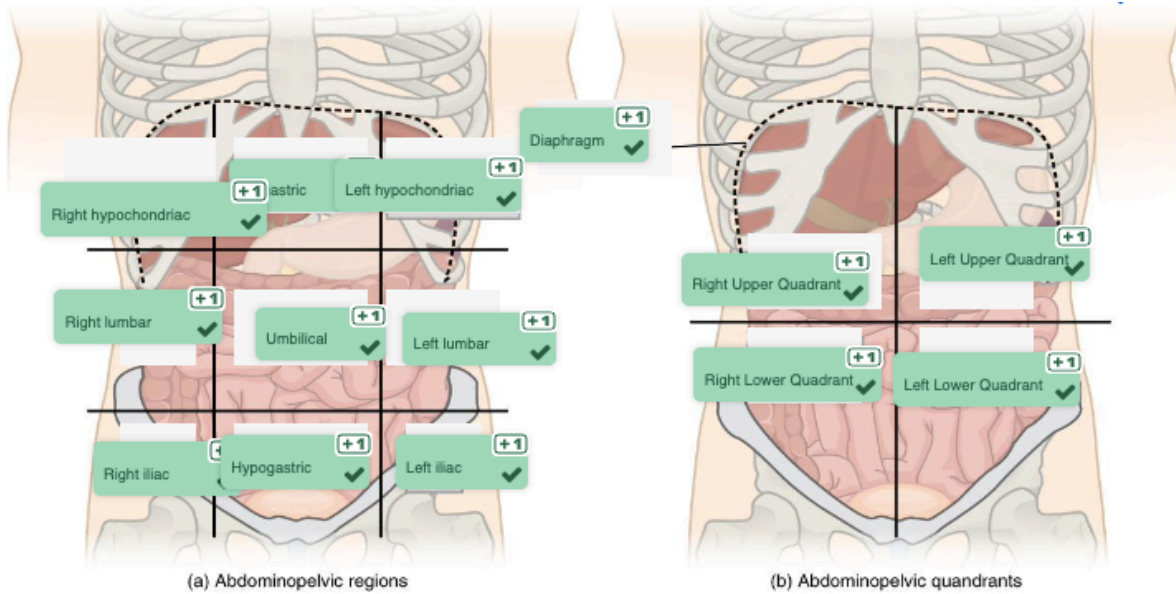
1.

Check your answers: Body Planes Diagram This illustration activity shows the human body standing upright in the anatomical position. Three anatomical planes are illustrated with transparent lines identifying the location of the three planes: the **sagittal plane** which divides the left and right side of the body, the **frontal plane** dividing front and back portions of the body, and the **transverse plane** dividing top and bottom portion of the body.



2.

Check your answers: Body Cavities Diagram (Text Version) This diagram activity shows two views of the human head and torso. The right image shows the lateral view, and the left image shows an anterior view of the human head and torso. The image is highlighting the several cavities or hollowed out spaces where organs and structures are positioned. The lateral view show four cavities: the head cavity known as the **cranial**, the upper back cavity known as the **dorsal**, the lower back area known as the **vertebral**, and the chest cavity known as the **thoracic** cavity. Adjoining lines for both views identify the **diaphragm** which is a muscular partition dividing the lungs from the location below it known as the **abdominal cavity** and followed by the lower **pelvic cavity**. The anterior view identifies the **cranial**, **vertebral**, **ventral**, **abdominopelvic** cavities, and sections.



3.

Check your answers: Locating the quadrants Diagrams (Text Version) This diagram activity shows two views of the abdominopelvic region. Image A shows the abdominopelvic region divided in nine sections with nine boxes. Image B shows the abdominopelvic region divided in four sections known as quadrants with a line dividing the four sections for each quadrant. For image A at the top are three white boxes identified working from right to left labeled as **right hypochondriac**, followed by **epigastric**, and **left hypochondriac** region. The middle three boxes working from right to left identified as **right lumbar**, followed by the **umbilical**, and **left lumbar** region. The three lower boxes working from right to left is the **right iliac**, followed by **hypogastric**, and **left iliac** region. Image B show two upper white boxes and are from right to left is the **right upper quadrant** followed by the **left upper quadrant**. The two lower boxes from right to left is the **right lower quadrant** followed by **left lower quadrant**.

Check Your Knowledge

Test Yourself

Test Yourself (Text Version)

1. The smallest unit of any of these pure substances (elements) is a(n) _____ [Blank 1].
 1. Cell
 2. Atom
 3. Organ
2. Describes a position closer to the surface of the body.
 1. Superficial
 2. Anterior
 3. Superior
3. The plane that divides the body or organ horizontally into upper and lower portions is called the _____ [Blank 2].
 1. Sagittal Plane
 2. Transverse Plane
 3. Frontal Place
4. The cavity that includes the cranial cavity and spinal cavity is called the _____ [Blank 3].
 1. Posterior cavity
 2. Anterior cavity
 3. Ventral Cavity
5. The name of the layer of the membrane that covers the organs is the _____ [Blank 4].
 1. Serous layer
 2. Visceral layer
 3. Parietal layer

Check your answers:¹

Activity source: Medical language with the Context of Anatomy and Physiology Reinforcement Activity by Tiffany Hunt, licensed under [CC BY 4.0.](https://creativecommons.org/licenses/by/4.0/)/Text version added.

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Notes

1. 1. Atom, 2. Superficial, 3. Transverse plane, 4. Posterior cavity, 5. Visceral layer

References

CrashCourse. (2015, January 6). *Introduction to anatomy & physiology: Crash Course anatomy & physiology #1* [Video]. YouTube. <https://youtu.be/uBG12BujkPQ>

CHAPTER 3: INTEGUMENTARY SYSTEM

Building a Medical Terminology Foundation 2e by Kimberlee Carter; Marie Rutherford; and Connie Stevens

- [3.1 – Introduction to the Integumentary System](#)
- [3.2 – Anatomy \(Structures\) of the Integumentary System](#)
- [3.3 – Physiology \(Function\) of the Integumentary System](#)
- [3.4 – Accessory Structures](#)
- [3.5 – Integumentary System Changes \(Aging, Disease and Disorders, Skin\)](#)
- [Vocabulary & Check Your Knowledge](#)
- [References](#)

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Please visit the web version of [Building a Medical Terminology Foundation 2e](#) to access the complete book, interactive activities and ancillary resources.

3.1 - Introduction to the Integumentary System

Learning Objectives

- Identify the anatomy and describe the main functions of the integumentary system and accessory structures
- Analyze, translate, and define medical terms and common abbreviations of the integumentary system
- Practice the spelling and pronunciation of integumentary system medical terminology
- Identify the medical specialties associated with the integumentary system and explore common diseases, disorders, diagnostic tests and procedures

Integumentary System Word Parts

Click on prefixes, combining forms, and suffixes to reveal a list of word parts to memorize for the Integumentary System.

Prefix

- **a-** (absence of, without)
- **bi-** (two or both)
- **dia-** (through, complete)
- **dys-** (difficult, painful, abnormal, laboured)
- **epi-** (upon, on, over)
- **hyper-** (above, excessive)
- **hypo-** (deficient, below, under, incomplete)
- **intra-** (within, in)
- **meta-** (change, beyond, after)
- **neo-** (new)

- **para-** (beside, around, beyond, abnormal)
- **per-** (through)
- **pro-** (before)
- **sub-** (under, below)
- **trans-** (through, across, beyond)
- **uni-** (one)

Combining Form

- **aut/o** (self)
- **bi/o** (life)
- **coni/o** (dust)
- **crypt/o** (hidden)
- **cutane/o** (skin)
- **derm/o** (skin)
- **dermat/o** (skin)
- **heter/o** (other)
- **hidr/o** (sweat)
- **kerat/o** (hard, horny tissue, keratin)
- **lei/o** (smooth)
- **myc/o** (fungus)
- **necr/o** (death)
- **onych/o** (nail)
- **pachy/o** (thick)
- **rhytid/o** (wrinkles)
- **seb/o** (sebum)
- **staphyl/o** (grapelike clusters)
- **strept/o** (twisted chains)
- **ungu/o** (nail)
- **xer/o** (dryness, dry)

Suffix

- **-a** (no meaning, noun ending)
- **-al** (pertaining to)
- **-ad** (toward)
- **-coccus** (berry-shaped)
- **-cyte** (cell)
- **-ectomy** (excision)
- **-gen** (substance that produces/causes, agent that produces/causes)
- **-genic** (producing, originating, causing)
- **-ia** (condition of, diseased state, abnormal state)
- **-ic** (pertaining to)
- **-itis** (inflammation)

- **-ior** (pertaining to)
- **-logy** (study of)
- **-logist** (specialist who studies and treats)
- **-malacia** (softening)
- **-megaly** (enlarged, enlargement)
- **-oid** (resembling)
- **-oma** (tumour, swelling)
- **-opsy** (view of, process of viewing, viewing)
- **-osis** (abnormal condition, increased numbers relating to blood)
- **-ous** (pertaining to)
- **-pathy** (disease)
- **-phagia** (eating, swallowing)
- **-plasia** (development, growth, condition of formation)
- **-plasm** (growth, substance, formation)
- **-plasty** (surgical repair)
- **-rrhea** (flow, discharge)
- **-sis** (state of)
- **-stasis** (stop, controlling, standing)
- **-tome** (instrument used to cut)

Activity source: Integumentary System Word List by Jesslyn Wilkinson, licensed under [CC BY 4.0./](https://creativecommons.org/licenses/by/4.0/)
Converted to text.

Introduction to the Integumentary System

The integumentary system refers to the skin and its accessory structures. In the adult human body, the skin makes up about 16 percent of body weight and covers an area of 1.5 to 2 m².

In fact, the skin and accessory structures are the largest organ system in the human body. The skin protects your inner organs and it is in need of daily care and protection to maintain its health.

Did You Know?

The skin and accessory structures are the largest organ system in the human body.

Watch [The Integumentary System, Part 1 – Skin Deep: Crash Course Anatomy & Physiology #6 \(10 min\) on YouTube](#)

Integumentary Medical Terms

Practice the following Integumentary System words by breaking into word parts and pronouncing
Integumentary Medical Terms (Text version)

1. **biopsy (bx)**

- BĪ-op-sē
- view of life (removal of living tissue to be viewed under a microscope)

2. **dermatitis**

- dĕr-mă-TĪT-ĭs
- inflammation of the skin

3. **dermatoautoplasty**

- dĕr-mă-tō-AW-tō-plăs-tē
- surgical repair using one's own skin

4. **dermatosis**

- dĕr-mă-tō-kō-nē-Ō-sĭs
- abnormal condition of the skin caused by dust

5. **dermatofibroma**

- dĕr-mă-tō-fi-BRŌ-mă
- fibrous tumour of the skin

6. **dermatoheteroplasty**

- dĕr-mă-tō-HĒT-ĕr-ō-plăs-tē

- surgical repair using skin from others
7. **dermatologist**
 - dĕr-mă-TŌL-ō-jĭst
 - Physician who specializes in treating diseases and disorders of the skin
 8. **dermatology (derm)**
 - dĕr-mă-TŌL-ō-jĕ
 - study of the skin
 9. **dermatome**
 - DĚR-mă-tōm
 - instrument used to cut skin
 10. **dermatoplasty**
 - DĚR-măt-ō-plas-tĕ
 - get meaning
 11. **epidermal**
 - ěp-ĭ-DĚR-mal
 - pertaining to upon/on the skin
 12. **erythroderma**
 - ě-rith-rŏ-DĚR-mă
 - red skin
 13. **hidradenitis**
 - hi-dra-ĕn-ĪT-ĭs
 - inflammation of a sweat gland
 14. **hypodermic**
 - hĭ-pŏ-DĚR-mĭk
 - pertaining to below the skin
 15. **intra dermal (ID)**
 - in-tră-DĚR-măl
 - pertaining to within the skin
 16. **keratogenic**
 - kĕr-ă-TŌJ-ĕ-nŭk
 - agent that causes growth of horny tissue

17. **keratosis**

- ker-ă-TŌ-sīs
- abnormal condition of growth of horny tissue

18. **leioderma**

- lī-ō-DĚR-mē-ă
- condition of smooth skin

19. **leukoderma**

- loo-kŏ-DĚR-mă
- white patches caused by depigmentation

20. **necrosis**

- ně-KRŌ-sīs
- condition of death

21. **onychocryptosis**

- ōn-ĭ-kŏ-krip-TŌ-sīs
- abnormal condition of a hidden nail

22. **onychomalacia**

- ōn-ĭ-kŏ-mă-LĀ-shă
- softening of the nails

23. **onychomycosis**

- on-i-kŏ-mī-KŌ-sīs
- abnormal condition of a fungus in the nails

24. **onychophagia**

- ōn-ĭ-KŌF-ă-jĕ
- eating the nails (nail biting)

25. **pachyderma**

- pak-ē-DĚR-mă
- thickening of the skin

26. **paronychia**

- pār-ō-NĪK-ē-ă
- diseased state around the nail

27. **percutaneous**

- pĕr-kū-TĀ-nē-ŭs
 - pertaining to through the skin
28. **rhytidectomy**
- rit-ĭ-DEK-tō-mē
 - excision of the wrinkles
29. **rhytidoplasty**
- RĪT-ĭ-dō-plās-tē
 - surgical repair of wrinkles
30. **seborrhea**
- sĕb-or-Ē-ă
 - discharge (excessive) of sebum
31. **staphylococcus (staph)**
- staf-ĭ-lō-KOK-ŭs
 - berry-shaped bacterium in grape-like clusters
32. **streptococcus (strep)**
- strep-tō-KOK-ŭs
 - berry-shaped bacterium in twisted chains
33. **subcutaneous (subcut, Sub-Q)**
- sŭb-kū-TĀ-nē-ŭs
 - pertaining to under the skin
34. **subungual**
- sŭb-ŪNG-gwāl
 - pertaining to under the nail
35. **transdermal (TD)**
- trānz-DĚRM-ăl
 - pertaining to through the skin
36. **ungual**
- ŪNG-gwāl
 - pertaining to the nail
37. **xeroderma**
- zer-ō-DĚR-mă

- dry skin

38. **xerosis**

- zĕ-RŌ-sĭs
- abnormal condition of dryness

Activity source: Integumentary Medical Terms from [Medical Terminology](#) by Grimm et al., licensed under [CC BY 4.0](#). / Text version added.

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3.2 - Anatomy (Structures) of the Integumentary System

The skin and its accessory structures make up the integumentary system, which provides the body with overall protection. The skin is made of multiple layers of cells and tissues, which are held to underlying structures by connective tissue. The deeper layer of skin is well **vascularized**. It also has numerous sensory, and **autonomic** and **sympathetic** nerve fibers ensuring communication to and from the brain.

Layers of the skin

The skin is composed of three main layers:

1. The **epidermis**
2. The **dermis**
3. Beneath the dermis lies the **hypodermis**

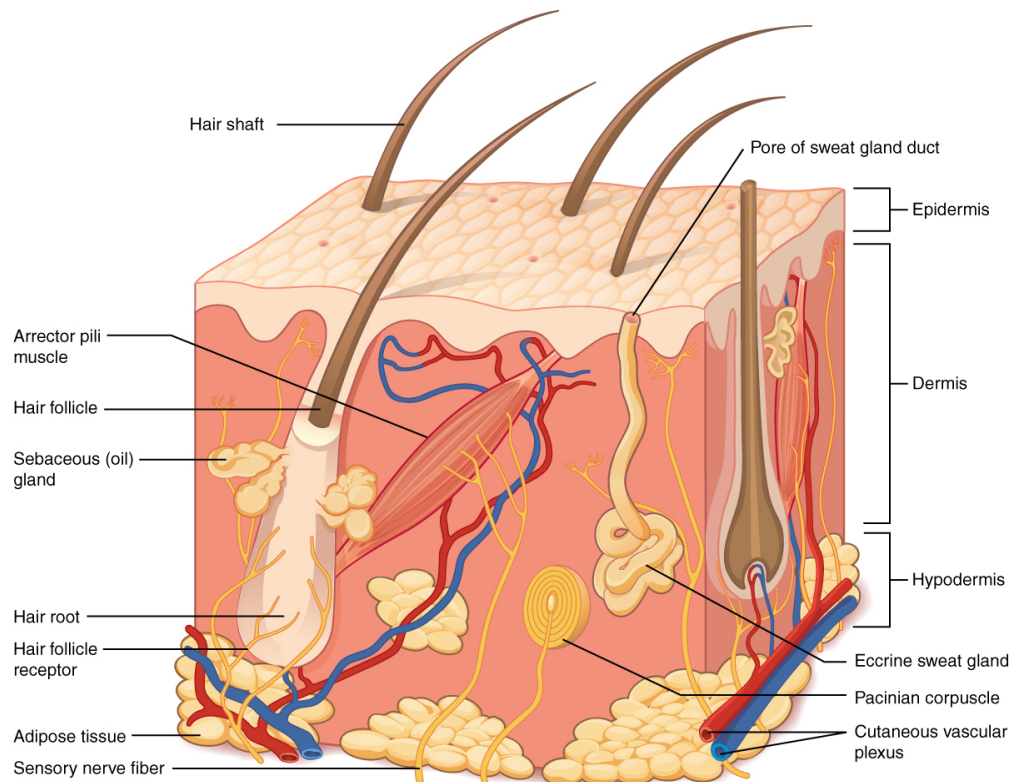


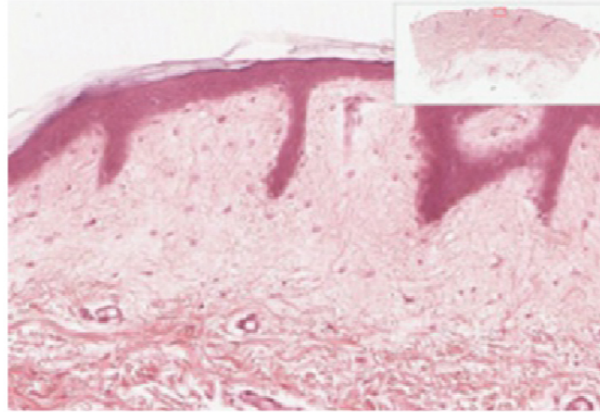
Figure 3.1 Layers of Skin. From Betts et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [[Fig. 3.1 Image description.](#)]

Concept Check

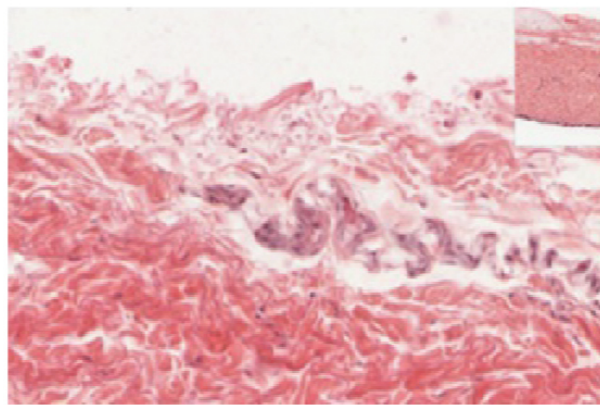
- On the diagram above, find the two layers of the skin; **epidermis** and **dermis**.
- The literal breakdown for **hypodermis** is below the dermis. On the diagram above, where can you locate it?
- Can you find a **hair follicle**, **hair root**, and **hair shaft**?
- Keep reading to find out what the **arrector pili muscle** does when you are frightened.

Epidermis

- **Thin skin** has four layers of cells. From deep to superficial, these layers are the **stratum basale**, stratum spinosum, stratum granulosum, and stratum corneum. Most of the skin can be classified as thin skin.
- **Thick skin** is found only on the palms of the hands and the soles of the feet. It has a fifth layer, called the stratum lucidum, located between the stratum corneum and the stratum granulosum (see [Figure 3.2](#)).



(a)



(b)

Figure 3.2 Thin Skin versus Thick Skin. These slides show cross-sections of the epidermis and dermis of (a) thin and (b) thick skin. Note the significant difference in the thickness of the epithelial layer of the thick skin. From top, LM \times 40, LM \times 40. (Micrographs provided by the Regents of University of Michigan Medical School \copyright 2012). From Betts et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [[Fig. 3.2 Image description.](#)]

The cells in all of the layers except the stratum basale are called **keratinocytes**. **Keratin** is an intracellular fibrous protein that gives hair, nails, and skin their hardness and water-resistant properties. The keratinocytes in the stratum corneum are dead and regularly slough away, being replaced by cells from the deeper layers (see [Figure 3.3](#)).

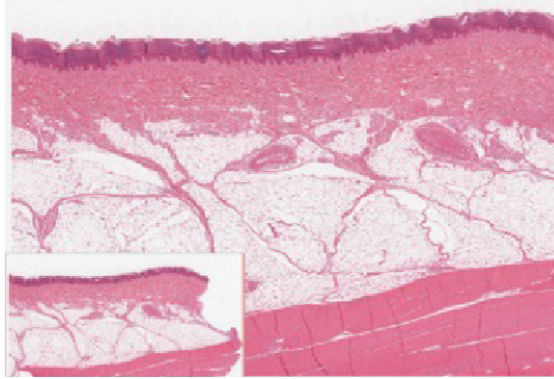


Figure 3.3 Epidermis. The epidermis is epithelium composed of multiple layers of cells. The basal layer consists of cuboidal cells, whereas the outer layers are squamous, keratinized cells, so the whole epithelium is often described as being keratinized stratified squamous epithelium. LM \times 40. (Micrograph provided by the Regents of University of Michigan Medical School \copyright 2012). From Betts et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 3.3 Image description.](#)]

Dermis

The dermis contains blood and lymph vessels, nerves, and other structures, such as hair follicles and sweat glands. The dermis is made of two layers (papillary layer and reticular layer) of connective tissue that compose an interconnected mesh of elastin and collagenous fibers, produced by fibroblasts (see [Figure 3.4](#)).



Figure 3.4 Layers of the Dermis. This stained slide shows the two components of the dermis—the papillary layer and the reticular layer. Both are made of connective tissue with fibers of collagen extending from one to the other, making the border between the two somewhat indistinct. The dermal papillae extending into the epidermis belong to the papillary layer, whereas the dense collagen fiber bundles below belong to the reticular layer. LM $\times 10$. (credit: modification of [image](#) by kilbad, [PDM](#)). From Betts et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 3.4 Image description.](#)]

Papillary Layer

The papillary layer is made of loose, areolar connective tissue, which means the collagen and elastin fibers of this layer form a loose mesh. This superficial layer of the dermis projects into the stratum basale of the epidermis to form finger-like dermal papillae (see [Figure 3.4](#)). Within the papillary layer are fibroblasts, a small number **adipocytes**, and an abundance of small blood vessels. In addition, the papillary layer contains **phagocytes**, that help fight bacteria or other infections that have breached the skin. This layer also contains lymphatic capillaries, nerve fibers, and **Meissner corpuscles**.

Reticular Layer

Underlying the papillary layer is the much thicker reticular layer, composed of dense, irregular connective tissue. This layer is well **vascularized** and has a rich sensory and **sympathetic** nerve supply. The reticular layer appears **reticulated** due to a tight meshwork of fibers. Elastin fibers provide some elasticity to the skin, enabling movement. Collagen fibers provide structure and tensile strength, with strands of collagen extending into both the papillary layer and the hypodermis. In addition, collagen binds water to keep the skin hydrated. Collagen injections and Retin-A creams help restore skin turgor by either introducing collagen externally or stimulating blood flow and repair of the dermis, respectively.

Hypodermis

The **hypodermis** serves to connect the skin to the underlying **fascia** of the bones and muscles. It is not strictly a part of the skin, although the border between the **hypodermis** and **dermis** can be difficult to distinguish. The hypodermis consists of well-vascularized, loose, areolar connective tissue and **adipose** tissue, which functions as a mode of fat storage and provides insulation and cushioning for the integument.

Layers of the Skin

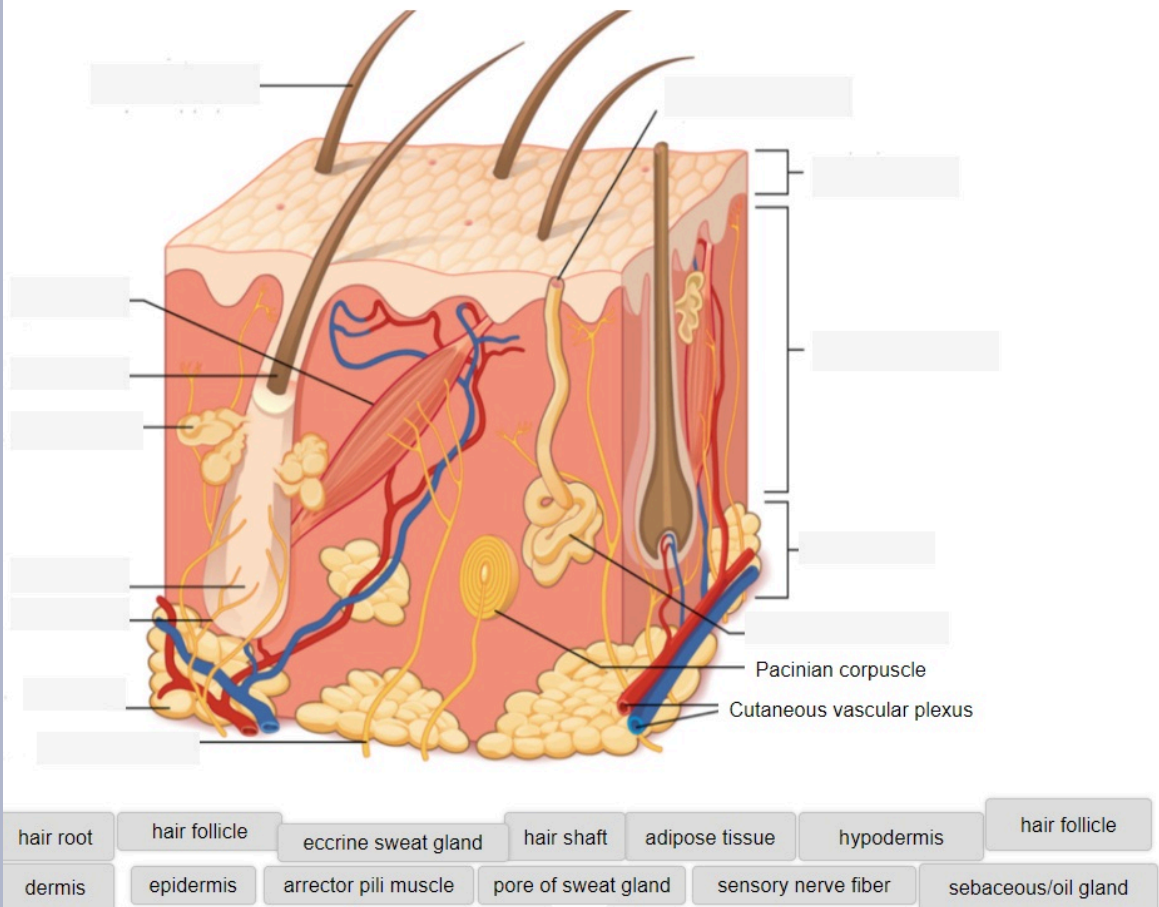
Practice labeling the layers of the skin.

Layers of the Skin (Text Version)

Label the diagram with correct words listed below:

- | | | |
|------------------------|--------------------------|-------------------------|
| 1. Hair Root | 6. Hypodermis | 11. pore of sweat gland |
| 2. Hair Follicle | 7. Hair follicle | 12. sensory nerve fiber |
| 3. Eccrine Sweat Gland | 8. dermis | 13. sebaceous/oil gland |
| 4. Hair shaft | 9. epidermis | |
| 5. Adipose tissue | 10. arrector pili muscle | |

Integumentary System Anatomy of a Skin Cube



Layers of the Skin Diagram (Text Version)

This illustration shows a cross section of skin tissue. The outermost layer is called the _____ [Blank 1] and occupies one fifth of the cross section. Several hairs are emerging from the surface. The epidermis dives around one of the hairs, forming a _____ [Blank 2]. The _____ [Blank 3] is located above the hair follicle. Surrounding the base of the hair follicle is the _____ [Blank 4] which lubricates the _____ [Blank 5]. Extending the surface of the skin is the _____ [Blank 6]. The middle layer is called the _____ [Blank 7], which occupies four fifths of the cross section. The dermis contains an _____ [Blank 8] that causes contraction of the hair follicle making the hair stand on end such as when someone experiences goosebumps. The dermis also contains an _____ [Blank 9], composed of a bunch of tubules. One tubule travels up from the bunch, through the epidermis, opening onto the surface a _____ [Blank 10]. There are two string-like nerves travelling vertically through the dermis. The right nerve is attached to a Pacinian corpuscle, which is a yellow structure consisting of concentric ovals like an onion. The lowest level of the skin, the _____ [Blank 11], contains _____ [Blank 12], arteries, and veins. Blood vessels travel from the hypodermis and connect to hair follicles and erector pili muscle in the dermis. _____ [Blank 13] located in the hypodermis supports the interpretation of touch.

Check your answers: ¹

Activity source: Layers of the Skin by Kimberlee Carter from [Building a Medical Terminology Foundation](#), illustration from [Anatomy and Physiology \(OpenStax\)](#), licensed under [CC BY 4.0](#). / Text version added.

Image Descriptions

Figure 3.1 image description: This illustration shows a cross section of skin tissue. The outermost layer is called the epidermis, and occupies one fifth of the cross section. Several hairs are emerging from the surface. The epidermis dives around one of the hairs, forming a follicle. The middle layer is called the dermis, which occupies four fifths of the cross section. The dermis contains an erector pilli muscle connected to one of the follicles. The dermis also contains an eccrine sweat gland, composed of a bunch of tubules. One tubule travels up from the bunch, through the epidermis, opening onto the surface a pore. There are two string-like nerves travelling vertically through the dermis. The right nerve is attached to a Pacinian corpuscle, which is a yellow structure consisting of concentric ovals similar to an onion. The lowest level of the skin, the hypodermis, contains fatty tissue, arteries, and veins. Blood vessels travel from the hypodermis and connect to hair follicles and erector pilli muscle in the dermis. [\[Return to Figure 3.1\]](#).

Figure 3.2 image description: Part A is a micrograph showing a cross section of thin skin. The topmost layer is a thin, translucent layer with irregular texture and areas where cells are sloughing off. The deepest layer is dark purple and extends into the third layer with finger like projections. The third light purple layer contains thin bands of fibers and small, dark cells. The fourth, and deepest layer, is darker than the third layer, but is still light purple. It contains thick fiber bands that are loosely packed. Part B is a magnified view of the epidermis of thick skin. It shows the topmost layer is five times thicker than the topmost layer of thin skin. The topmost layer of thick skin is also denser and less translucent than the topmost layer of thin skin. [\[Return to Figure 3.2\]](#).

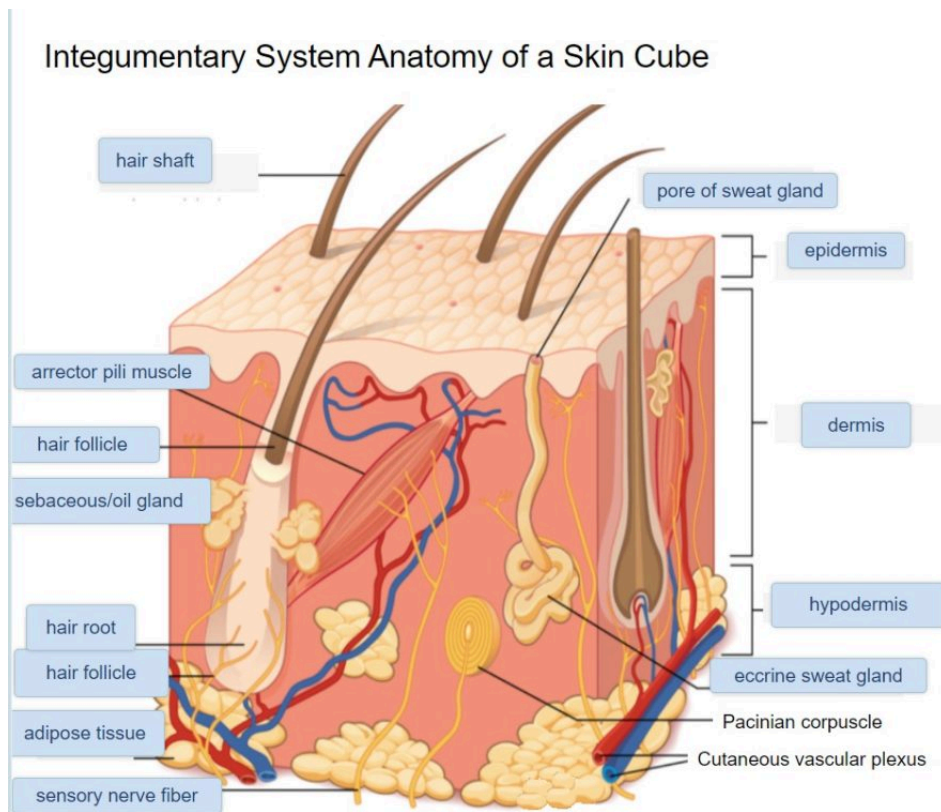
Figure 3.3 image description: The outer layer of cells in this micrograph is the thinnest layer and stained deep purple due to full keratinization of dead cells. The next layer occupies one quarter of the micrograph, is lightly stained, and is a dense collection of cells. The third layer from the top is mostly white, with lightly stained, loosely-packed strands radiating in random directions. The bottom-most layer is densely-packed, with thick bands of highly organized muscle tissue that are darkly stained. [\[Return to Figure 3.3\]](#).

Figure 3.4 image description: This micrograph shows layers of skin in a cross section. The papillary layer of the dermis extends between the downward fingers of the darkly stained epidermis. The papillary layer appears finer than the reticular layer, consisting of smaller, densely-packed fibers. The reticular layer is three times thicker than the papillary layer and contains larger, thicker fibers. The fibers seem more loosely packed than those of the papillary layer, with some separated by empty spaces. Both layers of the dermis contain cells with darkly stained nuclei. [\[Return to Figure 3.4\]](#).

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Notes



1.

Check

your answers: Layers of the Skin Diagram (Text Version) This illustration shows a cross section of skin tissue. The outermost layer is called the **epidermis** and occupies one fifth of the cross section. Several hairs are emerging from the surface. The epidermis dives around one of the hairs, forming a **hair follicle**. The **hair root** is located above the hair follicle. Surrounding the base of the hair follicle is the **sebaceous/oil gland** which lubricates the **hair follicle**. Extending the surface of the skin is the **hair shaft**. The middle layer is called the dermis, which occupies four fifths of the cross section. The dermis contains an **arrector pili muscle** that causes contraction of the hair follicle making the hair stand on end such as when someone experiences goosebumps. The dermis also contains an **eccrine sweat gland**, composed of a bunch of tubules. One tubule travels up from the bunch, through the epidermis, opening onto the surface a **pore of sweat gland**. There are two string-like nerves travelling vertically through the dermis. The right nerve is attached to a Pacinian corpuscle, which is a yellow structure consisting of concentric ovals like an onion. The lowest level of the skin, the **hypodermis**, contains **adipose tissue**, arteries, and veins. Blood vessels travel from the hypodermis and connect to hair follicles and erector pili muscle in the dermis. **Sensory nerve fibers** located in the hypodermis supports the interpretation of touch.

3.3 - Physiology (Function) of the Integumentary System

The skin and accessory structures perform a variety of essential functions, such as protecting the body from invasion by microorganisms, chemicals, and other environmental factors; preventing dehydration; acting as a sensory organ; modulating body temperature and electrolyte balance; and synthesizing vitamin D. The underlying hypodermis has important roles in storing fats, forming a “cushion” over underlying structures, and providing insulation from cold temperatures.

Protection

The skin protects the body from wind, water, and UV sunlight. It acts as a protective barrier against water loss and it also is the first line of defense against abrasive activity such as grit, microbes, or harmful chemicals. Sweat excreted from sweat glands deters microbes from over-colonizing the skin surface by generating dermicidin, which has antibiotic properties.

Sensory Function

The skin acts as a sense organ because the epidermis, dermis, and the hypodermis contain specialized sensory nerve structures that detect touch, surface temperature, and pain. These receptors are more concentrated on the tips of the fingers, which are most sensitive to touch, especially the **Meissner corpuscle**, which responds to light touch, and the **Pacinian corpuscle**, which responds to vibration. Merkel cells, seen scattered in the stratum basale, are also touch receptors. In addition to these specialized receptors, there are sensory nerves connected to each hair follicle, pain and temperature receptors scattered throughout the skin, and motor nerves innervate the arrector pili muscles and glands. This rich innervation helps us sense our environment and react accordingly.

Thermoregulation

The integumentary system helps regulate body temperature through its tight association with the **sympathetic nervous system**. The sympathetic nervous system is continuously monitoring body temperature and initiating appropriate motor responses.

When the **body becomes warm**, sweat glands, accessory structures to the skin, secrete water, salt, and other substances to cool the body.

- Even when the body does not appear to be noticeably sweating, approximately 500 mL of sweat are secreted a day.

If the **body becomes excessively warm** due to high temperatures, vigorous activity, or a combination of the two, sweat glands will be stimulated by the sympathetic nervous system to produce large amounts of sweat.

- When the sweat evaporates from the skin surface, the body is cooled as body heat is dissipated.
- In addition to sweating, arterioles in the dermis dilate so that excess heat carried by the blood can dissipate through the skin and into the surrounding environment.
- This accounts for the skin redness that many people experience when exercising.

When **body temperatures drop**, the arterioles constrict to minimize heat loss, particularly in the ends of the digits and tip of the nose.

- This reduced circulation can result in the skin taking on a whitish hue.
- Although the temperature of the skin drops as a result, passive heat loss is prevented, and internal organs and structures remain warm.
- If the temperature of the skin drops too much (such as environmental temperatures below freezing), the conservation of body core heat can result in **frostbite**.

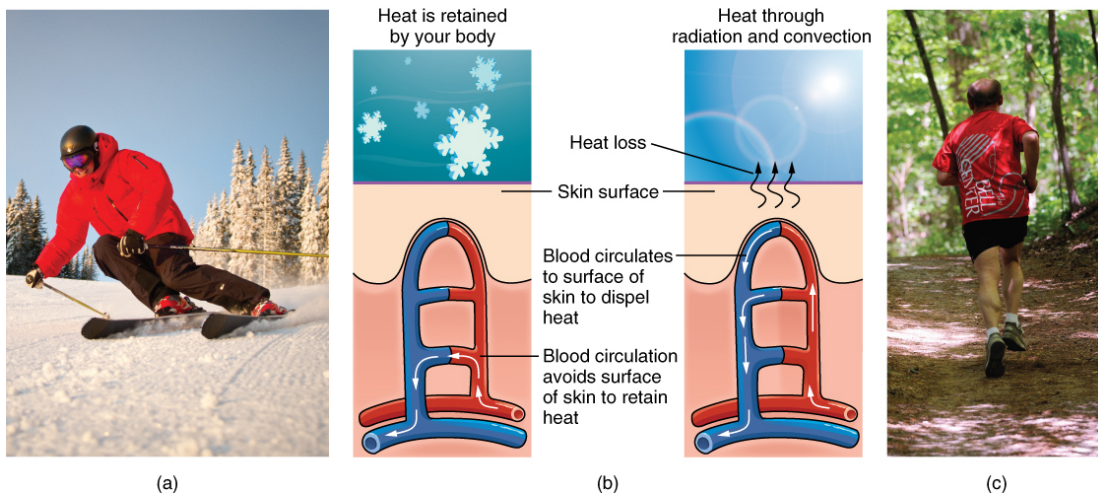


Figure 3.5 Thermoregulation. During strenuous physical activities, such as skiing (a) or running (c), the dermal blood vessels dilate and sweat secretion increases (b). These mechanisms prevent the body from overheating. In contrast, the dermal blood vessels constrict to minimize heat loss in response to low temperatures (b). (credit a: "Trysil"/flickr; credit c: Ralph Daily). From Betts et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 3.5 Image description.](#)]

Concept Check

Can you describe the **thermoregulation** process between the integumentary system and the sympathetic system?

- When body temperature is too warm.
- When body temperature is too cold.

Vitamin D Synthesis

The epidermal layer of human skin synthesizes Vitamin D when exposed to UV radiation. In the presence of sunlight, a form of Vitamin D₃ called cholecalciferol is synthesized from a derivative of the steroid cholesterol in the skin. The liver converts cholecalciferol to calcidiol, which is then converted to calcitriol (the active chemical form of the vitamin) in the kidneys.

- Vitamin D is essential for normal absorption of calcium and phosphorous, which are required for healthy bones.
- The absence of sun exposure can lead to a lack of vitamin D in the body; in children this can cause **rickets**. Vitamin D deficiency in elderly individuals may lead to **osteomalacia**.
- In present day society, Vitamin D is added as a supplement to many foods, including milk and orange juice, compensating for the need for sun exposure. In addition to its essential role in bone health, Vitamin D is essential for general immunity against bacterial, viral, and fungal infections.

Did You Know?

Vitamin D is essential for general immunity against bacterial, viral and fungal infections.

Image Descriptions

Figure 3.5 image description: Part A is a photo of a man skiing with several snow-covered trees in the background. Part B is a diagram with a right and left half. The left half is titled “Heat is retained by the body,” while the right half is titled “Heat loss through radiation and convection.” Both show blood flowing from an artery through three capillary beds within the skin. The beds are arranged vertically, with the topmost bed located along the boundary of the dermis and epidermis. The bottommost bed is located deep in the hypodermis. The middle bed is evenly spaced between the topmost and bottommost beds. In each bed, oxygenated blood (red) enters the bed on the left and deoxygenated blood (blue) leaves the bed on the right. The left diagram shows a picture of snowflakes above the capillary beds, indicating that the weather is cold. Blood is only flowing through the deepest of the three capillary beds, as the upper beds are closed off to reduce heat loss from the outer layers of the skin. The right diagram shows a picture of the sun above the capillary beds, indicating that the weather is hot. Blood is flowing through all three capillary beds, allowing heat to radiate out of the blood, increasing heat loss. Part C is a photo of a man running through a forested trail on a summer day. [\[Return to Figure 3.5\]](#).

Attribution

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3.4 - Accessory Structures

Accessory structures of the skin include hair, nails, sweat glands, and sebaceous glands. These structures embryologically originate from the epidermis and can extend down through the dermis into the **hypodermis**.

Hair

Hair is a keratinous filament growing out of the **epidermis**. It is primarily made of dead, keratinized cells. Strands of hair originate in an epidermal penetration of the dermis called the hair follicle. The hair shaft is the part of the hair not anchored to the follicle, and much of this is exposed at the skin's surface. The rest of the hair, which is anchored in the follicle, lies below the surface of the skin and is referred to as the hair root. The hair root ends deep in the dermis at the hair bulb, and includes a layer of mitotically active basal cells called the hair matrix. The hair bulb surrounds the hair papilla, which is made of connective tissue and contains blood capillaries and nerve endings from the dermis (see [Figure 3.6](#)).

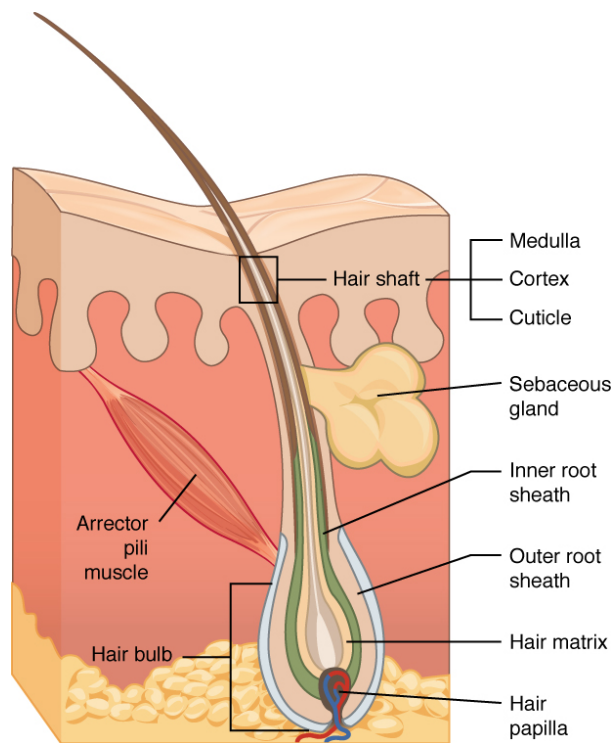


Figure 3.6 Hair. Hair follicles originate in the epidermis and have many different parts. From Betts et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 3.6 Image description.](#)]

Hair Function

Hair serves a variety of functions, including protection, sensory input, thermoregulation, and communication. For example:

- Hair on the head **protects** the skull from the sun.
- Hair in the nose and ears, and around the eyes (eyelashes) **defends** the body by trapping and excluding dust particles that may contain allergens and microbes.
- Hair of the eyebrows **prevents** sweat and other particles from dripping into and bothering the eyes.

Hair also has a **sensory function** due to sensory innervation by a hair root plexus surrounding the base of each hair follicle. Hair is extremely sensitive to air movement or other disturbances in the environment, much more so than the skin surface. This feature is also useful for the **detection** of the presence of insects or other potentially damaging substances on the skin surface.

Each hair root is connected to a smooth muscle called the arrector pili that contracts in response to nerve signals from the sympathetic nervous system, making the external hair shaft “stand up.” The primary purpose for this is to trap a layer of air to add insulation. This is visible in humans as goose bumps and even more obvious in animals, such as when a frightened cat raises its fur. Of course, this is much more obvious in organisms with a heavier coat than most humans, such as dogs and cats.

Did You Know?

When frightened, the arrector pili muscle is responsible for your hair standing on end. The same is true when a cat's fur is raised.

Hair Growth, Loss and Colour

Hair grows and is eventually shed and replaced by new hair. Hair typically grows at the rate of 0.3 mm per day. On average, 50 hairs are lost and replaced per day. Hair loss occurs if there is more hair shed than what is replaced and can happen due to hormonal or dietary changes. Hair loss can also result from the aging process, or the influence of hormones. Similar to the skin, hair gets its colour from the pigment melanin, produced by **melanocytes** in the hair papilla. Different hair color results from differences in the type of melanin. As a person ages, the melanin production decreases, and hair tends to lose its color and becomes gray and/or white.

Nails

The **nail bed** is a specialized structure of the epidermis that is found at the tips of our fingers and toes. The nail body is formed on the nail bed, and protects the tips of our fingers and toes as they are the farthest extremities and the parts of the body that experience the maximum mechanical stress (see [Figure 3.7](#)). The nail body forms a back-support for picking up small objects with the fingers. The nail body is composed of densely packed dead **keratinocytes**.

The epidermis in this part of the body has evolved a specialized structure upon which nails can form. The nail body forms at the nail root, which has a matrix of proliferating cells from the stratum basale that enables the nail to grow continuously. The lateral nail fold overlaps the nail on the sides, helping to anchor the nail body. The nail fold that meets the proximal end of the nail body forms the nail cuticle, also called the eponychium.

The nail bed is rich in blood vessels, making it appear pink, except at the base, where a thick layer of epithelium over the nail matrix forms a crescent-shaped region called the **lunula (the “little moon”)**. The area beneath the free edge of the nail, furthest from the cuticle, is called the hyponychium. It consists of a thickened layer of stratum corneum.

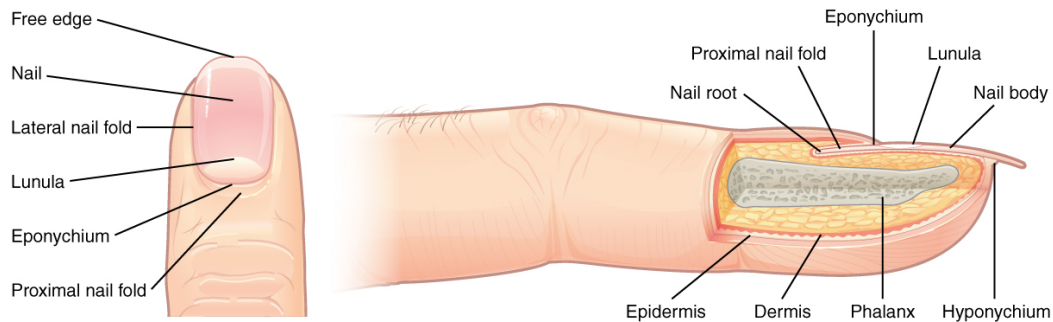


Figure 3.7 Nails. The nail is an accessory structure of the integumentary system. From Betts et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 3.7 Image description.](#)]

Sweat Glands

Sudoriferous Glands

When the body becomes warm, sudoriferous glands produce sweat to cool the body. Sweat glands develop from epidermal projections into the dermis and are classified as merocrine glands; that is, the secretions are excreted by **exocytosis** through a duct without affecting the cells of the gland. There are two types of sweat glands, each secreting slightly different products.

An **eccrine sweat gland** is a type of gland that produces a hypotonic sweat for thermoregulation as described previously. These glands are found all over the skin's surface, but are especially abundant on the palms of the hand, the soles of the feet, and the forehead ([Figure 3.8](#)). They are coiled glands lying deep in the dermis, with the duct rising up to a pore on the skin surface, where the sweat is released. This type of sweat, released by

exocytosis, is hypotonic and composed mostly of water, with some salt, antibodies, traces of metabolic waste, and dermicidin, an antimicrobial peptide. **Eccrine glands** are a primary component of thermoregulation in humans and thus help to maintain **homeostasis**.

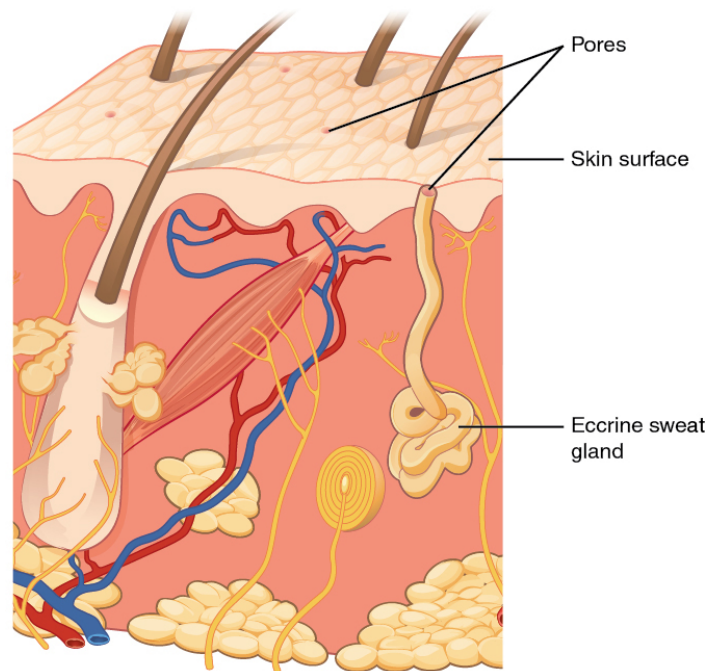


Figure 3.8 Eccrine Gland. Eccrine glands are coiled glands in the dermis that release sweat that is mostly water. From Betts et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [[Fig. 3.8 Image description.](#)]

An **apocrine sweat gland** is usually associated with hair follicles in densely hairy areas, such as armpits and genital regions. Apocrine sweat glands are larger than eccrine sweat glands and lie deeper in the dermis, sometimes even reaching the hypodermis, with the duct normally emptying into the hair follicle. In addition to water and salts, apocrine sweat includes organic compounds that make the sweat thicker and subject to bacterial decomposition and subsequent smell. The release of this sweat is under both nervous and hormonal control, and plays a role in the poorly understood human pheromone response. Most commercial antiperspirants use an aluminum-based compound as their primary active ingredient to stop sweat. When the antiperspirant enters the sweat gland duct, the aluminum-based compounds precipitate due to a change in pH and form a physical block in the duct, which prevents sweat from coming out of the pore.

Did You Know?

Aluminum-based compounds due to a change in pH form a physical block in the sweat gland duct. This prevents sweating.

Sebaceous Glands

A **sebaceous gland** is a type of oil gland that is found all over the body and helps to lubricate and waterproof the skin and hair. Most sebaceous glands are associated with hair follicles. They generate and excrete sebum, a mixture of lipids, onto the skin surface, thereby naturally lubricating the dry and dead layer of keratinized cells of the stratum corneum, keeping it pliable. The fatty acids of sebum also have antibacterial properties, and prevent water loss from the skin in low-humidity environments. The secretion of sebum is stimulated by hormones, many of which do not become active until puberty, thus sebaceous glands are relatively inactive during childhood.

The accessory structures also have lowered activity, generating thinner hair and nails, and reduced amounts of sebum and sweat. A reduced sweating ability can cause some elderly to be intolerant to extreme heat. Other cells in the skin, such as **melanocytes** and **dendritic** cells, also become less active, leading to a paler skin tone and lowered immunity. Wrinkling of the skin occurs due to breakdown of its structure, which results from decreased collagen and elastin production in the dermis, weakening of muscles lying under the skin, and the inability of the skin to retain adequate moisture.

Words Not Easily Broken into Word Parts

Integumentary System Terms Not Easily Broken into Word Parts

Integumentary Medical Terms (Text version)

1. **abscess**

- AB-ses (Original Term)
 - localized collection of pus
2. **abrasion**
- ă-BRĀ-zhŏn (Original Term)
 - scrape (by injury or mechanical process)
3. **acne**
- AK-nē
 - clogging of pores, which can lead to infection and inflammation
4. **adipocytes**
- AD-ĭ-pō-sīts
 - Fat cells
5. **adipose**
- AD-ĭ-pōs
 - Fat tissue
6. **albinism**
- AL-bĭ-nizm
 - genetic disorder that affects the coloring of skin, hair, and eyes.
7. **apocrine sweat gland**
- AP-ŏ-krĕn swet gland
 - A type of gland that is found in the skin, breast, eyelid, and ear
8. **autonomic**
- ot-ŏ-NOM-ik
 - unconsciously regulates
9. **bacteria, bacterium**
- bak-TĒR-ē, bak-TĒR-ē-ŭm (Original Term)
 - single-celled microorganisms that reproduce by cell division and may cause infection by invading body tissue
10. **basal cell carcinoma (BCC)**
- BĀ-sāl sel kar-sĭn-Ō-ma
 - form of cancer that affects the mitotically active stem cells in the stratum basale of the epidermis
11. **benign**

- bē-NĪN
 - Noncancerous, harmless
12. **cancer**
- KAN-sĕr
 - A process where abnormal cells in the body divide uncontrollably
13. **cauterize, cauterization**
- KAW-tĕr-ĭz (Original Term)
 - to burn tissues by various means with the intent destroy damaged tissues, prevent infections or coagulate blood vessels
14. **cellulitis**
- sel-yŭ-LĪT-ĭs (Original Term)
 - bacterial infection of the skin and subcutaneous tissue, characterized by redness, pain, heat and swelling
15. **contusion**
- kŏn-TOO-zhŏn (Original Term)
 - bruise
16. **cyanosis**
- sĭ-ă-NŌ-sĭs
 - Abnormal condition of blue (bluish colour, lips and nail beds). Typically caused by low oxygenation
17. **cyst**
- sist (Original Term)
 - closed sac containing fluid or semisolid material
18. **debride, debridement**
- di-BRĒD, di-BRĒD-mĕnt (Original Term)
 - remove damaged tissues and cell debris from a wound or burn to prevent infection and promote healing.
19. **dehydration**
- dĕ-hĭ-DRĀ-shŏn
 - Loss of fluids/water is greater than what is taken in.
20. **dendritic cells**
- den-DRIT-ik

- pertaining to dendrites
21. **dermabrasion**
- DĚRM-ă-brā-zhŏn (Original Term)
 - procedure to remove superficial scars using sandpaper or revolving wire brushes.
22. **diaphoresis**
- dī-ă-fŏ-RĚ-sīs (Original Term)
 - condition of profuse, excessive sweating
23. **eccrine sweat gland**
- ĚK-rĭn swet gland
 - type of gland that produces a hypotonic sweat for thermoregulation
24. **eczema**
- eg-ZĚ-mă (Original Term)
 - noninfectious, inflammatory disease presents as redness, blisters, scabs and itching
25. **edema**
- ě-DĚ-mă (Original Term)
 - puffy swollen tissue due to accumulation of fluid
26. **excise, excision**
- ěk-SĪZ, ek-SIZH-ŏn (Original Term)
 - surgical removal by cutting out
27. **fascia**
- FASH-ĕ-ă
 - Fibrous tissue
28. **frostbite**
- FROST-bĭt
 - Conservation of core body heat results in the skin actually freezing
29. **gangrene**
- GANG-grĕn (Original Term)
 - death of tissue due to blood supply loss
30. **incise, incision**
- in-SĪZ, in-SIZH-ŏn (Original Term)
 - surgical cut into or wound produced by a sharp instrument

31. **incision and drainage (I&D)**

- in-SIZH-ŏn & DRĀN-ǎj
- surgical cut made to allow the free flow of fluids from a lesion, wound, or cavity

32. **infection**

- in-FEK-shŏn (Original Term)
- invasion of pathogens to body tissue

33. **jaundice, jaundiced**

- JON-dīs, JON-dīsd (Original Term)
- yellow colouring of the mucous membranes and sclera

34. **keloid**

- (KĒ-loyd)
- Formation of a raised or hypertrophic scar

35. **keratin**

- (KER-ăt-in)
- intracellular fibrous protein that gives hair, nails, and skin their hardness and water-resistant properties

36. **keratinocyte**

- kĕ-RĀT-ī-nŏ-sīt
- Cell that manufactures and stores the protein keratin

37. **laceration**

- las-ĕ-RĀ-shŏn (Original Term)
- torn, ragged-edged wound

38. **laser surgery**

- LĀ-zĕr SŪRJ-ĕ-rĕ
- A surgical procedure using a powerful beam of light to cut or burn tissue.

39. **Lesion**

- lĒ-zhŏn (Original Term)
- visible change in tissue resulting from injury or disease

40. **leukoplakia**

- loo-kŏ-PLĀ-kĕ-ǎ
- white, thickened patches on mucus membrane tissue of the tongue or cheek

41. **macule**
 - MAK-ŭl (Original Term)
 - flat, coloured spot on the skin
42. **Meissner corpuscle**
 - MĪS-nĕr KOR-pŭs-ĕl
 - Tactile corpuscle that responds to light and touch, touch receptor
43. **melanoma**
 - mel-ă-NŌ-mă
 - cancer characterized by uncontrolled growth of melanocytes
44. **metastasize**
 - mĕ-TĂS-tă-sĭz
 - Production of cells that can mobilize and establish tumors in other organs of the body
45. **nevus**
 - NĒ-vŭs (Original Term)
 - a pigmented skin blemish
46. **nodule**
 - NOJ-ool (Original Term)
 - a small node-like structure
47. **Pacinian corpuscle**
 - pă-SIN-ĕ-ăn KOR-pŭs-ĕl
 - Lamellated corpuscle that responds to vibration
48. **pallor**
 - PĂL-or (Original Term)
 - paleness
49. **pathogens**
 - path-Ō-jĕns
 - Disease-causing agents
50. **phagocytes**
 - făg-ō-SĪTS
 - Cells that engulf and absorb bacteria and cell particles
51. **pruritus**

- proo-RĪT-ūs (Original Term)
 - itching
52. **psoriasis**
- sǒ-RĪ-ǎ-sīs
 - chronic autoimmune disorder that results in patches of thick red skin with the appearance of silvery scales
53. **pustule**
- PŪS-tūl (Original Term)
 - small elevation of the skin containing fluid
54. **reticulated**
- rě-TIK-yŭ-lāt-ěd
 - constructed, arranged, or marked like a net or network.
55. **rickets**
- RIK-ěts
 - A painful condition in children where bones are misshapen due to a lack of calcium, causing bow leggedness
56. **scar**
- skār
 - Collagen-rich skin formed after the process of wound healing that differs from normal skin. Also known as a cicatrix.
57. **sebaceous gland**
- sē-BĀ-shŭs gland
 - type of oil gland that is found all over the body and helps to lubricate and waterproof the skin and hair.
58. **squamous cell carcinoma (SCC)**
- SKWĀ-mŭs sel kar-sĭn-Ō-mǎ
 - cancer that affects the keratinocytes of the stratum spinosum and presents as lesions commonly found on the scalp, ears, and hands
59. **stratum basale**
- STRĀ-tŭm BĀS-al
 - Deepest layer of the epidermal
60. **suture**

- SOO-chŭr
- to stitch the edges of a wound

61. **sympathetic**

- sĭm-pă-THĚT-ĭk
- Flight or fight response

62. **Sympathetic Nervous System**

- sĭm-pă-THĚT-ĭk NĚR-vŭs SIS-tĕm
- Responsible for fight or flight responses

63. **tinea**

- TIN-ĕ-ă (Original Term)
- A group of fungal skin diseases, characterized by itching, scaling, and sometimes painful lesions.

64. **vascularized**

- VAS-kyŭ-lă-rĭzd
- Has numerous blood vessels

65. **verruca**

- vĕr-ROO-kă
- Also known as a wart. An epidermal growth caused by a virus.

66. **virus**

- VĪ-rŭs (Original Term)
- minute microorganism that may cause infection by invading body tissue

Activity Source: Integumentary Medical Terms from [Medical Terminology](#) by Grimm et al., licensed under [CC BY 4.0](#). /Re-recording of some H5P audio by Tania Deane and David McCuaig and text version added.

Common Integumentary System Abbreviations

Many terms and phrases related to the integumentary system are abbreviated. Learn these common abbreviations by expanding the list below.

Integumentary System Common Abbreviations

- **BCC** (basal cell carcinoma)
- **SCC** (squamous cell carcinoma)
- **SLE** (systemic lupus erythematosus)
- **staph** (staphylococcus)
- **strep** (streptococcus)
- **subcut** (subcutaneous)
- **ID** (intra-dermal)
- **TD** (transdermal)
- **derm** (dermatology)
- **bx** (biopsy)
- **MRSA** (methicillin-resistant *Staphylococcus aureus*)

Activity source: Integumentary System Common Abbreviations by Jesslyn Wilkinson, licensed under [CC BY 4.0](#). / Converted to text.

Image Description

Figure 3.6 image description: A cross section of the skin containing a hair follicle. The follicle is teardrop shaped. Its enlarged base, labeled the hair bulb, is embedded in the hypodermis. The outermost layer of the follicle is the epidermis, which invaginates from the skin surface to envelope the follicle. Within the epidermis is the outer root sheath, which is only present on the hair bulb. It does not extend up the shaft of the hair. Within the outer root sheath is the inner root sheath. The inner root sheath extends about half of the way up the hair shaft, ending midway through the dermis. The hair matrix is the innermost layer. The hair matrix surrounds the bottom of the hair shaft where it is embedded within the hair bulb. The hair shaft, in itself, contains three layers: the outermost cuticle, a middle layer called the cortex, and an innermost layer called the medulla. [\[Return to Figure 3.6\]](#).

Figure 3.7 image description: The anatomy of the fingernail region. The top image shows a dorsal view of a finger. The proximal nail fold is the part underneath where the skin of the finger connects with the edge of the nail. The eponychium is a thin, pink layer between the white proximal edge of the nail (the lunula), and the edge of the finger skin. The lunula appears as a crescent-shaped white area at the proximal edge of the pink-shaded nail. The

lateral nail folds are where the sides of the nail contact the finger skin. The distal edge of the nail is white and is called the free edge. An arrow indicates that the nail grows distally out from the proximal nail fold. The lower image shows a lateral view of the nail bed anatomy. In this view, one can see how the edge of the nail is located just proximal to the nail fold. This end of the nail, from which the nail grows, is called the nail root. [\[Return to Figure 3.7\]](#).

Figure 3.8 image description: An illustration of an eccrine sweat gland embedded in a cross section of skin tissue. The eccrine sweat gland is a bundle of white tubes embedded in the dermis. A single white tube travels up from the bundle and opens on to the surface of the epidermis. The opening is called a pore. There are several pores on the small block of skin portrayed in this diagram. [\[Return to Figure 3.8\]](#).

Attribution

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3.5 - Integumentary System Changes (Aging, Disease and Disorders, Skin)

Changes Due to Aging

All systems in the body accumulate subtle and some not-so-subtle changes as a person ages. Among these changes are reductions in cell division, metabolic activity, blood circulation, hormonal levels, and muscle strength (see [Figure 3.9](#)). In the skin, these changes are reflected in decreased mitosis in the stratum basale, leading to a thinner epidermis. The dermis, which is responsible for the elasticity and resilience of the skin, exhibits a reduced ability to regenerate, which leads to slower wound healing. The hypodermis, with its fat stores, loses structure due to the reduction and redistribution of fat, which in turn contributes to the thinning and sagging of skin.



Figure 3.9 Aging. Generally, skin, especially on the face and hands, starts to display the first noticeable signs of aging, as it loses its elasticity over time. The differences are shown in the image from a young woman in the right panel and an older woman in the left panel. (credit: “Granddaughter and Grandmother” by Janet Ramsden is licensed under [CC BY 2.0](#)). From Betts et al., 2013. [[Fig. 3.9 Image description.](#)]

Did You Know?

A reduced sweating ability can cause some elderly to be intolerant to extreme heat.

Disease and Disorders

The integumentary system is susceptible to a variety of diseases, disorders, and injuries. These range from annoying but relatively benign bacterial or fungal infections that are categorized as disorders, to skin cancer and severe burns, which can be fatal. In this section, you will learn several of the most common skin conditions.

One of the most talked about diseases is skin **cancer**. Most cancers are identified by the organ or tissue in which the cancer originates. One common form of cancer is skin cancer.

In general, cancers result from an accumulation of DNA mutations. These mutations can result in cell populations that do not die when they should and uncontrolled cell proliferation that leads to tumors. Although many tumors are **benign**, some **metastasize**. Cancers are characterized by their ability to metastasize.

Sun Damage

It requires about 10 days after initial sun exposure for melanin synthesis to peak, which is why pale-skinned individuals tend to suffer sunburns of the epidermis initially. Dark-skinned individuals can also get sunburns, but are more protected than pale-skinned individuals. Too much sun exposure can eventually lead to wrinkling due to the destruction of the cellular structure of the skin, and in severe cases, can cause sufficient DNA damage to result in skin cancer. When there is an irregular accumulation of melanocytes in the skin, freckles appear. Moles are larger masses of melanocytes, and although most are benign, they should be monitored for changes that might indicate the presence of cancer (see [Figure 3.10](#)).



Figure 3.10 Moles. Moles range from benign accumulations of melanocytes to melanomas. These structures populate the landscape of our skin. (credit: [Image](#) by the National Cancer Institute, [PDM](#)). From Betts et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 3.10 Image description.](#)]

Basal Cell Carcinoma (BCC)

Basal cell carcinoma is a form of cancer that affects the mitotically active stem cells in the stratum basale of the epidermis. It is the most common of all cancers that occur in the United States and is frequently found on the head, neck, arms, and back, which are as that are most susceptible to long-term sun exposure. Although UV rays are the main culprit, exposure to other agents, such as radiation and arsenic, can also lead to this type of cancer. Wounds on the skin due to open sores, tattoos, burns, etc. may be predisposing factors. Basal cell carcinomas start in the stratum basale and usually spread along this boundary. At some point, they begin to grow toward the surface and become an uneven patch, bump, growth, or scar on the skin surface (see [Figure 3.11](#)). Like most cancers, basal cell carcinomas respond



Figure 3.11 Basal Cell Carcinoma. Basal cell carcinoma can take several different forms. In this form it appears reddened, raised and shiny. Similar to other forms of skin cancer, it is readily cured if caught early and treated. [[Fig. 3.11 Image Description](#)](credit: [John Hendrix, MD, PDM](#)). From Betts et al., 2013. Licensed under [CC BY 4.0](#).

best to treatment when caught early. Treatment options include surgery, freezing (cryosurgery), and topical ointments.

Squamous Cell Carcinoma (SCC)

Squamous cell carcinoma is a cancer that affects the keratinocytes of the stratum spinosum and presents as lesions commonly found on the scalp, ears, and hands (see [Figure 3.12](#)). It is the second most common skin cancer. The American Cancer Society reports that two of 10 skin cancers are squamous cell carcinomas, and it is more aggressive than basal cell carcinoma. If not removed, these carcinomas can **metastasize**. Surgery and radiation are used to cure squamous cell carcinoma.



Figure 3.12 Squamous Cell Carcinoma Squamous cell carcinoma presents here as a lesion on a nose. (credit: [Image](#) by the National Cancer Institute, [PDM](#)). From Betts et al., 2013. Licensed under [CC BY 4.0](#).

Melanoma

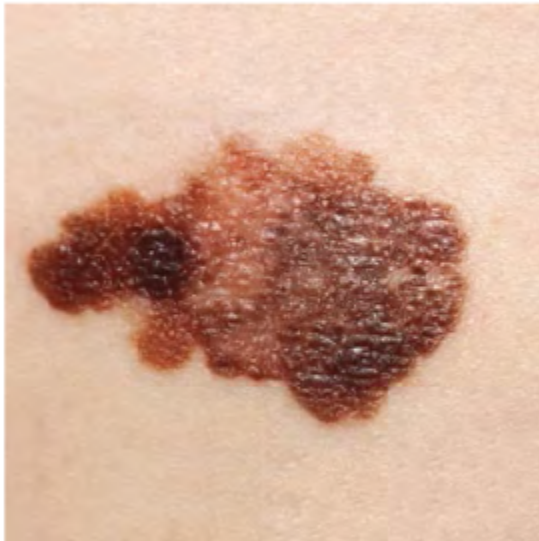


Figure 3.13 Melanoma. Melanomas typically present as large brown or black patches with uneven borders and a raised surface. (credit: [Image](#) by the National Cancer Institute, [PDM](#)). From Betts et al., 2013. Licensed under [CC BY 4.0](#).

A melanoma is a cancer characterized by the uncontrolled growth of melanocytes, the pigment-producing cells in the epidermis. Typically, a melanoma develops from a mole. It is the most fatal of all skin cancers, as it is highly metastatic and can be difficult to detect before it has spread to other organs. Melanomas usually appear as asymmetrical brown and black patches with uneven borders and a raised surface (see [Figure 3.13](#)). Treatment typically involves surgical excision and immunotherapy.

ABCDE for Early Diagnosis

Doctors often give their patients the following ABCDE mnemonic to help with the diagnosis of early-stage melanoma. If you observe a mole on your body displaying these signs, consult a doctor.

- **A**symmetry – the two sides are not symmetrical
- **B**orders – the edges are irregular in shape
- **C**olor – the color is varied shades of brown or black
- **D**iameter – it is larger than 6 mm (0.24 in)
- **E**volving – its shape has changed

Some specialists cite the following additional signs for the most serious form, nodular melanoma:

- **Elevated** – it is raised on the skin surface
- **Firm** – it feels hard to the touch
- **Growing** – it is getting larger

Albinism

Albinism is a genetic disorder that affects (completely or partially) the coloring of skin, hair, and eyes. This is primarily due to the inability of melanocytes to produce melanin. Individuals with albinism tend to appear white or very pale due to the lack of melanin in their skin and hair. Recall that melanin helps protect the skin from the harmful effects of UV radiation. Individuals with albinism tend to need more protection from UV radiation, as they are more prone to sunburns and skin cancer. They also tend to be more sensitive to light and have vision problems due to the lack of pigmentation on the retinal wall (Betts et al., 2013).

Treatment of this disorder usually involves addressing the symptoms, such as limiting UV light exposure to the skin and eyes. In **vitiligo**, the melanocytes in certain areas lose their ability to produce melanin, possibly due to an autoimmune reaction. This leads to a loss of color in patches (see [Figure 3.14](#)). Neither albinism nor vitiligo directly affects the lifespan of an individual (Betts et al., 2013).



Figure 3.14 Vitiligo. Individuals with vitiligo experience depigmentation that results in lighter colored patches of skin. The condition is especially noticeable on darker skin. (credit: [Image by Klaus D. Peter, CC BY 3.0 Germany](#)).

Changes in Skin Colouration

Other changes in the appearance of skin colouration can be indicative of diseases associated with other body systems.

- Liver disease or liver cancer can cause the accumulation of bile and the yellow pigment bilirubin, leading to the skin appearing **yellow** or **jaundiced**.
- Tumors of the pituitary gland can result in the secretion of large amounts of melanocyte-stimulating hormone (MSH), which results in a **darkening** of the skin.
- Addison's disease can stimulate the release of excess amounts of adrenocorticotropic hormone (ACTH), which can give the skin a **deep bronze** color.
- A sudden drop in oxygenation can affect skin color, causing the skin to initially turn **ashen** (white).
- A prolonged reduction in oxygen levels, dark red deoxyhemoglobin becomes dominant in the blood, making the skin appear **blue**, a condition referred to as **cyanosis**. This happens when the oxygen supply is restricted, as when someone is experiencing difficulty in breathing because of asthma or a heart attack. However, in these cases the effect on skin color has nothing to do with the skin's pigmentation (Betts et al., 2013).

Skin Disorders

Two common skin disorders are **eczema** and **acne**. Eczema is an inflammatory condition that occurs in individuals of all ages. Acne involves the clogging of pores, which can lead to infection and inflammation, and is often seen in adolescents. Other disorders, include seborrheic dermatitis (on the scalp), psoriasis, fungal infections, cold sores, impetigo, scabies, hives, and warts (Betts et al., 2013).

Eczema

Eczema is an allergic reaction that manifests as dry, itchy patches of skin that resemble rashes (see [Figure 3.15](#)). It may be accompanied by swelling of the skin, flaking, and in severe cases, bleeding. Symptoms are usually managed with moisturizers, corticosteroid creams, and immunosuppressants (Betts et al., 2013).



Figure 3.15 Eczema. Eczema is a common skin disorder that presents as a red, flaky rash. (credit: "Jambula"/Wikimedia Commons). From Betts et al., 2013. Licensed under [CC BY 4.0](#).

Acne

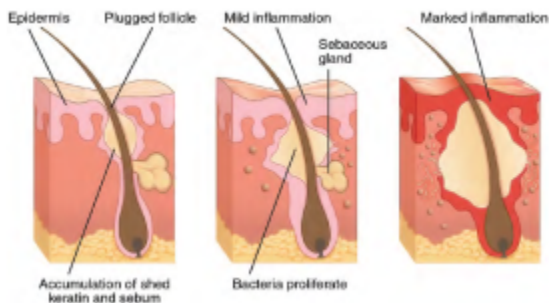


Figure 3.16. Acne. Acne is a result of over-productive sebaceous glands, which leads to formation of blackheads and inflammation of the skin. From Betts et al., 2013. Licensed under [CC BY 4.0](#).

Acne is a skin disturbance that typically occurs on areas of the skin that are rich in sebaceous glands (face and back). It is most common along with the onset of puberty due to associated hormonal changes, but can also occur in infants and continue into adulthood. Hormones, such as androgens, stimulate the release of sebum. An overproduction and accumulation of sebum along with keratin can block hair follicles. This plug is initially white. The sebum, when oxidized by exposure to air, turns black. Acne results from infection by acne-causing bacteria (*Propionibacterium* and *Staphylococcus*), which can lead to redness and potential scarring due to the natural wound healing process (see [Figure 3.16](#)) (Betts et al., 2013).

Ringworm

Tinea or dermatophytosis is often referred to as ringworm. Ringworm presents as a circular rash that is itchy and red and can be found on various parts of the body. It is referred to by the location where it is found:

- **Tinea pedis:** feet or commonly referred to as athlete's feet
- **Tinea capitis:** scalp
- **Tinea barbae** – beard
- **Tinea manuum** – hands
- **Tinea unguium** – Toenails and fingernails also called onychomycosis
- **Tinea corporis** – Body parts such as arms and legs (Center for Disease Control and Prevention, 2018a).

To learn more about ringworm, visit the [Center for Disease Control and Prevention's web page on fungal infections \[New Tab\]](#).

Psoriasis

Psoriasis is a chronic autoimmune disorder that results in patches of thick red skin with the appearance of silvery scales. These patches can be found on elbows, knees, scalp, lower back, face, feet, fingernails, toenails and even the mouth. Psoriasis can be confused with other skin diseases, so a dermatologist is the best physician to diagnose psoriasis. Treatments may include creams, ointments, ultraviolet light therapy and medication (Center for Disease Control and Prevention, 2018). To learn more, visit the [Canadian Association of Psoriasis Patients' page on psoriasis and inflammation \[New Tab\]](#).

Injuries

Because the skin is the part of our bodies that meets the world most directly, it is especially vulnerable to injury. Injuries include **burns, wounds**, as well as **scars** and **calluses**. They can be caused by sharp objects, heat, excessive pressure or friction to the skin (Betts et al., 2013).

Skin injuries set off a healing process that occurs in several overlapping stages.

- The first step to repairing damaged skin is the **formation of a blood clot** that helps stop the flow of blood and scabs over time. Many different types of cells are involved in wound repair, especially if the surface area that needs repair is extensive.
- Before the basal stem cells of the stratum basale can **recreate the epidermis**, fibroblasts mobilize and divide rapidly to **repair the damaged tissue** by collagen deposition, forming granulation tissue.
- Blood capillaries follow the fibroblasts and help **increase blood circulation and oxygen** supply to the area.
- Immune cells, such as macrophages, roam the area and **engulf any foreign matter** to reduce the chance of infection (Betts et al., 2013).

Burns

A burn results when the skin is damaged by intense heat, radiation, electricity, or chemicals. The damage results in the death of skin cells, which can lead to a massive loss of fluid. Dehydration, electrolyte imbalance, and renal and circulatory failure follow, which can be fatal. Burn patients are treated with intravenous fluids to offset **dehydration**, as well as **intravenous** nutrients that enable the body to repair tissues and replace lost proteins. Another serious threat to the lives of burn patients is **infection**. Burned skin is extremely susceptible to bacteria and other **pathogens**, due to the loss of protection by intact layers of skin (Betts et al., 2013).

Burn Classification

Burns are sometimes measured in terms of the size of the total surface area affected. This is referred to as the *rule of nines*, which associates specific anatomical areas with a percentage that is a factor of nine (see [Figure 3.17](#)) (Betts et al., 2013).

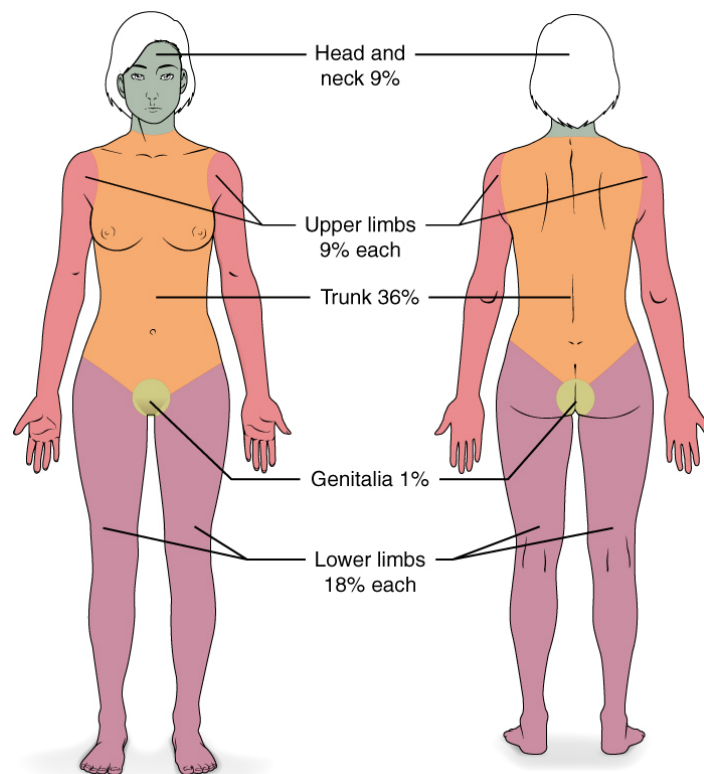


Figure 3.17 Calculating the Size of a Burn. The size of a burn will guide decisions made about the need for specialized treatment. Specific parts of the body are associated with a percentage of body area. From Betts et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 3.17 Image description.](#)]

Burns are also classified by the **degree of their severity**.

- A **first-degree** burn is a superficial burn that affects only the epidermis. Although the skin may be painful and swollen, these burns typically heal on their own within a few days. Mild sunburn fits into the category of a first-degree burn.
- A **second-degree** burn goes deeper and affects both the epidermis and a portion of the dermis. These burns result in swelling and painful blistering of the skin. It is important to keep the burn site clean and sterile to prevent infection. If this is done, the burn will heal within several weeks.
- A **third-degree** burn fully extends into the epidermis and dermis, destroying the tissue and affecting the nerve endings and sensory function. These are serious burns that may appear white, red, or black; they require medical attention and will heal slowly without it.
- A **fourth-degree** burn is even more severe, affecting the underlying muscle and bone.

Oddly, third and fourth-degree burns are usually not as painful because the nerve endings themselves are damaged. Full-thickness burns cannot be repaired by the body, because the local tissues used for repair are damaged and require **debridement**, or amputation in severe cases, followed by grafting of the skin from an unaffected part of the body, or from skin grown in tissue culture for grafting purposes. Skin grafts are required when the damage from trauma or infection cannot be closed with sutures or staples (Betts et al., 2013).

Scars and Keloids

Most cuts or wounds, with the exception of ones that only scratch the epidermis, lead to **scar** formation. Scarring occurs in cases in which there is repair of skin damage, but the skin fails to regenerate the original skin structure. Fibroblasts generate scar tissue in the form of collagen, and the bulk of repair is due to the basket-weave pattern generated by collagen fibers and does not result in regeneration of the typical cellular structure of skin. Instead, the tissue is fibrous in nature and does not allow for the regeneration of accessory structures, such as hair follicles, sweat glands, or sebaceous glands (Betts et al., 2013).

Sometimes, there is an overproduction of scar tissue, because the process of collagen formation does not stop when the wound is healed; this results in a **keloid**. In contrast, scars that result from acne and chickenpox have a sunken appearance and are called atrophic scars (Betts et al., 2013)

Scarring of skin after wound healing is a natural process and does not need to be treated further. The application of mineral oil and lotions may reduce the formation of scar tissue. However, modern cosmetic procedures, such as dermabrasion, laser treatments, and filler injections have been invented as remedies for severe scarring. All of these procedures try to reorganize the structure of the epidermis and underlying collagen tissue to make it look more natural (Betts et al., 2013).

Bedsore and Stretch Marks

Skin and its underlying tissue can be affected by excessive pressure. One example of this is called a bedsore. Bedsore, also called decubitus ulcers, are caused by constant, long-term, unrelieved pressure on certain body parts that are bony, reducing blood flow to the area and leading to **necrosis**. Bedsore are most common in elderly patients who have debilitating conditions that cause them to be immobile. Most hospitals and long-term

care facilities have the practice of turning the patients every few hours to prevent the incidence of bedsores. If left untreated bedsores can be fatal if they become infected (Betts et al., 2013)

The skin can also be affected by pressure associated with rapid growth. A stretch mark results when the dermis is stretched beyond its limits of elasticity, as the skin stretches to accommodate the excess pressure. Stretch marks usually accompany rapid weight gain during puberty and pregnancy. They initially have a reddish hue, but lighten over time. Other than for cosmetic reasons, treatment of stretch marks is not required. They occur most commonly over the hips and abdomen (Betts et al., 2013).

Calluses

When you wear shoes that do not fit well and are a constant source of abrasion on your toes, you tend to form a callus at the point of contact. This occurs because the basal stem cells in the stratum basale are triggered to divide more often to increase the thickness of the skin at the point of abrasion to protect the rest of the body from further damage. This is an example of a minor or local injury, and the skin manages to react and treat the problem independent of the rest of the body. Calluses can also form on your fingers if they are subject to constant mechanical stress, such as long periods of writing, playing string instruments, or video games. A corn is a specialized form of callus. Corns form from abrasions on the skin that result from an elliptical-type motion (Betts et al., 2013).

Integumentary System Medical Terms In Use

Medical Terms in Context: Consultation Report

Consultation Report (Text Version)

INTEGUMENTARY SYSTEM – CONSULTATION REPORT

Fill in the consultation report with using the following words:

- Excisional
- Lesion
- Asymmetrical
- Mole
- Benign
- Biopsy
- Irregular

PATIENT NAME: Rosemary COOMBS

AGE: 54

Sex: Female

DOB: December 2

DATE OF CONSULTATION: May 29

REQUESTING PHYSICIAN: Trevor Sharpe, MD, Family Medicine

CONSULTING PHYSICIAN: Donna Brown, MD, Dermatology

HISTORY: This 54-year-old white female, went to her family doctor a year ago when she noticed a dark brown spot on her neck. The spot was a six cm, dark brown, flat _____[Blank 1] with smooth borders that appeared _____[Blank 2]. Ms. Coombs recently went to Dr. Sharpe for a physical and the _____[Blank 3] was examined, it was suggested that Ms. Coombs see me.

PAST HISTORY: No known history of any skin disorders.

PHYSICAL EXAMINATION: Normal except for the lesion on her chest which has grown to 1.3 cm in diameter and _____[Blank 4] in shape. It is mainly dark brown, with regions of darker black. The borders are _____[Blank 5] in outline. There is some blackened areas that are slightly elevated.

PLAN: I have booked a follow up appointment for next week to do an _____[Blank 6] biopsy. I will then send the specimen for a _____[Blank 7]. Another follow up appointment will be made once I receive the results of the biopsy.

Donna Brown, MD, Dermatology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers:¹

Activity source: Integumentary system – consultation report by Heather Scudder, licensed under [CC BY 4.0](#). /Text version added.

Medical Terminology in Text

Medical Terminology (Text version)

Fill in the spaces below with the following terms:

- Xero
- o
- hidr
- rhytid
- ous
- genic

- logist
- o
- ectomy
- derma
- cutane
- itis
- ous
- o
- al
- necr

- o
- o
- plasty
- sis
- phagia
- tone
- trans
- sub
- cutane
- dermat

- derma
- kerat
- aden
- auto
- derm
- per
- onych
- dermat

_____[Blank 1a] / _____ [Blank 2a] / _____ [Blank 3a] / _____ [Blank 4a] refers to the surgical repair of one's own skin.

Something that generates the production of epidermal tissues might be called _____ [Blank 2a] / _____ [Blank 2b] / _____ [Blank 2b].

_____[Blank 3a] / _____ [Blank 3b] / _____ [Blank 3c] refers to something in state of death.

_____[Blank 4a] / _____ [Blank 4b] / _____ [Blank 4c] is a technical name for finger-biting.

_____[Blank 5a] / _____ [Blank 5b] / _____ [Blank 5c] means pertaining to through the skin.

_____[Blank 6a] / _____ [Blank 6b] / _____ [Blank 6c] injection is given under the skin.

During the winter months many people complain of _____ [Blank 7a] / _____ [Blank 7b] and use extra lotion.

A patch filled with medication, applied to the skin so that medication goes through the skin is referred to as a _____ [Blank 8a] / _____ [Blank 8b] / _____ [Blank 8c] patch.

An instrument use to cut the skin for biopsy is referred to as a _____ [Blank 9a] / _____ [Blank 9b].

A specialist who studies and treats disorders and diseases of the skin is referred to as a _____ [Blank 10a] / _____ [Blank 10b] / _____ [Blank 10b].

The medical term that means a sweat gland is inflamed is _____ [Blank 11a] / _____ [Blank 11b] / _____ [Blank 11c].

The medical term to excise wrinkles or commonly referred to as a facelift is _____ [Blank 12a] / _____ [Blank 12b].

Check your answers: ²

Activity source: Integumentary Medical Terms by Jesslyn Wilkinson, licensed under [CC BY 4.0](#). / Text version added.

Medical Specialties and Procedures Related to the Integumentary System

A dermatologist is a medical doctor with specialized training in treating diseases, disorders and injuries related to the integumentary system and its accessory structures. There are many **dermatologic** subspecialties such as cosmetic dermatology, **dermatopathology**, and pediatric dermatology. To learn more visit the [Dermatology and Subspecialties section \[New Tab\]](#) of the Canadian Dermatology Association website.

Dermatologists can be specially trained to perform a procedure called Mohs surgery. Mohs surgery **excises** skin cancers in thin layers until all cancer is removed from the tissue (Mayo Clinic Staff, 2017).

Image Descriptions

Figure 3.9 image description: This figure consists of two photos. One photo shows a young woman on the phone. Her skin is smooth and unwrinkled. The other photo shows an elderly woman in the same posture while on the phone. The skin of her hands and forearms is wrinkled. [\[Return to Figure 3.9\].](#)

Figure 3.10 image description: Five photos of moles. The three upper photos show moles that are small, flat, and dark brown. The bottom left photo shows a dark black mole that is raised above the skin. The bottom right photo shows a large, raised, reddish mole with protruding hairs. [\[Return to Figure 3.10\].](#)

Figure 3.11 image description: The image shows a section of skin tissue with a raised reddened growth in a circular shape with irregular margins. The raised area is shiny. In this appearance the growth appears to be a basal cell carcinoma. [\[Return to Figure 3.11\]](#)

Figure 3.17 image description: This diagram depicts the percentage of the total body area burned when a victim suffers complete burns to regions of the body. Complete burning of the face, head and neck account for 19% of the total body area. Burning of the chest, abdomen and entire back above the waist accounts for 36% of the total body area. Anterior and posterior surfaces of the arms and hands account for 18% of the total body area (9% for each arm). The anterior and posterior surface of both legs, along with the buttocks, accounts for 36% of the total body area (18% for each leg). Finally, the anterior and posterior surfaces of the genitalia account for 1% of the total body area. [\[Return to Figure 3.17\].](#)

Attribution

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Notes

1. Mole, 2. Benign, 3. Lesion, 4. Asymmetrical, 5. Irregular, 6. Excisional, 7. Biopsy
2. 1. Dermat /o /auto /plasty. 2. Kerat /o /genic. 3. Nocr /o /sis. 4. Onych /o /phagia. 5. Per /cutane /ous. 6. Sub /cutane /ous. 7. Xero /derma. 8. Trans /derm /al. 9. Derma /tone. 10. Dermat /o /logist. 11. Hidr /aden /itis. 12. Rhytid /ectomy.

Vocabulary & Check Your Knowledge

Integumentary System Vocabulary

Adipocytes

Fat cells.

Adipose tissue

Fat tissue.

Autonomic nerve fibers

Unconsciously regulates communication to and from the brain.

Avascular

Without blood vessels.

Benign

Noncancerous, harmless.

Cancer

A process where abnormal cells in the body divide uncontrollably.

Cyanosis

Abnormal condition of blue (bluish colour, lips and nail beds). Typically caused by low oxygenation.

Debridement

Excision of damaged tissue or foreign object.

Dehydration

Loss of fluids/water is greater than what is taken in.

Dermatologic

Pertaining to dermatology.

Dermatopathology

Study of diseases of the skin.

Dermis

The layer of skin that is made of dense, irregular connective tissue that houses blood vessels, hair follicles, sweat glands, and other structures.

Epidermis

Outer layer of skin, made of closely packed epithelial cells.

Excises

Remove by cutting out.

Exocytosis

Active transport of molecules out of the cell.

Fascia

Fibrous tissue.

Frostbite

Conservation of core body heat results in the skin actually freezing.

Hypodermis

Literally means below the dermis. The layer of skin below the dermis that is composed mainly of loose connective and fatty tissues.

Infection

Invasion by disease-causing organisms.

Intravenous

Pertaining to within the vein.

Jaundiced

Yellow-coloured.

Keloid

Formation of a raised or hypertrophic scar.

Keratinocytes

Cells that manufacture and store the protein keratin.

Meissner corpuscle

Tactile corpuscle that responds to light and touch, touch receptor.

Meissner corpuscles

Tactile corpuscle that responds to light and touch, touch receptors.

Melanocytes

Specialized cells that produce melanin which is a dark pigment responsible for the colouration of skin and hair.

Metastasize

Production of cells that can mobilize and establish tumors in other organs of the body.

Necrosis

Tissue death.

Osteomalacia

Softening of the bones.

Pacinian corpuscle

Lamellated corpuscle that responds to vibration.

Pathogens

Disease-causing agents.

Phagocytes

Cells that engulf and absorb bacteria and cell particles.

Reticulated

Net like.

Rickets

A painful condition in children where bones are misshapen due to a lack of calcium, causing bow leggedness.

Scar

Collagen-rich skin formed after the process of wound healing that differs from normal skin.

Stratum Basale

Deepest layer of the epidermal.

Sympathetic nerve fibers

Flight or fight response determines communication to and from the brain.

Sympathetic Nervous System

Responsible for fight or flight responses.

Vascularized

Has numerous blood vessels.

Test Yourself

Integumentary System Glossary Reinforcement Activity (Text version)

1. Cells that manufacture and store the protein keratin are called _____[Blank 1].
 - a. Scar
 - b. Vascularized
 - c. Keratinocytes
2. The outer layer of skin, made of closely packed epithelial cells are called_____ [Blank 2].
 - a. Fascia
 - b. Adipocytes
 - c. Epidermis
3. Specialized cells that produce melanin which is a dark pigment responsible for the colouration of skin and hair are called_____ [Blank 3].
 - a. Necrosis
 - b. Melanocytes
 - c. Keloid
4. Deepest layer of the epidermal is the _____[Blank 4].
 - a. Dermis
 - b. Fascia
 - c. Stratum Basale
5. Production of cells that can mobilize and establish tumors in other organs of the body are called _____[Blank 5].
 - a. Pathogens
 - b. Debridement
 - c. Metastasize

Check your answers: ¹

Activity source: Integumentary System Glossary Reinforcement Activity by Gisele Tuzon and Kimberlee Carter, licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). /Text version added.

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Notes

1. 1. Keratinocytes, 2. Epidermis, 3. Melanocytes, 4. Stratum Basale, 5. Metastasize

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CHAPTER 4: RESPIRATORY SYSTEM

Building a Medical Terminology Foundation 2e by Kimberlee Carter; Marie Rutherford; and Connie Stevens

- [4.1 – Introduction to the Respiratory System](#)
- [4.2 – Anatomy \(Structures\) of the Respiratory System](#)
- [4.3 – Physiology \(Function\) of the Respiratory System](#)
- [4.4 – Respiratory Diseases and Disorders](#)
- [Vocabulary & Check Your Knowledge](#)
- [References](#)

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Please visit the web version of [Building a Medical Terminology Foundation 2e](#) to access the complete book, interactive activities and ancillary resources.

4.1 - Introduction to the Respiratory System

Learning Objectives

- Identify the anatomy and describe the main functions of the respiratory system
- Analyze, translate, and define medical terms and common abbreviations of the respiratory system
- Practice the spelling and pronunciation of respiratory system terminology
- Identify the medical specialties associated with the respiratory system and explore common diseases, disorders, diagnostic testing and procedures related to the respiratory system

Respiratory System Word Parts

Click on prefixes, combining forms, and suffixes to reveal a list of word parts to memorize for the respiratory system

Respiratory System Medical Terms (Text Version)

Prefix

- **a-** (absence of, without)
- **an-** (absence of, without)
- **dys-** (difficult, painful, abnormal, laboured)
- **endo-** (Gr. within, in)
- **eu-** (normal, good)
- **hyper-** (above, excessive)
- **hypo-** (below, deficient, under)
- **intra-** (L. within, in)
- **poly-** (many, much)

- **tachy-** (fast, rapid)

Combining Form

- **adenoid/o** (adenoids)
- **alveol/o** (alveolus)
- **atel/o** (imperfect, incomplete)
- **bronch/o** (bronchus)
- **bronchi/o** (bronchus)
- **capn/o** (carbon dioxide)
- **diaphragmat/o** (diaphragm)
- **epiglott/o** (epiglottis)
- **hem/o** (blood)
- **hemat/o** (blood)
- **laryng/o** (larynx)
- **lob/o** (lobe)
- **muc/o** (mucus)
- **nas/o** (nose)
- **orth/o** (straight)
- **ox/i** (oxygen)
- **pharyng/o** (pharynx)
- **phon/o** (sound, voice)
- **phren/o** (diaphragm)
- **pleur/o** (pleura)
- **pneum/o** (lung, air)
- **pneumon/o** (lung, air)
- **pneumat/o** (lung)
- **pulmon/o** (lung)
- **py/o** (pus)
- **radi/o** (x-rays, ionizing radiation)
- **respir/o** (breath, breathing)
- **rhin/o** (nose)
- **sept/o** (septum)
- **sinus/o** (sinus)
- **somn/o** (sleep)
- **son/o** (sound)
- **spir/o** (breathe, breathing)
- **thorac/o** (thorax, chest cavity, thoracic cavity)
- **tom/o** (to cut, section, slice)
- **tonsill/o** (tonsil)
- **trache/o** (trachea)

Suffix

- **-algia** (pain)
- **-ar** (pertaining to)
- **-ary** (pertaining to)
- **-cele** (hernia, protrusion)
- **-centesis** (surgical puncture to aspirate fluid)
- **-eal** (pertaining to)
- **-ectasis** (stretching out, dilation, expansion)
- **-emia** (in the blood)
- **-gram** (the record, radiographic image)
- **-graph** (instrument used to record)
- **-graphy** (process of recording, radiographic imaging)
- **-meter** (instrument used to measure)
- **-metry** (measurement)
- **-pexy** (surgical fixation, suspension)
- **-pnea** (breathing)
- **-rrhagia** (rapid flow of blood, excessive bleeding)
- **-scope** (instrument used for visual examination)
- **-scopic** (pertaining to visual examination)
- **-scopy** (process of visually examining, visual examination)
- **-spasm** (sudden involuntary muscle contraction, spasmodic contraction)
- **-stenosis** (constriction, narrowing)
- **-stomy** (creation of an artificial opening)
- **-thorax** (chest, chest cavity, thoracic cavity)
- **-tomy** (cut into, incision)
- **-itis** (inflammation)
- **-ectomy** (excision, cut out)
- **-tome** (instrument used to cut)
- **-genic** (producing, originating, causing)
- **-ic** (pertaining to)
- **-ia** (condition, diseased state, abnormal state)
- **-plasty** (surgical repair)
- **-oid** (resembling)
- **-logy** (study of)
- **-logist** (specialist or physician who studies and treats)

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Introduction to the Respiratory System

How long you can hold your breath as you continue reading? How long can you do it? Chances are you are feeling

uncomfortable already. A typical human cannot survive without breathing for more than three minutes, and even if you wanted to hold your breath longer, your **autonomic** nervous system would take control. Although oxygen is critical for cells, it is the accumulation of carbon dioxide that primarily drives your need to breathe.

Did You Know?

If you hold your breath for longer than 3 minutes, your autonomic nervous system will take control.

The major structures of the respiratory system function primarily provide oxygen to body tissues for cellular respiration, remove the waste product carbon dioxide, and help to maintain acid-base balance. Portions of the respiratory system are also used for non-vital functions, such as sensing odors, speech production, and for straining, such as coughing.

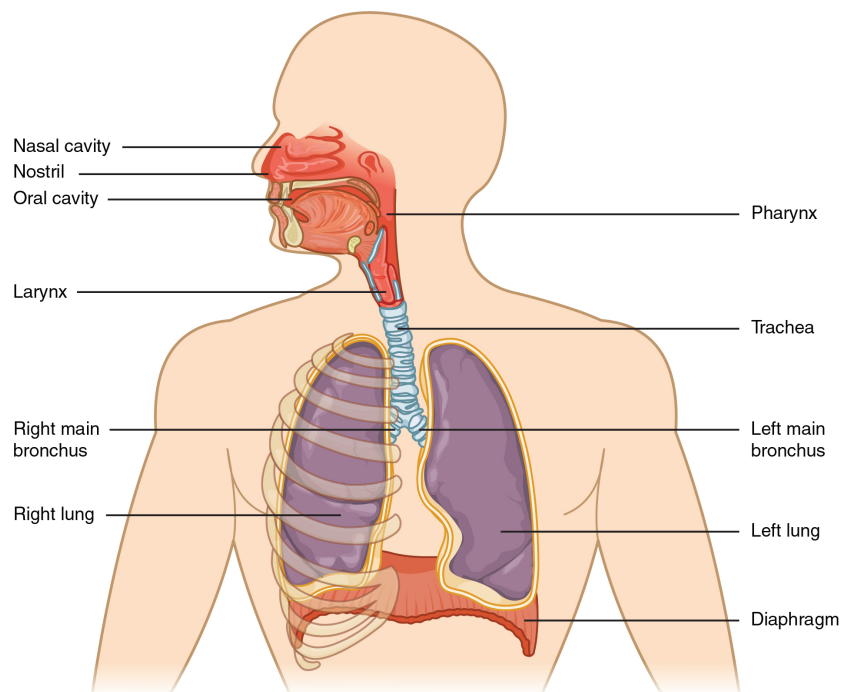


Figure 4.1 Major Respiratory Structures. The major respiratory structures span the nasal cavity to the diaphragm. From Betts, et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 4.1 Image description.](#)]

Watch [Respiratory system, Part 1: Crash Course Anatomy & Physiology #31 \(10 min on YouTube\)](#)

Respiratory System Medical Terms

Respiratory System Medical Terms (Text version)

1. **Adenoiditis**

- adenoid/itis
- inflammation of the adenoids

2. **adenoidectomy**

- adenoid/ectomy
- excision of the adenoids

3. **adenotome**

- aden/o/tome
- instrument used to cut the adenoids

4. **alveolitis**

- alveol/itis
- inflammation of the alveoli

5. **alveolar**

- alveol/ar
- pertaining to the alveolus

6. **atelectasis**

- atel/ectasis
- incomplete expansion

7. **bronchitis**

- bronch/itis
- inflammation of the bronchus

8. **bronchogenic carcinoma**

- bronch/o/genic carcin/oma
 - cancerous tumour originating in a bronchus (lung cancer)
9. **bronchopneumonia**
- bronch/o/pneumon/ia
 - diseased state of bronchi and lungs
10. **bronchoplasty**
- bronch/o/plasty
 - surgical repair of the bronchi
11. **bronchoscope**
- bronch/o/scope
 - instrument used for visual examination of the bronchi
12. **bronchoscopy**
- bronch/o/scopy
 - visual examination of the bronchi
13. **bronchoalveolar**
- bronch/o/alveol/ar
 - pertaining to the bronchi and alveoli
14. **bronchospasm**
- bronch/o/spasm
 - spasmodic contraction of the bronchi
15. **bronchiectasis**
- bronchi/ectasis
 - dilation of the bronchi
16. **capnometer**
- capn/o/meter
 - instrument used to measure carbon dioxide
17. **acapnia**
- a/capn/ia
 - condition of absence (less than normal level) of carbon dioxide (in the blood)
18. **hypercapnia**

- hyper/capn/ia
 - condition of excessive (greater than normal levels) carbon dioxide (in the blood)
19. **hypocapnia**
- hypo/capn/ia
 - condition of deficient (low levels) of carbon dioxide (in the blood)
20. **diaphragmatocele**
- diaphragmat/o/cele
 - hernia of the diaphragm
21. **diaphragmatic**
- diaphragmat/ic
 - pertaining to the diaphragm
22. **epiglottitis**
- epiglott/itis
 - inflammation of the epiglottis
23. **hemothorax**
- hem/o/thorax
 - blood in the thoracic cavity
24. **hematology**
- hemat/o/logy
 - study of blood
25. **hematologist**
- hemat/o/logist
 - specialist in blood and blood disorders
26. **laryngotracheobronchitis (LTB)**
- laryng/o/trache/o/bronch/itis
 - inflammation of the larynx, trachea, and bronchi
27. **laryngoplasty**
- laryng/o/plasty
 - surgical repair of the larynx
28. **laryngostomy**
- laryng/o/stomy

- creation of an artificial opening into the larynx
29. **laryngotracheotomy**
- laryng/o/trache/o/tomy
 - incision into the larynx and trachea
30. **laryngoscope**
- laryng/o/scope
 - instrument used for visual examination of the larynx
31. **laryngoscopy**
- laryng/o/scopy
 - process of viewing the larynx
32. **laryngeal**
- laryng/eal
 - pertaining to the larynx
33. **laryngospasm**
- laryng/o/spasm
 - spasmodic contraction of the larynx
34. **laryngitis**
- laryng/itis
 - inflammation of the larynx
35. **lobar pneumonia**
- lob/ar pneumon/ia
 - disease state of the lung pertaining to the lobe(s)
36. **lobectomy**
- lob/ectomy
 - excision of the lobe(s)
37. **muroid**
- muc/oid
 - resembling mucus
38. **mucous**
- muc/ous
 - pertaining to mucus

39. **nasopharyngitis**
- nas/o/pharyng/itis
 - inflammation of the nose and pharynx
40. **nasopharyngeal**
- nas/o/pharyng/eal
 - pertaining to the nose and pharynx
41. **orthopnea**
- orth/o/pnea
 - breathing is easier in a straight position
42. **anoxia**
- an/ox/ia
 - condition of absence (deficiency) of oxygen
43. **oximeter**
- oxi/meter
 - instrument used to measure oxygen
44. **hypoxemia**
- hyp/ox/emia
 - condition of deficient oxygen in the blood
45. **hypoxia**
- hyp/ox/ia
 - condition of deficient oxygen
46. **pharyngitis**
- pharyng/itis
 - inflammation of the pharynx
47. **aphonia**
- a/phon/ia
 - condition of absence of voice
48. **dysphonia**
- dys/phon/ia
 - condition of difficult speaking (voice)
49. **phrenalgia**

- phren/algia
 - pain in the diaphragm
50. **phrenospasm**
- phren/o/spasm
 - spasm of the diaphragm
51. **pleuritic**
- pleurit/ic
 - pertaining to the pleura
52. **pleuritis**
- pleur/itis
 - inflammation of the pleura
53. **pleuropexy**
- pleur/o/pexy
 - surgical fixation of the pleura
54. **interpleural**
- inter/pleur/al
 - pertaining to between the pleura (space between the pleural membranes)
55. **pneumoconiosis**
- pneum/o/coni/osis
 - abnormal condition of dust in the lungs
56. **pneumonia**
- pneumon/ia
 - diseased state of lung
57. **pneumonitis**
- pneumon/itis
 - inflammation of the lung
58. **pneumothorax**
- pneum/o/thorax
 - air in the thoracic cavity
59. **pneumonectomy**
- pneumon/ectomy

- excision of the lung
- 60. **pneumatocele**
 - pneumat/o/cele
 - hernia of the lung
- 61. **pulmonary**
 - pulmon/ary
 - pertaining to the lung(s)
- 62. **pyothorax**
 - py/o/thorax
 - pus in the thoracic cavity
- 63. **radiography**
 - radi/o/graphy
 - process of recording x-rays
- 64. **radiologist**
 - radi/o/logist
 - physician who specializes in the diagnosis and treatment of disease using medical imaging
- 65. **radiology**
 - radi/o/logy
 - study of the use of radiant energy in diagnosing disease
- 66. **respirologist**
 - respir/o/logist
 - specialist who studies and treats disease and disorders related to breathing
- 67. **respirology**
 - respir/o/logy
 - the study of breathing disorders and disease
- 68. **rhinitis**
 - rhin/itis
 - inflammation of the nose
- 69. **rhinomycosis**
 - rhin/o/myc/osis
 - abnormal condition of fungus in the nose

70. **rhinorrhagia**
- rhin/o/rrhagia
 - rapid flow of blood from the nose
71. **rhinoplasty**
- rhin/o/plasty
 - surgical repair of the nose
72. **rhinorrhea**
- rhin/o/rrhea
 - discharge from the nose
73. **septoplasty**
- sept/o/plasty
 - surgical repair of the septum
74. **septotomy**
- sept/o/tomy
 - incision into the (nasal) septum
75. **sinusitis**
- sinus/itis
 - inflammation of a sinus
76. **polysomnography (PSG)**
- poly/somn/o/graphy
 - process of recording many (test) during sleep
77. **sonogram**
- son/o/gram
 - the record of sound
78. **sonography**
- son/o/graphy
 - process of recording sound
79. **spirometer**
- spir/o/meter
 - instrument used to measure breathing (lung volume)
80. **spirometry**

- spir/o/metry
 - measuring breathing (air flow)
81. **thoracalgia**
- thorac/algia
 - pain in the chest, thorax
82. **thoracocentesis**
- thorac/o/centesis
 - surgical puncture to aspirate fluid (from the thoracic cavity)
83. **thoracentesis**
- thora/centesis
 - surgical puncture to aspirate fluid from thoracic cavity
84. **thoracotomy**
- thorac/o/tomy
 - incision into the thoracic cavity
85. **thoracoscopy**
- thorac/o/scopy
 - visual examination of the thoracic cavity
86. **thoracic**
- thorac/ic
 - pertaining to the chest, thorax
87. **thoracoscope**
- thorac/o/scope
 - instrument used to visualize the thoracic cavity
88. **tomography**
- tom/o/graphy
 - process of recording slices
89. **tonsillitis**
- tonsill/itis
 - inflammation of the tonsils
90. **tonsillectomy**
- tonsill/ectomy

- excision of the tonsils
91. **tracheitis**
- trache/itis
 - inflammation of the trachea
92. **tracheoplasty**
- trache/o/plasty
 - surgical repair of the trachea
93. **tracheostomy**
- trache/o/stomy
 - creation of an artificial opening into the trachea
94. **tracheotomy**
- trache/o/tomy
 - incision into the trachea
95. **endotracheal**
- endo/trach/eal
 - pertaining to within the trachea
96. **tracheostenosis**
- trache/o/stenosis
 - narrowing of the trachea
97. **endoscope**
- endo/scope
 - instrument used to view within
(a hollow organ or cavity)
98. **endoscopic**
- endo/scopic
 - pertaining to view within
(a hollow organ or cavity)
99. **endoscopy**
- endo/scopy
 - visual examination within
(a hollow organ or cavity)
100. **apnea**

- a/pnea
- absence of breathing

101. **dyspnea**

- dys/pnea
- breathing that is difficult

102. **eupnea**

- eu/pnea
- normal breathing

103. **hypopnea**

- hypo/pnea
- deficient breathing

104. **tachypnea**

- tachy/pnea
- rapid breathing

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Image Descriptions

Figure 4.1 image description: This figure shows the upper half of the human body. The major organs in the respiratory system are labeled. [\[Return to Figure 4.1\]](#).

Attribution

Except where otherwise noted, this chapter is adapted from “[Respiratory System](#)” in [Building a Medical Terminology Foundation](#) by Kimberlee Carter and Marie Rutherford licensed under [CC BY 4.0](#). / A derivative of Betts et al., which can be accessed for free from [Anatomy and Physiology \(OpenStax\)](#). Adaptations: dividing Respiratory System chapter content into sub-chapters.

4.2 - Anatomy (Structures) of the Respiratory System

The Nose and its Adjacent Structures

The major entrance and exit for the respiratory system is through the **nose**. When discussing the nose, it is helpful to divide it into two major sections:

- **external nose**
- **internal nose**

The **nares** open into the nasal cavity, which is separated into left and right sections by the nasal septum ([Figure 4.2](#)). The **nasal septum** is formed anteriorly by a portion of the **septal cartilage** and posteriorly by the perpendicular plate of the ethmoid bone and the thin vomer bones.

Each lateral wall of the nasal cavity has three bony projections the inferior conchae are separate bones and the superior and middle conchae are portions of the ethmoid bone. **Conchae** increase the surface area of the nasal cavity and disrupt the flow of air as it enters the nose, causing air to bounce along the epithelium, where it is cleaned and warmed. The conchae and meatuses trap water during exhalation preventing dehydration.

The floor of the nasal cavity is composed of the **hard palate** and the **soft palate**. Air exits the nasal cavities via the internal nares and moves into the pharynx.

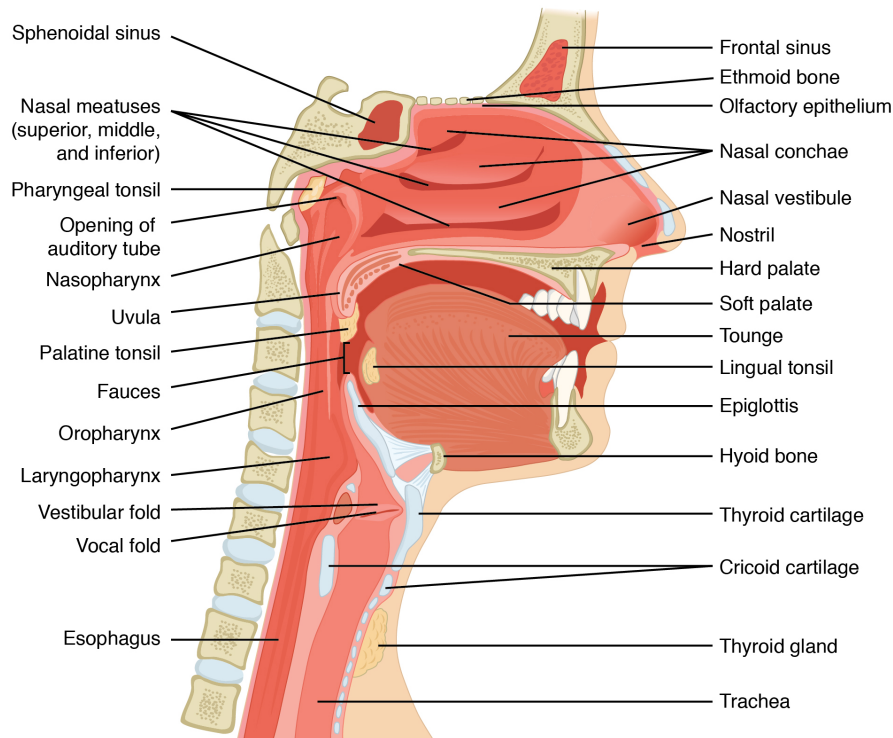


Figure 4.2 Upper Airway. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [[Fig. 4.2 Image description.](#)]

Paranasal sinuses serve to warm and humidify incoming air and are lined with a mucosa which produces mucus. Paranasal sinuses are named for their associated bone:

- frontal sinus
- maxillary sinus
- sphenoidal sinus
- ethmoidal sinus

The nares and anterior portion of the nasal cavities are lined with mucous membranes, containing sebaceous glands and hair follicles that serve to prevent the passage of large debris, such as dirt, through the nasal cavity. An olfactory epithelium used to detect odors is found deeper in the nasal cavity.

The conchae, meatuses, and paranasal sinuses are lined by respiratory epithelium composed of pseudostratified ciliated columnar epithelium ([Figure 4.3](#)). The epithelium contains specialized epithelial cells that produce mucus to trap debris. The cilia of the respiratory epithelium help to remove mucus and debris with a constant beating motion, sweeping materials towards the throat to be swallowed.

This moist epithelium functions to warm and humidify incoming air. Capillaries located just beneath the nasal epithelium warm the air by convection. Serous and mucus-producing cells also secrete **defensins**, immune cells patrol the connective tissue providing additional protection.

Did You Know 1?

Cold air slows the movement of cilia that may result in the accumulation of mucus leading to **rhinorrhea** during cold weather.

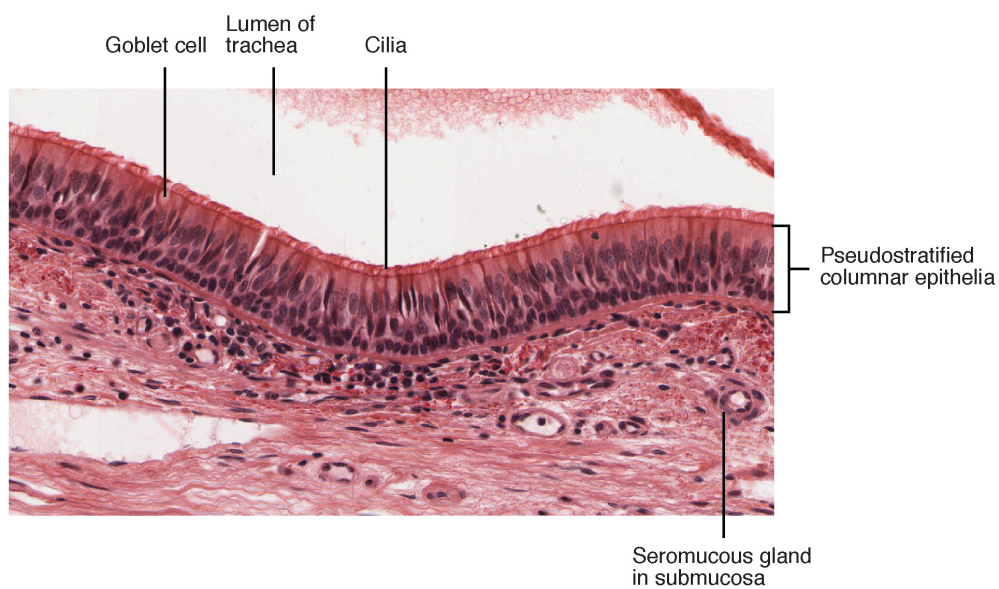


Figure 4.3 Pseudostratified Ciliated Columnar Epithelium. Respiratory epithelium is pseudostratified ciliated columnar epithelium. Seromucous glands provide lubricating mucus. LM \times 680. (Micrograph provided by the Regents of University of Michigan Medical School \copyright 2012). From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [[Fig. 4.3 Image description.](#)]

Pharynx

The **pharynx** is divided into three major regions: the **nasopharynx**, the **oropharynx**, and the **laryngopharynx** (see [Figure 4.4](#)).

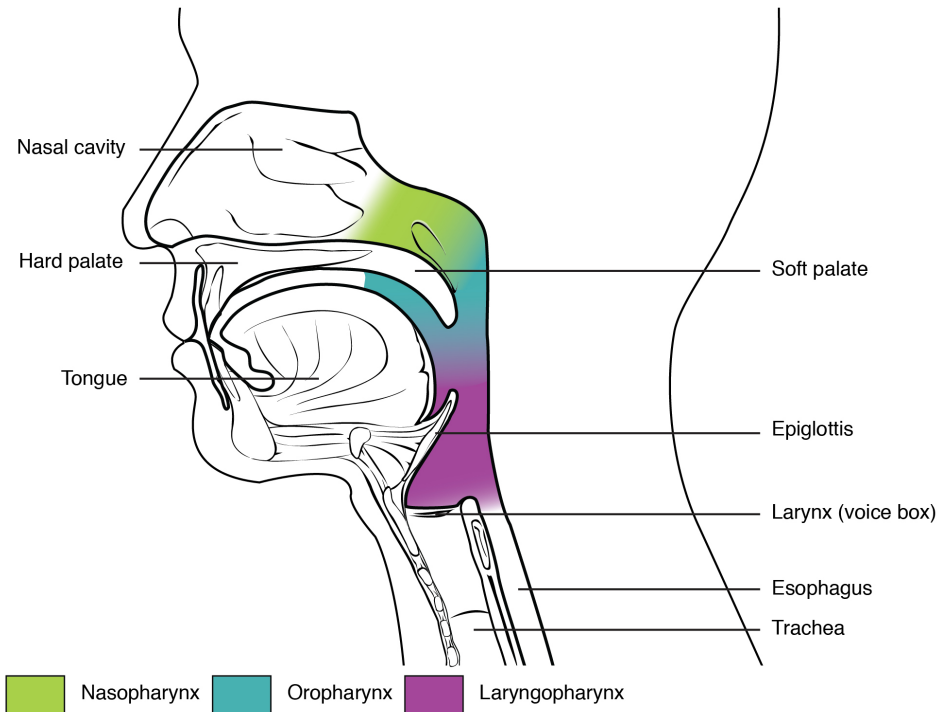


Figure 4.4 Divisions of the Pharynx. The pharynx is divided into three regions: the nasopharynx, the oropharynx, and the laryngopharynx. From Betts, et al., 2013. Licensed under [CC BY 4.0](#). [Fig. 4.4 Image description.]

At the top of the **nasopharynx** are the pharyngeal tonsils. The function of the **pharyngeal** tonsil is not well understood, but it contains a rich supply of **lymphocytes** and is covered with ciliated epithelium that traps and destroys invading pathogens that enter during inhalation. The pharyngeal tonsils are large in children, but tend to regress with age and may even disappear. The **uvula** and **soft palate** move like a pendulum during swallowing, swinging upward to close off the nasopharynx to prevent ingested materials from entering the nasal cavity. Auditory (Eustachian) tubes that connect to each middle ear cavity open into the nasopharynx. This connection is why colds often lead to ear infections.

The **oropharynx** is bordered superiorly by the **nasopharynx** and anteriorly by the oral cavity. The **oropharynx** contains two distinct sets of tonsils:

- The palatine tonsils.
 - A palatine tonsil is one of a pair of structures located laterally in the oropharynx in the area of the **fauces**.
- The lingual tonsils.
 - The **lingual** tonsil is located at the base of the tongue.

Similar to the pharyngeal tonsil, the palatine and **lingual** tonsils are composed of lymphoid tissue, and trap and destroy pathogens entering the body through the oral or nasal cavities.

The **laryngopharynx** is **inferior** to the oropharynx and **posterior** to the larynx. It continues the route for ingested

material and air until its **inferior** end, where the digestive and respiratory systems diverge. The stratified squamous epithelium of the oropharynx is continuous with the laryngopharynx. **Anteriorly**, the laryngopharynx opens into the larynx, whereas **posteriorly**, it enters the esophagus.

Larynx

The structure of the **larynx** is formed by several pieces of cartilage. Three large cartilage pieces form the major structure of the **larynx**.

- Thyroid cartilage (anterior):
 - The thyroid cartilage is the largest piece of cartilage that makes up the larynx. The thyroid cartilage consists of the **laryngeal** prominence, or “Adam’s apple,” which tends to be more prominent in males.
- Epiglottis (superior):
 - Three smaller, paired cartilages—the arytenoids, corniculates, and cuneiforms—attach to the **epiglottis** and the vocal cords and muscle that help move the vocal cords to produce speech.
- Cricoid cartilage (inferior):
 - The thick cricoid cartilage forms a ring, with a wide posterior region and a thinner anterior region.

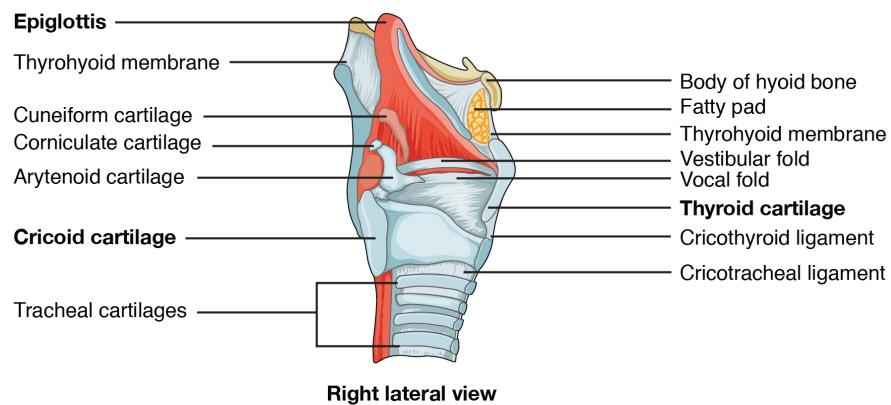
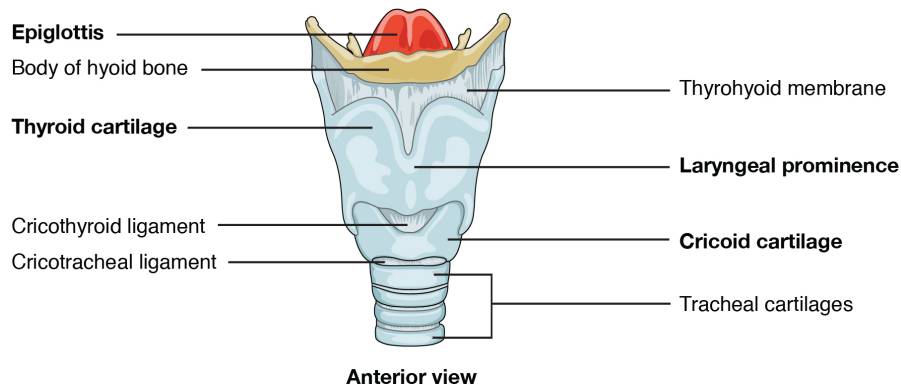


Figure 4.5 Larynx. The larynx extends from the laryngopharynx and the hyoid bone to the trachea. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [Fig. 4.5 Image description.]

Did You Know 2?

Folds of the true vocal cords differ between individuals, resulting in voices with different pitches.

When the **epiglottis** is in the “closed” position, the unattached end of the epiglottis rests on the **glottis**. A vestibular fold, or false vocal cord, is one of a pair of folded sections of mucous membrane. A true vocal cord is one of the white, membranous folds attached by muscle to the thyroid and arytenoid cartilages of the larynx on their outer edges. The inner edges of the true vocal cords are free, allowing oscillation to produce sound.

The act of swallowing causes the pharynx and larynx to lift upward, allowing the pharynx to expand and the epiglottis of the larynx to swing downward, closing the opening to the trachea. These movements produce a larger area for food to pass through, while preventing food and beverages from entering the trachea.

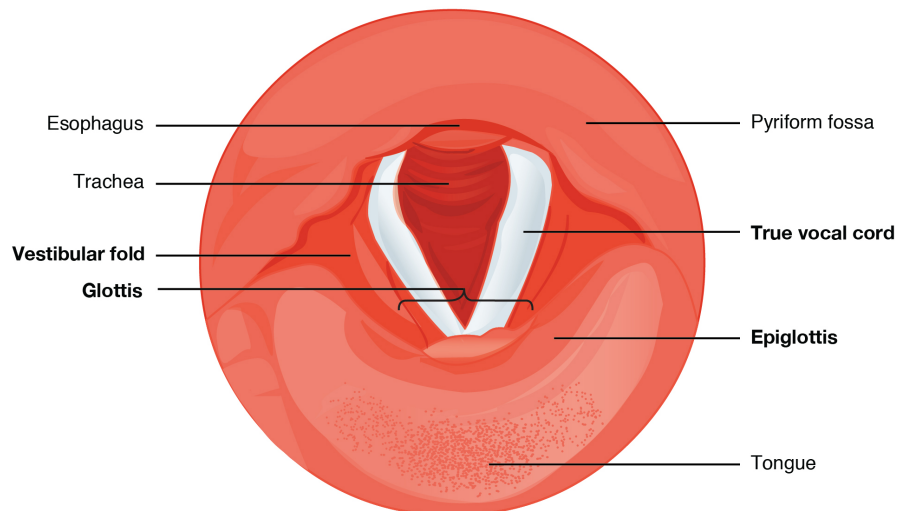


Figure 4.6 Vocal Cords. The true vocal cords and vestibular folds of the larynx are viewed inferiorly from the laryngopharynx. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [Fig. 4.6 Image description.]

Similar to the nasal cavity and nasopharynx, this specialized epithelium produces mucus to trap debris and pathogens as they enter the trachea. The cilia beat the mucus upward towards the laryngopharynx, where it can be swallowed down the esophagus.

Trachea

The **trachea** is formed by 16 to 20 stacked, C-shaped pieces of hyaline cartilage that are connected by dense connective tissue. The trachealis muscle and elastic connective tissue together form the **fibroelastic membrane**. The fibroelastic membrane allows the trachea to stretch and expand slightly during inhalation and exhalation, whereas the rings of cartilage provide structural support and prevent the trachea from collapsing. The trachealis muscle can be contracted to force air through the trachea during exhalation. The trachea is lined with pseudostratified ciliated columnar epithelium, which is continuous with the larynx. The esophagus borders the trachea **posteriorly**.

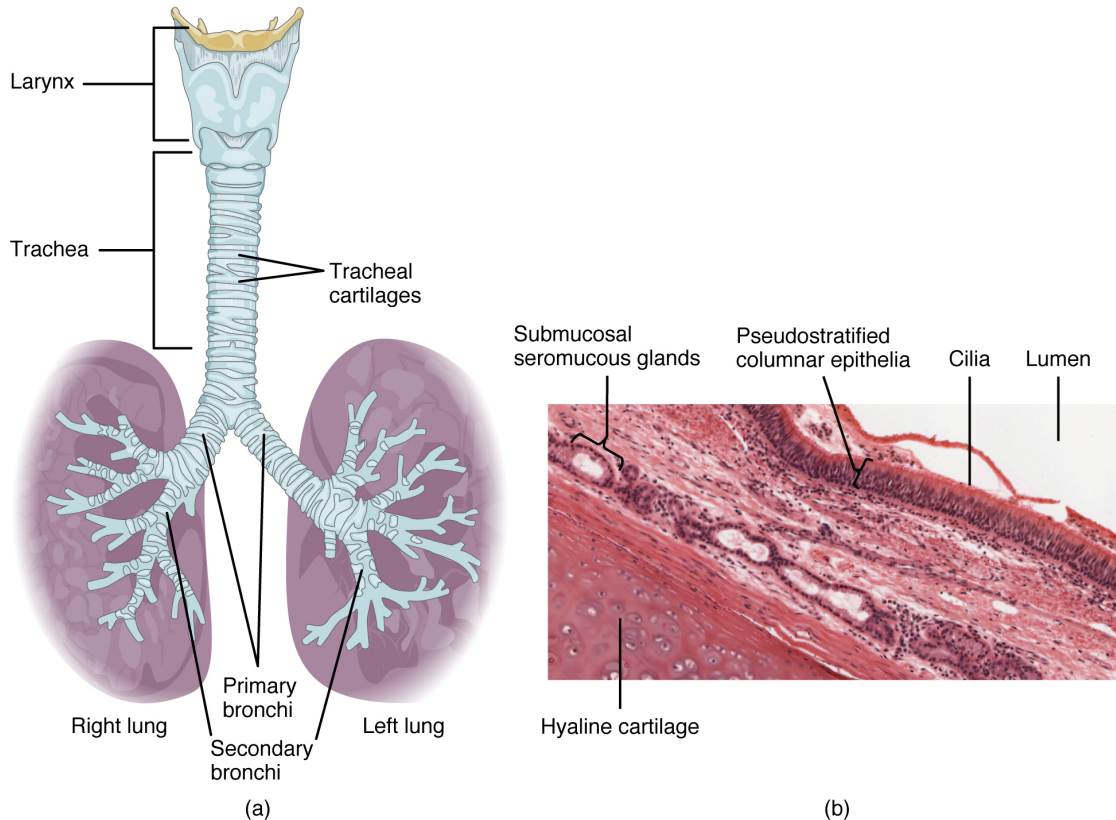


Figure 4.7 Trachea. (a) The tracheal tube is formed by stacked, C-shaped pieces of hyaline cartilage. (b) The layer visible in this cross-section of tracheal wall tissue between the hyaline cartilage and the lumen of the trachea is the mucosa, which is composed of pseudostratified ciliated columnar epithelium that contains goblet cells. LM \times 1220. (Micrograph provided by the Regents of University of Michigan Medical School \copyright 2012). From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [[Fig. 4.7 Image description.](#)]

Bronchial Tree

The trachea branches into the right and left primary bronchi at the **carina**. These bronchi are also lined by pseudostratified ciliated columnar epithelium containing mucus-producing goblet cells ([Figure 4.7b](#)). The carina is a raised structure that contains specialized nervous tissue that induces violent coughing if a foreign body, such as food, is present. Rings of cartilage, similar to those of the trachea, support the structure of the bronchi and

prevent their collapse. The primary bronchi enter the lungs at the **hilum**. The bronchi continue to branch into bronchial a tree. A bronchial tree (or respiratory tree) is the collective term used for these multiple-branched bronchi. The main function of the bronchi, like other conducting zone structures, is to provide a passageway for air to move into and out of each lung. The mucous membrane traps debris and pathogens.

A bronchiole branches from the tertiary bronchi. Bronchioles, which are about 1 mm in diameter, further branch until they become the tiny terminal bronchioles, which lead to the structures of gas exchange. There are more than 1000 terminal bronchioles in each lung. The muscular walls of the bronchioles do not contain cartilage like those of the bronchi. This muscular wall can change the size of the tubing to increase or decrease airflow through the tube.

Respiratory Zone

In contrast to the **conducting zone**, the **respiratory zone** includes structures that are directly involved in gas exchange. The respiratory zone begins where the terminal bronchioles join a respiratory bronchiole, the smallest type of bronchiole (see [Figure 4.8](#)), which then leads to an alveolar duct, opening into a cluster of alveoli.

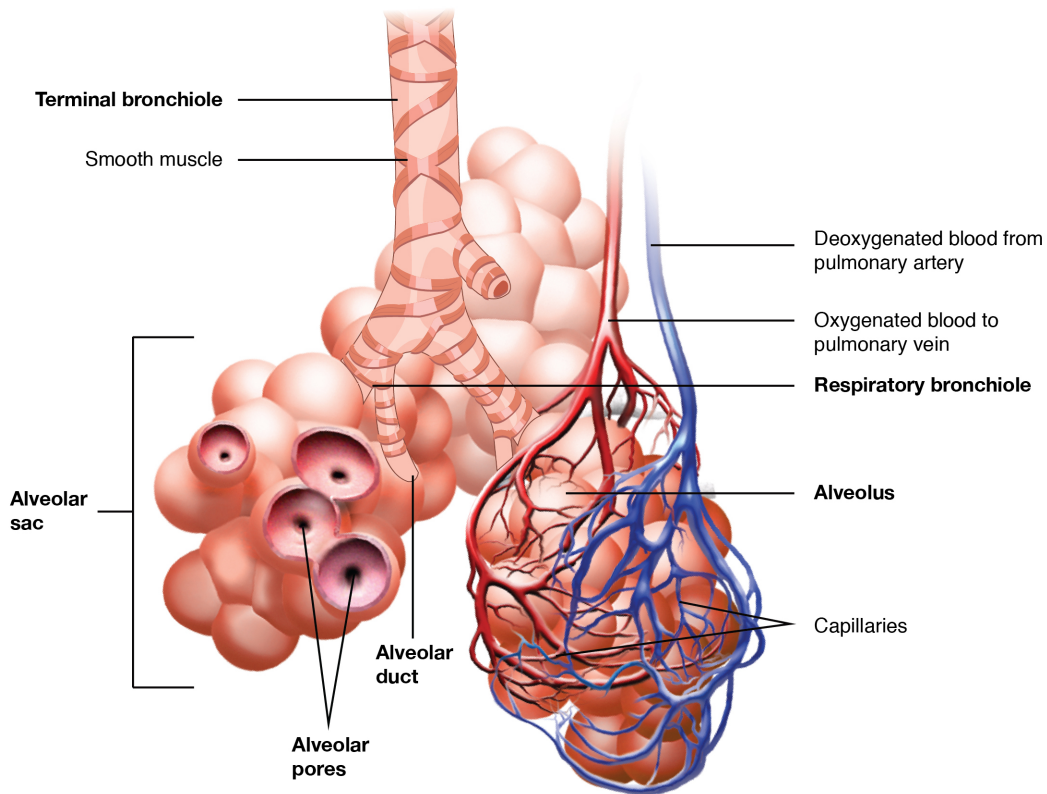


Figure 4.8 Respiratory Zone. Bronchioles lead to alveolar sacs in the respiratory zone, where gas exchange occurs. From Betts, et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 4.8 Image description.](#)]

Alveoli

An **alveolar duct** opens into a cluster of alveoli. An alveolus is one of the many small, grape-like sacs that are attached to the alveolar ducts. An alveolar sac is a cluster of many individual alveoli that are responsible for gas exchange. An alveolus is approximately 200 μm in diameter with elastic walls that allow the alveolus to stretch during air intake, which greatly increases the surface area available for gas exchange. Alveoli are connected to their neighbors by alveolar pores, which help maintain equal air pressure throughout the alveoli and lung (see [Figure 4.9](#)).

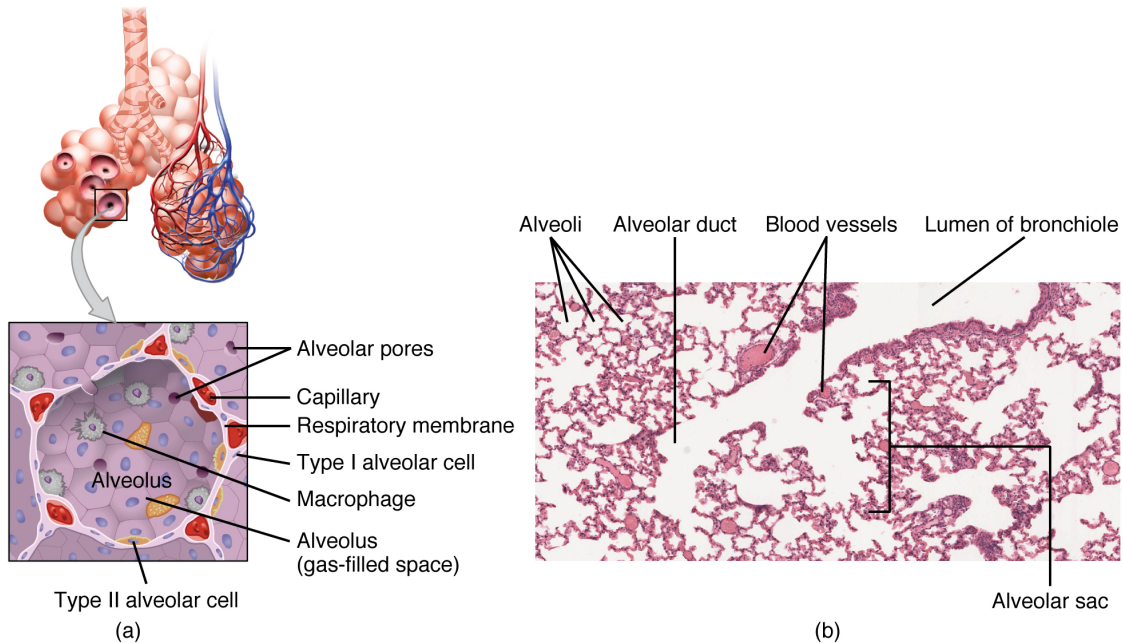


Figure 4.9 Structures of the Respiratory Zone. (a) The alveolus is responsible for gas exchange. (b) A micrograph shows the alveolar structures within lung tissue. LM $\times 178$. (Micrograph provided by the Regents of University of Michigan Medical School \textcopyright 2012). From Betts, et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 4.9 Image description.](#)]

Concept Check

- What are the components of the **bronchial** tree?
- What is the purpose of **cilia**?
- Where does **gas** exchange take place?

Gross Anatomy of the Lungs

The lungs are pyramid-shaped, paired organs that are connected to the trachea by the right and left bronchi; on the inferior surface, the lungs are bordered by the **diaphragm**. The lungs are enclosed by the pleurae, which are attached to the mediastinum. The right lung is shorter and wider than the left lung, and the left lung occupies a smaller volume than the right. The **cardiac notch** allows space for the heart (see [Figure 4.10](#)). The apex of the lung is the superior region, whereas the base is the opposite region near the diaphragm. The costal surface of the lung borders the ribs. The mediastinal surface faces the midline.

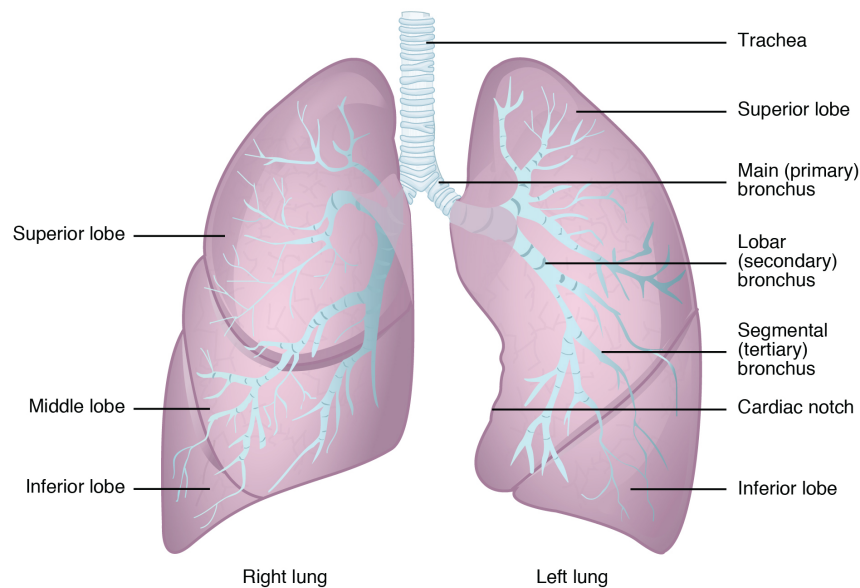


Figure 4.10 Gross Anatomy of the Lungs. From Betts, et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 4.10 Image description.](#)]

Each lung is composed of smaller units called lobes. Fissures separate these lobes from each other. The right lung consists of three lobes: the superior, middle, and inferior lobes. The left lung consists of two lobes: the superior and inferior lobes. A pulmonary lobule is a subdivision formed as the bronchi branch into bronchioles. Each lobule receives its own large bronchiole that has multiple branches. An interlobular septum is a wall, composed of connective tissue, which separates lobules from one another.

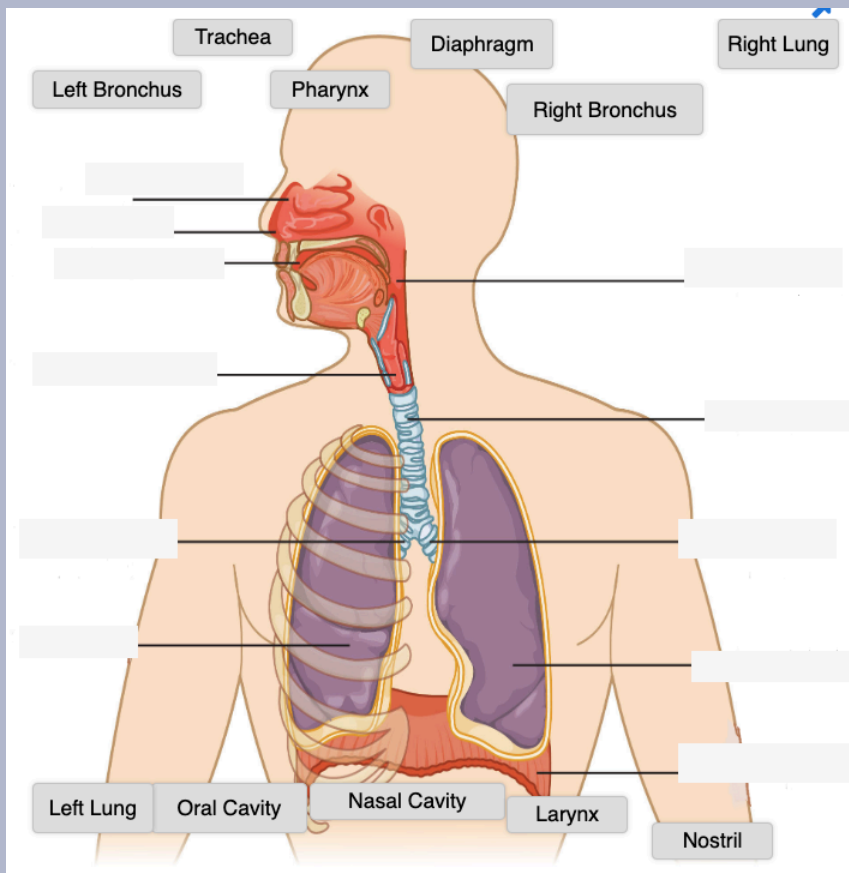
Labeling the Respiratory System

Can you correctly label the respiratory system structures?

Labeling the Respiratory System (Text Version)

Label the diagram with correct words listed below:

- | | | |
|------------------|-------------------|-----------------|
| 1. Left Bronchus | 5. Right Bronchus | 9. Nasal Cavity |
| 2. Trachea | 6. Right Lung | 10. Larynx |
| 3. Pharynx | 7. Left Lung | 11. Nostril |
| 4. Diaphragm | 8. Oral Cavity | |



Labeling the Respiratory System Diagram (Text version)

This is an anatomical diagram of the major organs and structure of the human respiratory system. Identified starting from the top of the diagram is the organs and structures which serve as a passageway for air and include, _____[Blank 1] which warms and moistens the air, the _____[Blank 2] where air enters the respiratory system and travels to the _____[Blank 3] also know as the mouth, from

the mouth the air moves to the _____[Blank 4], then to through the voice box correctly called the _____[Blank 5], and passes into the _____[Blank 6] often referred to as the windpipe. The trachea bifurcates meaning it separates into two anatomical branches each leading to each lung, on the right side is the _____[Blank 7], on the left side, the _____[Blank 8]. Air arrives at the lungs to allow for the exchange of gases arrives and enters on the right side into the _____[Blank 9] and on the left side the _____[Blank 10]. The muscular partition supporting the lungs known as the _____[Blank 11]. This detailed illustration supports understanding of the respiratory system's structure and function.

Check your answers: ¹

Activity source: Respiratory System Anatomy by Kimberlee Carter, illustration from [Anatomy and Physiology \(OpenStax\)](#), licensed under [CC BY 4.0](#). / Text version added.

Image Descriptions

Figure 4.2 image description: This figure shows a cross section view of the nose and throat. The major parts are labeled. [\[Return to Figure 4.2\]](#).

Figure 4.3 image description: This figure shows a micrograph of pseudostratified epithelium. [\[Return to Figure 4.3\]](#).

Figure 4.4 image description: This figure shows the side view of the face. The different parts of the pharynx are color-coded and labeled (from the top): nasal cavity, hard palate, soft palate, tongue, epiglottis, larynx, esophagus, trachea. [\[Return to Figure 4.4\]](#).

Figure 4.5 image description: The top panel of this figure shows the anterior view of the larynx, and the bottom panel shows the right lateral view of the larynx. [\[Return to Figure 4.5\]](#).

Figure 4.6 image description: This diagram shows the cross section of the larynx. The different types of cartilages are labeled (clockwise from top): pyriform fossa, true vocal cord, epiglottis, tongue, glottis, vestibular fold, trachea, esophagus. [\[Return to Figure 4.6\]](#).

Figure 4.7 image description: The top panel of this figure shows the trachea and its organs. The major parts including the larynx, trachea, bronchi, and lungs are labeled. [\[Return to Figure 4.7\]](#).

Figure 4.8 image description: This image shows the bronchioles and alveolar sacs in the lungs and depicts the exchange of oxygenated and deoxygenated blood in the pulmonary blood vessels. [\[Return to Figure 4.8\]](#).

Figure 4.9 image description: This figure shows the detailed structure of the alveolus. The top panel shows the alveolar sacs and the bronchioles. The middle panel shows a magnified view of the alveolus, and the bottom panel shows a micrograph of the cross section of a bronchiole. [\[Return to Figure 4.9\]](#).

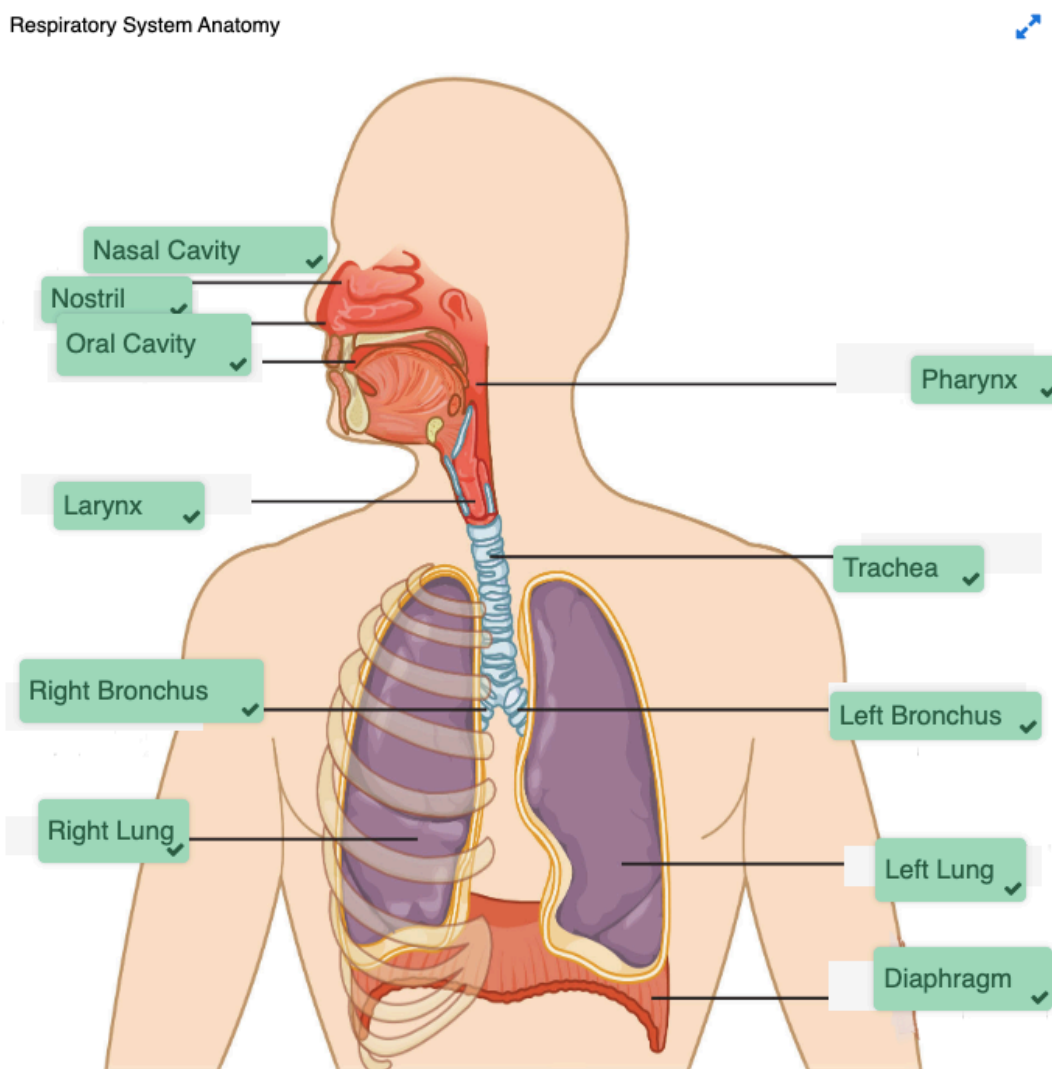
Figure 4.10 image description: Diagram of the lungs with the major parts labelled (from top, clockwise): trachea,

superior lobe, main bronchus, lobar bronchus, segmental bronchus, inferior lobe, inferior lobe, middle lobe, superior lobe of the left lung. [\[Return to Figure 4.10\].](#)

Attribution

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Notes



1. **Check your answers: Labeling the Respiratory System Diagram** This is an anatomical diagram of the major organs and structure

of the human respiratory system. Identified starting from the top of the diagram is the organs and structures which serve as a passageway for air and include, **nasal cavity** which warms and moistens the air, the **nostril** where air enters the respiratory system and travels to the **oral cavity** also known as the mouth, from the mouth the air moves to the **pharynx**, then through the voice box correctly called the **larynx**, and passes into the **trachea** often referred to as the windpipe. The trachea bifurcates meaning it separates into two anatomical branches each leading to each lung, on the right side is the **right main bronchus** branch, on the left side, the **left main bronchus**. Air arrives at the lungs to allow for the exchange of gases and enters on the right side into the **right lung** and on the left side the **left lung**. The muscular partition supporting the lungs known as the **diaphragm**. This detailed illustration supports understanding of the respiratory system's structure and function.

4.3 - Physiology (Function) of the Respiratory System

Blood Supply

The major function of the lungs is to perform gas exchange, which requires blood from the pulmonary circulation.

- This blood supply contains deoxygenated blood and travels to the lungs where **erythrocytes** pick up oxygen to be transported to tissues throughout the body.
- The **pulmonary artery** carries deoxygenated, arterial blood to the alveoli.
- The pulmonary artery branches multiple times as it follows the bronchi and each branch becomes progressively smaller in diameter.
- One arteriole and an accompanying venule supply and drain one pulmonary lobule. As they near the alveoli, the pulmonary arteries become the pulmonary capillary network.
- The pulmonary capillary network consists of tiny vessels with very thin walls that lack smooth muscle fibres.
- The capillaries branch and follow the bronchioles and structure of the alveoli. It is at this point that the capillary wall meets the alveolar wall, creating the respiratory membrane.
- Once the blood is oxygenated, it drains from the alveoli by way of multiple pulmonary veins, which exit the lungs through the **hilum**.

Nervous Innervation

The blood supply of the lungs plays an important role in gas exchange and serves as a transport system for gases throughout the body. Innervation by both the **parasympathetic** and **sympathetic** nervous systems provides an important level of control through dilation and constriction of the airway.

- The parasympathetic system causes bronchoconstriction.
- The sympathetic nervous system stimulates bronchodilation.

Reflexes such as coughing, and the ability of the lungs to regulate oxygen and carbon dioxide levels, also result from **autonomic** nervous system control. Sensory nerve fibres arise from the vagus nerve, and from the second to fifth thoracic ganglia. The pulmonary plexus is a region on the lung root formed by the entrance of the nerves at the hilum. The nerves then follow the bronchi in the lungs and branch to innervate muscle fibres, glands, and blood vessels.

Pleura of the Lungs

Each lung is enclosed within a cavity that is surrounded by the pleura. The pleura (plural = pleurae) is a serous membrane that surrounds the lung. The right and left pleurae, which enclose the right and left lungs, respectively, are separated by the mediastinum.

The pleurae consist of two layers:

1. The **visceral pleura** is the layer that is superficial to the lungs, and extends into and lines the lung fissures (see [Figure 4.11](#)).
2. The **parietal pleura** is the outer layer that connects to the thoracic wall, the mediastinum, and the diaphragm.

The visceral and parietal pleurae connect to each other at the **hilum**. The pleural cavity is the space between the visceral and parietal layers.

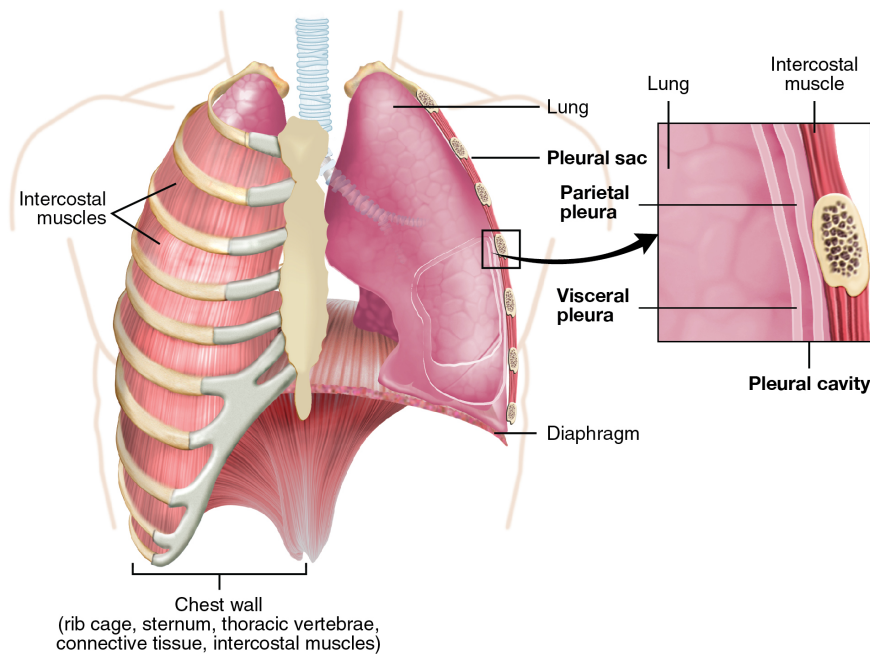


Figure 4.11 Parietal and Visceral Pleurae of the Lungs. From Betts, et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 4.11 Image description.](#)]

The pleurae perform two major functions:

1. **Produce pleural fluid** that lubricates surfaces, reduces friction to prevent trauma during breathing, and creates surface tension that helps maintain the position of the lungs against the thoracic wall. This adhesive characteristic of the pleural fluid causes the lungs to enlarge when the thoracic wall expands during ventilation, allowing the lungs to fill with air.
2. The pleurae also **create a division** between major organs that prevents interference due to the movement of the organs, while preventing the spread of infection.

Pulmonary Ventilation

The difference in pressures drives pulmonary ventilation because air flows down a pressure gradient, that is, air flows from an area of higher pressure to an area of lower pressure.

- Air flows into the lungs largely due to a difference in pressure; atmospheric pressure is greater than intra-alveolar pressure, and intra-alveolar pressure is greater than intrapleural pressure.
- Air flows out of the lungs during expiration based on the same principle; pressure within the lungs becomes greater than the atmospheric pressure.

Pulmonary ventilation comprises two major steps: **inspiration** and **expiration** (Figure 4.12). A respiratory cycle is one sequence of inspiration and expiration.

Two muscle groups are used during **normal inspiration**, the diaphragm and the external intercostal muscles. Additional muscles can be used if a bigger breath is required.

- The diaphragm contracts, it moves inferiorly toward the abdominal cavity, creating a larger thoracic cavity and more space for the lungs.
- The external intercostal muscles contract and moves the ribs upward and outward, causing the rib cage to expand, which increases the volume of the thoracic cavity.

Due to the adhesive force of the pleural fluid, the expansion of the thoracic cavity forces the lungs to stretch and expand as well. This increase in volume leads to a decrease in intra-alveolar pressure, creating a pressure lower than atmospheric pressure. As a result, a pressure gradient is created that drives air into the lungs.

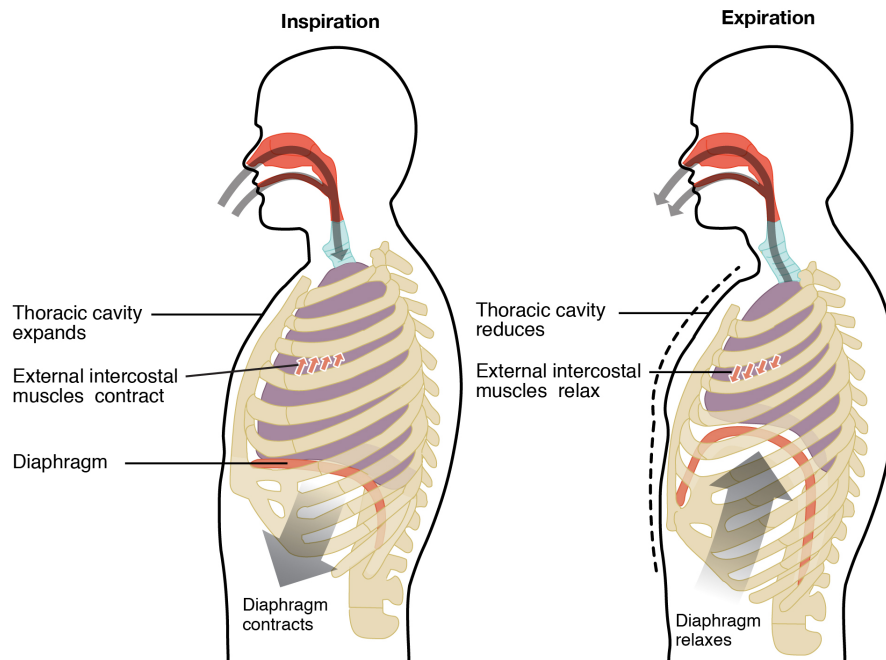


Figure 4.12 Inspiration and Expiration. Inspiration and expiration occur due to the expansion and contraction of the thoracic cavity, respectively. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [Fig. 4.12 Image description.]

The process of **normal expiration** is passive, meaning that energy is not required to push air out of the lungs.

- The elasticity of the lung tissue causes the lung to recoil, as the diaphragm and intercostal muscles relax following inspiration.
- The thoracic cavity and lungs decrease in volume, causing an increase in interpulmonary pressure. The interpulmonary pressure rises above atmospheric pressure, creating a pressure gradient that causes air to leave the lungs.

There are different types, or modes, of breathing that require a slightly different process to allow inspiration and expiration:

- **Quiet breathing**, also known as **eupnea**, is a mode of breathing that occurs at rest and does not require the cognitive thought of the individual. During quiet breathing, the diaphragm and external intercostals must contract.
- **Diaphragmatic breathing**, also known as deep breathing, requires the diaphragm to contract. As the diaphragm relaxes, air passively leaves the lungs.
- **Costal breathing**, also known as a shallow breath, requires contraction of the intercostal muscles. As the intercostal muscles relax, air passively leaves the lungs.
- **Forced breathing**, also known as **hyperpnea**, is a mode of breathing that can occur during exercise or actions that require the active manipulation of breathing, such as singing.
 - During forced breathing, inspiration and expiration both occur due to muscle contractions. In addition to the contraction of the diaphragm and intercostal muscles, other accessory muscles must also contract.
 - During **forced inspiration**, muscles of the neck contract and lift the thoracic wall, increasing lung volume.
 - During **forced expiration**, accessory muscles of the abdomen contract, forcing abdominal organs upward against the diaphragm. This helps to push the diaphragm further into the thorax, pushing more air out. In addition, accessory muscles help to compress the rib cage, which also reduces the volume of the thoracic cavity.

Concept Check

- Breathing normally, place your hand on your stomach take in one full **respiratory** cycle.
 - What type of breathing are you doing?
- Keeping your hand on your stomach, take in one large breath and exhale.
 - What type of breathing are you doing?

- Complete 10 jumping jacks, once completed, place your hand on your stomach and take in one full respiratory cycle.
 - What type of breathing are you doing?

Respiratory Rate and Control of Ventilation

Breathing usually occurs without thought, although at times you can consciously control it, such as when you swim under water, sing a song, or blow bubbles. The respiratory rate is the total number of breaths that occur each minute. Respiratory rate can be an important indicator of disease, as the rate may increase or decrease during an illness or in a disease condition. The respiratory rate is controlled by the respiratory center located within the medulla oblongata in the brain, which responds primarily to changes in carbon dioxide, oxygen, and pH levels in the blood.

The normal respiratory rate of a child decreases from birth to adolescence:

- A child under 1 year of age has a normal respiratory rate between 30 and 60 breaths per minute.
- By the time a child is about 10 years old, the normal rate is closer to 18 to 30.
- By adolescence, the normal respiratory rate is similar to that of adults, 12 to 18 breaths per minute.

Did You Know?

Respiratory rate is the total number of breaths that occur each minute.

Watch [Respiratory System, Part 2: Crash Course Anatomy & Physiology #32 \(10:30 min\) on YouTube](#)

Respiratory System Words Not Easily Broken Down

Respiratory System Word Not Easily Broken Down (Text version)

1. **Epistaxis**

- nosebleed (rhinorrhagia)

2. **influenza (flu)**

- highly contagious viral infection effecting the respiratory tract

3. **pleural effusion**

- fluid in the pleural space
(caused by disease or trauma)

4. **pulmonary edema**

- fluid accumulation in alveoli and bronchioles
(related to heart failure)

5. **pulmonary embolism (PE)**

- blockage of pulmonary circulation to the lungs

6. **upper respiratory infection**

- infection of the nasal cavity, sinuses, pharynx and larynx

7. **stethoscope**

- instrument used to hear internal body sounds

8. **asphyxia**

- deprivation of oxygen to tissues, suffocation

9. **aspirate**

- suction of fluid, inhalation of fluid

10. **mucus**

- slimy liquid secreted by mucous membranes

11. **nebulizer**

- device that creates a mist for giving respiratory treatment or medication
12. **nosocomial infection**
 - infection acquired in hospital
 13. **sputum**
 - mucous secretion from lungs, bronchi, and trachea that is expelled through the mouth
 14. **ventilator**
 - mechanical device that assist with breathing

Activity Source: Respiratory System Word Not Easily Broken Down by Kimberlee Carter, licensed under [CC BY 4.0](#). / Text version added.

Common Respiratory Abbreviations

Learn more about common respiratory abbreviations below.

Common Respiratory Abbreviations

- **ABGs** (arterial blood gases)
- **AFB** (acid-fast bacilli)
- **ARDS** (acute respiratory distress syndrome)
- **C&S** (culture and sensitivity)
- **CAP** (community-acquired pneumonia)
- **CF** (cystic fibrosis)
- **CO₂** (carbon dioxide)
- **COPD** (chronic obstructive pulmonary disease)
- **CPAP** (continuous positive airway pressure)
- **CT** (computed tomography, computerized tomography)
- **CXR** (chest x-ray)
- **flu** (influenza)
- **IPF** (idiopathic pulmonary fibrosis)
- **LLL** (left lower lobe)

- **LTB** (laryngotracheobronchitis)
- **LUL** (left upper lobe)
- **O₂** (oxygen)
- **OSA** (obstructive sleep apnea)
- **PE** (pulmonary embolism)
- **PFM** (peak flow meter)
- **PFTs** (pulmonary function tests)
- **RLL** (right lower lobe)
- **RML** (right middle lobe)
- **RUL** (right upper lobe)
- **SOB** (shortness of breath)
- **TB** (tuberculosis)
- **URI** (upper respiratory infection)
- **BiPAP** (bilevel positive airway pressure)
- **CPT** (chest physiotherapy)
- **DPI** (dry powder inhaler)
- **IPPB** (intermittent positive-pressure breathing)
- **MDI** (metered-dose inhaler)
- **NIPPV** (non-invasive positive-pressure ventilator)
- **PEP** (positive expiratory pressure)
- **SVN** (small-volume nebulizer)
- **VAP** (ventilator-associated pneumonia)

Activity source: Respiratory System Abbreviations by Kimberlee Carter, licensed under [CC BY 4.0](#). /
Converted to text.

Image Descriptions

Figure 4.11 image description: This figure shows the lungs and the chest wall, which protects the lungs, in the left panel. In the right panel, a magnified image shows the pleural cavity and a pleural sac. [\[Return to Figure 4.11\]](#).

Figure 4.12 image description: The left panel of this image shows a person inhaling air and the location of the thoracic muscles. The right panel shows the person exhaling air and the contraction of the thoracic cavity. [\[Return to Figure 4.12\]](#).

Attribution

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of Betts et al., which can be accessed for free from [Anatomy and Physiology \(OpenStax\)](#). Adaptations: dividing Respiratory System chapter content into sub-chapters.

4.4 - Respiratory Diseases, Disorders and Diagnostic Testing

A variety of diseases can affect the respiratory system, such as asthma, emphysema, chronic obstruction pulmonary disorder (COPD), and lung cancer. All of these conditions affect the gas exchange process and result in labored breathing and other difficulties (Betts, et al., 2013).

The Effects of Second-Hand Tobacco Smoke

The burning of a tobacco cigarette creates multiple chemical compounds that are released through mainstream smoke, which is inhaled by the smoker, and through sidestream smoke, which is the smoke that is given off by the burning cigarette. **Second-hand smoke**, which is a combination of sidestream smoke and the mainstream smoke that is exhaled by the smoker, has been demonstrated by numerous scientific studies to cause disease. At least **40 chemicals in sidestream smoke** have been identified that negatively impact human health, leading to the development of cancer or other conditions, such as immune system dysfunction, liver toxicity, cardiac **arrhythmias**, pulmonary **edema**, and neurological dysfunction. Tobacco and second-hand smoke are considered to be **carcinogenic**. Exposure to second-hand smoke can cause lung cancer in individuals who are not tobacco users themselves.

- It is estimated that the risk of developing lung cancer is increased by up to **30 percent in nonsmokers** who live with an individual who smokes in the house, as compared to nonsmokers who are not regularly exposed to second-hand smoke.
- **Children who live with an individual who smokes** inside the home have a larger number of lower respiratory infections, which are associated with hospitalizations, and a higher risk of sudden infant death syndrome (SIDS). Second-hand smoke in the home has also been linked to a greater number of ear infections in children, as well as worsening symptoms of asthma (Betts et al., 2013).

Chronic Obstructive Pulmonary Disease (COPD)

COPD is a term used to represent a number of respiratory diseases including chronic bronchitis and emphysema. COPD is a **chronic** condition with most symptoms appearing in people in their mid 50s. Symptoms include shortness of breath, cough, and sputum production. Symptoms during flare ups or times of **exacerbation** may include green or brown mucus, increase in the viscosity or amount of mucus, chest pain, fever, swollen ankles, headaches, dizziness, and blue lips or fingers. There is no cure for COPD. Shortness of breath may be controlled with **bronchodilators**. The best plan is to avoid triggers and getting sick. Clients with COPD are advised to avoid people who are sick, get the flu shot and reduce their exposure to pollution and cigarette smoke. While there are several risk factors, 80% of cases are associated with cigarette smoking (Government of Canada, 2018). To learn more about COPD visit the [Public Health Agency of Canada's web page on COPD \[New Tab\]](#).

Asthma

Asthma is a common chronic condition that affects all age groups. In 2011/2012, there were 3.8 million Canadians diagnosed with asthma and a disproportionate number of children and youth (Government of Canada, 2018). To learn more, visit the [Asthma in Canada Data Blog \[New Tab\]](#). Asthma is a chronic disease characterized by inflammation, **edema** of the airway, and bronchospasms which can inhibit air from entering the lungs. Bronchospasms can lead to an “asthma attack.” An attack may be triggered by environmental factors such as dust, pollen, pet hair, or dander, changes in the weather, mold, tobacco smoke, and respiratory infections, or by exercise and stress (Betts, et al., 2013).

Symptoms of an asthma attack involve coughing, shortness of breath, wheezing, and tightness of the chest. Symptoms of a severe asthma attack require immediate medical attention and may include **dyspnea** that results in **cyanotic** lips or face, confusion, drowsiness, a rapid pulse, sweating, and severe anxiety. The severity of the condition, frequency of attacks, and identified triggers influence the type of medication that an individual may require. Longer-term treatments are used for those with more severe asthma. Short-term, fast-acting drugs that are used to treat an asthma attack are typically administered via an inhaler. For young children or individuals who have difficulty using an inhaler, asthma medications can be administered via a nebulizer (Betts, et al., 2013).

Lung Cancer

Lung cancer is a leading cause of cancer death among both males and females in Canada, with 98% occurring in adults over 50. Symptoms often appear in the late stages, with 50% being diagnosed at stage IV (Government of Canada, 2019a). Symptoms may include shortness of breath, wheezing, blood in the mucus, chronic chest infections, **dysphagia**, pleural effusion, and enlarged lymph nodes. There are two types of lung cancer: **small cell lung cancer (SCLC)**, linked to cigarette smoking, grows quickly and metastasizes; **non-small cell lung cancer (NSCLC)** is more common and grows slowly. Changes in lung cells may lead to **benign** tumours or **malignant** tumours. Cancers that start in other parts of the body may metastasize to the lungs. Risk factors include smoking, air pollution, family history of exposure to second-hand smoke, exposure to radon gas, and exposure to carcinogens (Government of Canada, 2019). Treatment will depend on the type of lung cancer and the stage at diagnosis. Treatments may include surgery, chemotherapy, targeted therapy, immunotherapy, and radiation therapy (Government of Canada, 2019).

Sleep Apnea

Sleep apnea is a **chronic** disorder that occurs in children and adults. It is characterized by the **cessation** of breathing during sleep. These episodes may last for several seconds or several minutes, and may differ in the frequency with which they are experienced. Sleep apnea leads to poor sleep. Symptoms include fatigue, evening napping, irritability, memory problems, morning headaches, and excessive snoring. A diagnosis of sleep apnea is usually done during a sleep study, where the patient is monitored in a sleep laboratory for several nights. Treatment of sleep apnea commonly includes the use of a device called a **continuous positive airway pressure (CPAP) machine** during sleep. The CPAP machine has a mask that covers the nose, or the nose and mouth, and

forces air into the airway at regular intervals. This pressurized air can help to gently force the airway to remain open, allowing more normal ventilation to occur (Betts et al., 2013).

Respiratory System Medical Terms in Use

Respiratory System History and Physical

Respiratory System History and Physical (Text Version)

Fill in the consultation report with correct words listed below:

- Exert
- Edema
- diuretic
- membranes
- HEENT
- apnea
- heart failure
- lobes
- inspiration
- allergens
- breath
- erythema
- monitor
- asthma
- edema

RESPIRATORY SYSTEM – HISTORY & PHYSICAL EXAMINATION

PATIENT NAME: Randy BURNS

AGE: 56

DOB: July 2

SEX: Male

ATTENDING PHYSICIAN: Joyce Mathers, MD, Pulmonology

HISTORY: This 56-year-old male is presenting with a 2-week history of worsening dyspnea not associated with exertion. The patient states that he does not have to _____[Blank 1] himself for his breathing to get difficult. He feels that “he cannot get his breath” sometimes even with lying in bed. He does report developing a cold and runny nose over the last 10 days, but the worsened breathing seemed to have started a few days earlier than this. He reports that the shortness of _____[Blank 2] has progressively gotten worse in the past 2-3 days. Patient does not report any leg or foot _____[Blank 3].

PAST HISTORY: The patient has a life history of asthma triggered by environmental _____[Blank 4] – grass cutting, trees budding in the spring, street dust etc. He has used a puffer when he has symptoms since he was a child. He has a history of congestive _____[Blank 5] (CHF) and sleep _____[Blank 6] for which he uses a CPAP machine nightly.

PHYSICAL EXAMINATION: GENERAL APPEARANCE: The patient appears laboring in breathing. He is quite distressed. VITAL SIGNS: Temperature 97.1, pulse 88, blood pressure 121/86, weight 209 pounds, height 5 feet 8 inches. _____[Blank 7] : Eye exam PERRLA. Normocephalic, atraumatic. Moist mucous _____[Blank 8]. No oropharyngeal _____[Blank 9]. No signs of infection. Tongue is coated but tonsils are clear. NECK: Supple. No lymphadenopathy. No bruits. LUNGS: There is marked wheezing on

_____ [Blank 10] bilaterally. Some minimal evidence of consolidation in the lower _____ [Blank 11] bilaterally. No rales or rubs. CARDIAC: Irregular rate and rhythm, variable S1 and S2. EXTREMITIES: Some pedal and ankle _____ [Blank 12] noted in low extremities. No cyanosis or clubbing.

ASSESSMENT AND PLAN

1. Acute shortness of breath with a history of allergic _____ [Blank 13]. Rule out upper respiratory infection (URI). Will order chest x-ray stat.
2. Atrial fibrillation. Patient has a controlled rate. Will administer one dose of Lovenox overnight.
3. Mild symptoms of CHF due to lower extremity edema. Will administer Aldactone to bring this under control. Will _____ [Blank 14] the patient's diuretic volume.
4. Plan to admit patient overnight for observation to await stat CXR result and to monitor the effects of _____ [Blank 15] and anticoagulant therapies.

Joyce Mathers, MD, Pulmonology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers:¹

Activity source: Respiratory System History and Physical by Sheila Bellefeuille and Heather Scudder, licensed under [CC BY 4.0](#). / Text version added.

Respiratory System Consultation Report

Respiratory System Consultation Report (Text Version)

Fill in the consultation report with correct words listed below:

- Oxygen
- pleura
- basal
- hemoptysis
- dyspnea
- thoracostomy
- q. d.
- COPD
- antibiotics
- wheezing
- atelectasis

RESPIRATORY SYSTEM – CONSULTATION REPORT

PATIENT NAME: Wayne SAUNDERS

AGE: 59

DOB: September 7

SEX: Male

DATE OF CONSULTATION: March 29

CONSULTANT: Joyce Mathers, MD, Pulmonology

REASON FOR CONSULTATION: Sudden onset dyspnea and respiratory distress.

HISTORY: This garrulous 59-year-old was seen in the ER today with a complaint of sudden onset _____[Blank 1] and some respiratory distress. Denies any nausea, vomiting, chest pain, _____[Blank 2], cough, fever or chills.

PAST HISTORY: Is positive for asthma and _____[Blank 3] as patient is a lifelong smoker at 1+ packs per day.

ASSESSMENT: CHEST has good air entry bilaterally. No _____[Blank 4]. Bilateral _____[Blank 5] crackles are noted. Some dullness to percussion on the left. CT scan was ordered and shows a left _____ [Blank 6] effusion and acute pneumothorax due to infectious process. Probable comprehensive _____[Blank 7].

MEDICATIONS

1. Adalat 30 mg _____[Blank 8].
2. Atenolol 50 mg (half dose) q.d.
3. Flonase 50 mcg one spray on each side q.d.
4. Zolof 100 mg once q.d.

PLAN

1. Admit patient to the unit for treatment and possible left _____[Blank 9] if indicated by lack of improvement on standard therapy.
2. Treat with a course of _____[Blank 10] for the URI.
3. _____[Blank 11] therapy if indicated by O2 sats.
4. Repeat CT scan in 48 hours.

Joyce Mathers, MD, Pulmonology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers: ²

Activity source: Respiratory System Consultation Report by Sheila Bellefeuille and Heather Scudder, licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). / Text version added.

Respiratory System Consultation Report

Respiratory System Consultation Report (Text Version)

Fill in the consultation report with correct words listed below:

- Kidney
- respiratory
- childhood
- urinalysis
- shadowing
- mid-thoracic
- pulmonary
- hepatotoxic
- x-ray
- apex
- dyspnea
- flu shot
- myoplasmal
- rasping
- rhinorrhea
- expiration
- rales
- vaccine

RESPIRATORY SYSTEM – CONSULTATION REPORT

PATIENT NAME: Mateo DIAZ

AGE: 22

DOB: June 25

SEX: Male

DATE OF CONSULTATION: April 16

CONSULTING PHYSICIAN: Joyce Mathers, MD Pulmonology

HISTORY: This 22-year-old Hispanic gentleman is referred to me for a 2-week history of new rasping cough associated with a dull right _____[Blank 1] intercostal discomfort. He has some associated _____[Blank 2] on exertion but is otherwise well with no presenting symptoms of a cold or _____[Blank 3] infection. No fever, sputum or _____[Blank 4].

PAST HISTORY: He has a history of _____[Blank 5] asthma that seemed to disappear after he hit his mid-20s. He has a history of extensive travel for work and leisure and most recently was on a work trip to Wuhan, China in late December. He receives a _____[Blank 6] annually and did have the most recent _____[Blank 7] in October 2019.

His physical exam is relatively unremarkable. Blood pressure is 120/83, respirations 12. Temperature normal at 37. Chest exam is CTA with no _____[Blank 8], rhonchi or wheezes. Even on a forced exhalation, we could not reproduce the _____[Blank 9] cough symptom.

ASSESSMENT: A PA and lateral chest _____[Blank 10] revealed a new infiltrate and _____[Blank 11]

along the left mid-lung margin all the way to the _____[Blank 12]. Spirometry showed normal pressures on forced _____[Blank 13].

PLAN

1. Rule out _____[Blank 14] pneumonia versus other lung infection or infiltrates such as granulomatosis, aspergillosis or sarcoidosis.
2. CBC with differential, chem panel, ESR, ACE, and mycoplasma titres.
3. Repeat full function tests (PFTs) in 2 weeks.

If required, will treat with Amphotericin B, Tosufloxacin, Macrolide or similar. If any of these treatments are indicated, weekly LFTs and _____[Blank 15] function testing will be required as these classes of drugs is notoriously _____[Blank 16] and nephrotoxic.

I will see the patient again in approximately 4 days to review the results and decide on a course of action – more testing or appropriate treatments as indicated above.

Joyce Mathers, MD Pulmonology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers: ³

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Medical Specialties and Procedures Related to the Respiratory System

Respiratory Medicine (Respirology)

Respiratory medicine is concerned with the diagnosis and treatment of diseases related to the respiratory system. Respiratory medicine requires in-depth knowledge of internal medicine. A physician who specializes in respirology is called a respirologist. Physicians specialize with three years in either adult or pediatric respiratory medicine in addition to three-years core training in internal medicine or pediatric medicine (Canadian Medical Association, 2018). For more information, visit the [Canadian Medical Association's information page on respirology \[PDF\]](#).

Respiratory Therapists (RTs)

Respiratory Therapists (RTs) are health care professionals that monitor, assess, and treat people who are having problems breathing. RTs are regulated, which means they must be a member of the College of Respiratory Therapists of Ontario to work as an RT in Ontario. RTs are trained in ventilation and airway management, cardiopulmonary resuscitation, oxygen and aerosol therapy. They care for patients during cardiac stress-testing, pulmonary function testing, smoking cessation, high-risk births, rehabilitation, and surgery. They treat patients with asthma, bronchitis, COPD, emphysema, heart disease, and pneumonia (College of Respiratory Therapists of Ontario, n.d.). For more information, visit the College of Respiratory Therapist's [College of Respiratory Therapist's What is a Respiratory Therapist? \[New Tab\]](#) web page.

Thoracic Surgeon

A thoracic surgeon refers to a surgeon who has specialized in either thoracic (chest) surgery or cardiothoracic (heart and chest) surgery and cares for or performs surgery for patients with serious conditions of the thorax (London Health Sciences Centre, 2020). To learn more, visit the [London Health Science Centre's Welcome to Thoracic Surgery web page \[New Tab\]](#).

Spirometry Testing

Spirometry testing is used to find out how well lungs are working by measuring air volume.

- **Respiratory volume** describes the amount of air in a given space within the lungs, or which can be moved by the lung, and is dependent on a variety of factors.
- **Tidal volume** refers to the amount of air that enters the lungs during quiet breathing, whereas inspiratory reserve volume is the amount of air that enters the lungs when a person inhales past the tidal volume.
- **Expiratory reserve volume** is the extra amount of air that can leave with forceful expiration following tidal expiration.
- **Residual volume** is the amount of air that is left in the lungs after expelling the expiratory reserve volume.
- **Respiratory capacity** is the combination of two or more volumes.
- **Anatomical dead space** refers to the air within the respiratory structures that never participates in gas exchange, because it does not reach functional alveoli.
- **Respiratory rate** is the number of breaths taken per minute, which may change during certain diseases or conditions.

Both respiratory rate and depth are controlled by the respiratory centres of the brain, which are stimulated by factors such as chemical and pH changes in the blood. These changes are sensed by central chemoreceptors, which are located in the brain, and peripheral chemoreceptors, which are located in the aortic arch and carotid arteries. A rise in carbon dioxide or a decline in oxygen levels in the blood stimulates an increase in respiratory rate and depth (Betts, et al., 2013).

Watch [Spirometry \(5 min\) on YouTube](#)

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Notes

1. Exert, 2. Breath, 3. Edema, 4. Allergens, 5. Heart failure, 6. Apnea, 7. HEENT, 8. Membranes, 9. Erythema, 10. Inspiration, 11. Lobes, 12. Edema, 13. Asthma, 14. Monitor, 15. Diuretic
1. Dyspnea, 2. Hemoptysis, 3. COPD, 4. Wheezing, 5. Basal, 6. Pleural, 7. atelectasis, 8. q. d., 9. Thoracostomy, 10. Antibiotics, 11. Oxygen
1. Mid-thoracic, 2. Dyspnea, 3. Respiratory, 4. Rhinorrhea, 5. Childhood, 6. Flu-shot, 7. Vaccine, 8. Rales, 9. Rasping, 10. X-ray, 11. Shadowing, 12. Apex, 13. Expiration, 14. Myoplasmal, 15. Urinalysis, 16. Pulmonary, 17. Kidney, 18. Hepatotoxic.

Vocabulary & Check Your Knowledge

Respiratory System Vocabulary

Alveolar Duct

A tube composed of smooth muscle and connective tissue.

Anteriorly

Pertaining to front.

Autonomic

Unconsciously regulates.

Benign

Non-cancerous.

Bronchodilators

Substance that dilates the bronchi and bronchioles.

Carcinogenic

Causing cancer.

Cardiac Notch

The cardiac notch is an indentation on the surface of the left lung.

Carina

The carina is a ridge of cartilage that separates the two main bronchi.

Cessation

Stop or stopping.

Chronic

A condition that lasts over a long time with periods of exacerbation and periods of remission.

Conducting Zone

The major functions of the conducting zone are to provide a route for incoming and outgoing air, remove debris and pathogens from the incoming air, and warm and humidify the incoming air. Several structures within the conducting zone perform other functions as well. The epithelium of the nasal passages, for example, is essential to sensing odors, and the bronchial epithelium that lines the lungs can metabolize some airborne carcinogens.

Cyanotic

Pertaining to abnormal colour of blue (bluish colour, lips and nail beds) caused by deoxygenation.

Defensins

The lysozyme enzyme and proteins which have antibacterial properties.

Diaphragm

A flat, dome shaped muscle located at the base of the lungs and thoracic cavity.

Dyspnea

Difficulty breathing.

Epiglottis

The epiglottis, attached to the thyroid cartilage, is a very flexible piece of elastic cartilage that covers the opening of the trachea.

Erythrocytes

Red blood cells.

Eupnea

Normal breathing.

Expiration

Exhalation or the process of causing air to leave the lungs.

External nose

The external nose consists of the surface and skeletal structures that result in the outward appearance of the nose and contribute to its numerous functions.

Fauces

The fauces is the opening at the connection between the oral cavity and the oropharynx.

Fibroelastic Membrane

A fibroelastic membrane is a flexible membrane that closes the posterior surface of the trachea, connecting the C-shaped cartilages.

Glottis

The glottis is composed of the vestibular folds, the true vocal cords, and the space between these folds.

Hard Palate

The hard palate is located at the anterior region of the nasal cavity and is composed of bone.

Hilum

The hilum is a ridge of cartilage that separates the two main bronchi. A concave region where blood vessels, lymphatic vessels, and nerves also enter the lungs.

Hyperpnea

Forced breathing or breathing that is excessive.

Inferior

Pertaining to below.

Inspiration

Inhalation or process of breathing air into the lungs.

Laryngeal

Pertaining to the larynx.

Laryngopharynx

The laryngopharynx borders the oropharynx, trachea, and esophagus.

Larynx

The larynx is a cartilaginous structure inferior to the laryngopharynx that connects the pharynx to the trachea and helps regulate the volume of air that enters and leaves the lungs. Also known as the voice box.

Lingual

Pertaining to the tongue.

Lymphocytes

Lymphocytes are lymph cells, a type of white blood cell.

Malignant

Cancerous.

Nasopharynx

The nasopharynx serves as an airway and is continuous with the nasal cavity.

Oropharynx

The oropharynx is a passageway for both air and food and borders the nasopharynx and the oral cavity.

Pharyngeal

Pertaining to the pharynx.

Pharyngeal Tonsils

A pharyngeal tonsil, also called an adenoid, is an aggregate of lymphoid reticular tissue similar to a lymph node that lies at the superior portion of the nasopharynx.

Pharynx

The pharynx is a tube formed by skeletal muscle and lined by mucous membrane that is continuous with that of the nasal cavities. Also known as the throat.

Posterior

Pertaining to behind.

Pulmonary Artery

The pulmonary artery is the artery that arises from the pulmonary trunk.

Respiratory Zone

The respiratory zone includes structures that are directly involved in gas exchange.

Rhinorrhea

Excessive flow or discharge from the nasal cavity (runny nose).

Septal Cartilage

The flexible portion you can touch with your fingers.

Soft Palate

The soft palate is located at the posterior portion of the nasal cavity and consists of muscle tissue.

Sympathetic

Flight or fight response.

Trachea

The trachea (windpipe) extends from the larynx toward the lungs.

Uvula

The uvula is a small bulbous, teardrop-shaped structure located at the apex of the soft palate.

Test Yourself

Respiratory System Glossary Reinforcement Activity (Text Version)

1. A small bulbous, teardrop-shaped structure located at the apex of the soft palate is called the _____[Blank 1].
 - a. Lymphocytes
 - b. Posterior
 - c. Uvula
2. Located at the anterior region of the nasal cavity and is composed of bone is the _____[Blank 2].
 - a. Glottis
 - b. Fauces
 - c. Hard Palate
3. A ridge of cartilage that separates the two main bronchi is called the _____[Blank 3].
 - a. Carina
 - b. Eupnea
 - c. Alveolar Duct
4. _____[Blank 4] serves as an airway and is continuous with the nasal cavity.
 - a. Conducting zone
 - b. Nasopharynx
 - c. Hilum
5. _____[Blank 5] consists of the surface and skeletal structure that result in the outward appearance of the nose and contribute to its numerous functions.
 - a. Pharynx
 - b. Inferior
 - c. External nose

Check your answers: ¹

Activity source: Respiratory System Glossary Reinforcement Activity by Gisele Tuzon, licensed under [CC BY 4.0](#)./Text version added.

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Notes

1. 1. Uvula, 2. Hard Palate, 3. Carina, 4. Nasopharynx, 5. External nose

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CHAPTER 5: URINARY SYSTEM

Building a Medical Terminology Foundation 2e by Kimberlee Carter; Marie Rutherford; and Connie Stevens

- [5.1 – Introduction to the Urinary System](#)
- [5.2 – Anatomy \(Structures\) of the Urinary System](#)
- [5.3 – Physiology \(Function\) of the Urinary System](#)
- [5.4 – Urinary Diseases, Disorders and Diagnostic Testing](#)
- [Vocabulary & Check Your Knowledge](#)
- [References](#)

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Please visit the web version of [Building a Medical Terminology Foundation 2e](#) to access the complete book, interactive activities and ancillary resources.

5.1 - Introduction to the Urinary System

Learning Objectives

- Identify the anatomy and describe the main functions of the urinary system
- Analyze, translate, and define medical terms and common abbreviations of the urinary system
- Practice the spelling and pronunciation of urinary system medical terminology
- Identify the medical specialties associated with the urinary system and explore common diseases, disorders, diagnostic tests and procedures

Urinary System Word Parts

Click on prefixes, combining forms, and suffixes to reveal a list of word parts to memorize for the urinary system.

Urinary System Word Parts

Prefix

- **a-** (absence of, without)
- **an-** (absence of, without)
- **dia-** (through, complete)
- **dys-** (painful, abnormal, difficult, laboured)
- **poly-** (many, much)

Combining Forms

- **albumin/o** (albumin)
- **azot/o** (urea, nitrogen)
- **blast/o** (developing cell, germ cell)
- **cyst/o** (bladder, sac)

- **glomerul/o** (glomerulus)
- **glyc/o** (sugar)
- **glycos/o** (sugar)
- **hydr/o** (water)
- **lith/o** (stone, calculus)
- **meat/o** (meatus)
- **nephr/o** (kidney)
- **noct/i** (night)
- **olig/o** (few, scanty)
- **pyel/o** (renal pelvis)
- **ren/o** (kidney)
- **ureter/o** (ureter)
- **urethr/o** (urethra)
- **urin/o** (urine, urinary tract)
- **ur/o** (urine, urinary tract)
- **vesic/o** (bladder, sac)

Suffix

- **-al** (pertaining to)
- **-ary** (pertaining to)
- **-cele** (hernia, protrusion)
- **-emia** (in the blood)
- **-gram** (the record, radiographic image)
- **-graph** (instrument used to record)
- **-graphy** (process of recording, radiographic imaging)
- **-iasis** (condition)
- **-esis** (condition)
- **-itis** (inflammation)
- **-lith** (stone)
- **-lysis** (loosening, dissolution, separating)
- **-megaly** (enlarged, enlargement)
- **-oma** (tumour, swelling)
- **-osis** (abnormal condition)
- **-ptosis** (drooping, sagging, prolapse)
- **-rrhaphy** (suturing, repairing)
- **-scope** (instrument used for visual examination)
- **-scopic** (pertaining to visual examination)
- **-scopy** (visual examination)
- **-stomy** (creation of an artificial opening)
- **-tomy** (cut into, incision)
- **-tripsy** (surgical crushing)
- **-uria** (urine, urination)

Activity source: Urinary System Word Parts by Kimberlee Carter, from [Building a Medical Terminology Foundation](#), licensed under [CC BY 4.0](#). / Text version added.

Introduction to the Urinary System

The urinary system has roles you may be well aware of. Cleansing the blood and ridding the body of wastes probably come to mind. However, there are additional, equally important functions, played by the system. For example, regulation of **pH**, a function shared with the lungs and the buffers in the blood. Additionally, the regulation of blood pressure is a role shared with the heart and blood vessels. What about regulating the concentration of **solutes** in the blood? Did you know that the kidney is important in determining the concentration of red blood cells? Eighty-five percent of the erythropoietin (EPO) produced to stimulate red blood cell production is produced in the kidneys. The kidneys also perform the final synthesis step of vitamin D production, converting calcidiol to calcitriol, the active form of vitamin D. If the kidneys fail, these functions are compromised or lost altogether, with devastating effects on **homeostasis**.

Watch [Urinary System, Part 1: Crash Course Anatomy & Physiology #38 \(10 min\) on YouTube](#)

Urinary System Medical Terms

Urinary System Medical Terms

1. **albuminuria**
 - albumin/uria
 - albumin in the urine
2. **azotemia**
 - azot/emia
 - urea in the blood
3. **cystectomy**
 - cyst/ectomy
 - excision of the bladder

4. **cystolithotomy**
 - cyst/o/lith/o/tomy
 - incision into the bladder to remove stone(s)
5. **cystorrhaphy**
 - cyst/o/rrhaphy
 - suturing the bladder
6. **cystostomy**
 - cyst/o/stomy
 - creation of an artificial opening into the bladder
7. **cystotomy**
 - cyst/o/tomy
 - incision into the bladder
8. **cystogram**
 - cyst/o/gram
 - radiographic image of the bladder
9. **cystography**
 - cyst/o/graphy
 - radiographic imaging of the bladder
10. **cystoscope**
 - cyst/o/scope
 - instrument used for visual examination of the bladder
11. **cystoscopy**
 - cyst/o/scopy
 - visual examination of the bladder
12. **cystitis**
 - cyst/itis
 - inflammation of the bladder
13. **cystocele**
 - cyst/o/cele
 - protrusion of the bladder
14. **cystolith**

- cyst/o/lith
 - stone(s) in the bladder
15. **glomerulonephritis**
- glomerul/o/nephr/itis
 - inflammation of the gomeruli of the kidney
16. **glycosuria**
- glycos/uria
 - sugar (glucose) in the urine
17. **hydronephrosis**
- hydro/nephr/osis
 - abnormal condition of water in the kidney
18. **lithotripsy**
- lith/o/tripsy
 - surgical crushing of stone(s)
19. **meatotomy**
- meat/o/tomy
 - incision into the meatus
20. **meatal**
- meat/al
 - pertaining to the meatus
21. **nephritis**
- nephr/itis
 - inflammation of the kidney
22. **nephrolithiasis**
- nephr/o/lith/iasis
 - condition of stone(s) in the kidney
23. **nephroma**
- nephr/oma
 - tumour of kidney
24. **nephromegaly**
- nephr/o/megaly

- enlarged kidney
- 25. **nephroptosis**
 - nephr/o/ptosis
 - drooping kidney
- 26. **nephrectomy**
 - nephr/ectomy
 - excision of the kidney
- 27. **nephrolitotomy**
 - nephr/o/lith/o/tomy
 - incision into the kidney to remove stone(s)
- 28. **nephrolithotripsy**
 - nephr/o/lith/o/tripsy
 - surgical crushing of stone(s) in the kidney
- 29. **nephrolysis**
 - nephr/o/lysis
 - separating the kidney (from body structures)
- 30. **nephropexy**
 - nephr/o/pexy
 - surgical fixation of the kidney
- 31. **nephrostomy**
 - nephr/o/stomy
 - creation of an artificial opening into the kidney
- 32. **nephrography**
 - nephr/o/graphy
 - radiographic imaging of the kidney
- 33. **nephroscopy**
 - nephr/o/scopy
 - process of viewing the kidney
- 34. **nephrosonography**
 - nephr/o/son/o/graphy
 - process of recording the kidney using sound

35. **nephrologist**
 - nephr/o/logist
 - specialist who studies and treats disease and disorders of the kidney
36. **nephrology**
 - nephr/o/logy
 - study of the kidney
37. **nocturia**
 - noct/uria
 - night urination
38. **oliguria**
 - olig/uria
 - scanty urine (output)
39. **pyelitis**
 - pyel/itis
 - inflammation of the renal pelvis
40. **pyelonephritis**
 - pyel/o/nephr/itis
 - inflammation of the renal pelvis and the kidney
41. **pyelolithotomy**
 - pyel/o/lith/o/tomy
 - incision into the renal pelvis
42. **pyeloplasty**
 - pyel/o/plasty
 - surgical repair of the renal pelvis
43. **renogram**
 - ren/o/gram
 - radiographic record of the kidney
44. **ureteritis**
 - ureter/itis
 - inflammation of the ureter
45. **ureterectomy**

- ureter/ectomy
 - excision of the ureter
46. **ureterostomy**
- ureter/o/stomy
 - creation of an artificial opening into the ureter
47. **ureterocele**
- ureter/o/cele
 - protrusion of a ureter
48. **ureterolithiasis**
- ureter/o/lith/iasis
 - condition of stone(s) in the ureter
49. **ureterostenosis**
- ureter/o/stenosis
 - narrowing of the ureter
50. **ureteroscopy**
- ureter/o/scopy
 - visual examination of the ureter(s)
51. **urethrocystitis**
- urethr/o/cyst/itis
 - inflammation of the urethra and the bladder
52. **anuria**
- an/uria
 - absence of urine
53. **diuresis**
- di/ur/esis
 - condition of urine passing through
(increased excretion of urine)
54. **dysuria**
- dys/uria
 - difficult or painful urine
55. **urinary**

- urin/ary
 - pertaining to urine
56. **retrograde urogram**
- retrograde ur/o/gram
 - radiographic image of the urinary tract
57. **ureteroscopy**
- ureter/o/scopy
 - visual examination of the ureter(s)
58. **urogram**
- ur/o/gram
 - radiographic image of the urinary tract
59. **hematuria**
- hemat/uria
 - blood in the urine
60. **polyuria**
- poly/uria
 - excessive urine
61. **pyuria**
- py/uria
 - pus in the urine
62. **urinary**
- urin/ary
 - pertaining to urine
63. **urologist**
- ur/o/logist
 - physician who studies and treats diseases of the urinary tract
64. **urology**
- ur/o/logy
 - study of the urinary tract
65. **vesicotomy**
- vesic/o/tomy

- incision into the bladder

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5.2 - Anatomy (Structures) of the Urinary System

Kidney(s)

The kidneys lie on either side of the spine in the retroperitoneal space between the parietal peritoneum and the posterior abdominal wall, well protected by muscle, fat, and ribs. They are roughly the size of your fist. The male kidney is typically a bit larger than the female kidney. The kidneys are well vascularized, receiving about twenty-five percent of the cardiac output at rest. [Figure 5.1](#) displays the location of the kidneys.

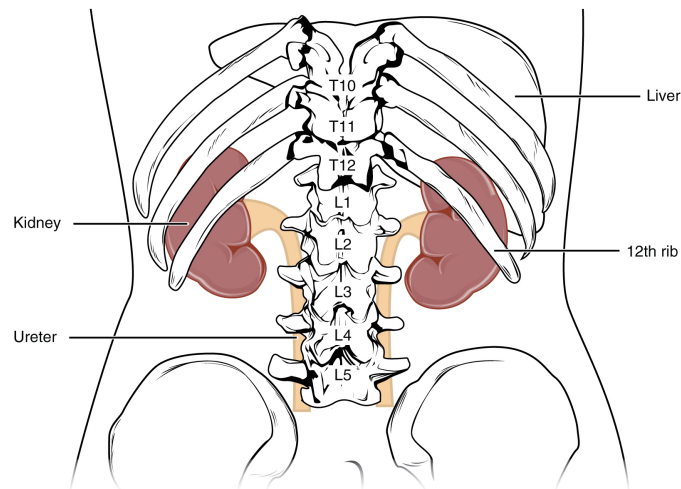


Figure 5.1 Kidneys. The kidneys are slightly protected by the ribs and are surrounded by fat for protection (not shown). From Betts, et al., 2013. Licensed under [CC BY 4.0](#).

Did You Know?

The right kidney is smaller than the left. It also sits slightly lower to make room for the liver located on the right side of your body.

Kidneys' Internal Structure

A frontal section through the kidney reveals an outer region called the renal cortex and an inner region called the **medulla** (see [Figure 5.2](#)). The **renal columns** are connective tissue extensions that radiate downward from the cortex through the medulla to separate the most characteristic features of the medulla, the **renal pyramids** and **renal papillae**. The papillae are bundles of collecting ducts that transport urine made by nephrons to the **calyces** of the kidney for **excretion**. The renal columns also serve to divide the kidney into 6–8 lobes and provide a supportive framework for vessels that enter and exit the cortex. The pyramids and renal columns taken together constitute the kidney lobes.

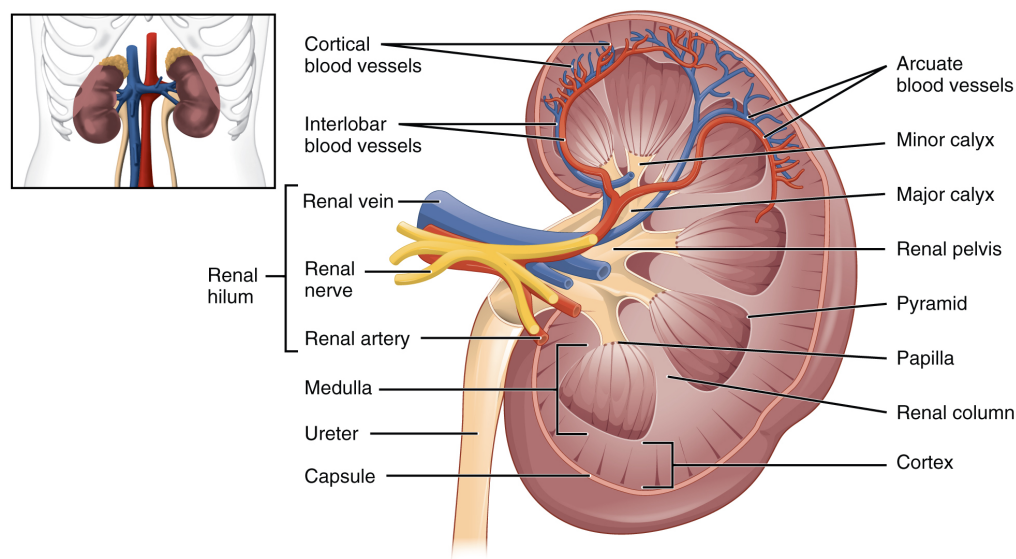


Figure 5.2 Left Kidney. From Betts, et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 5.2 Image description](#).]

Renal Hilum

The **renal hilum** is the entry and exit site for structures servicing the kidneys: vessels, nerves, lymphatics, and ureters. The medial-facing hila are tucked into the sweeping convex outline of the cortex. Emerging from the hilum is the renal pelvis, which is formed from the major and minor **calyces** in the kidney. The smooth muscle in the renal pelvis funnels urine via **peristalsis** into the ureter. The renal arteries form directly from the descending aorta, whereas the renal veins return cleansed blood directly to the inferior vena cava. The artery, vein, and renal pelvis are arranged in an anterior-to-posterior order.

Nephrons and Vessels

The renal artery first divides into segmental arteries, followed by further branching to form interlobar arteries that pass through the renal columns to reach the cortex (see [Figure 5.3](#)). The **interlobar** arteries branch into

arcuate arteries, cortical **radiate** arteries, and then into afferent arterioles. The afferent arterioles service about 1.3 million nephrons in each kidney.

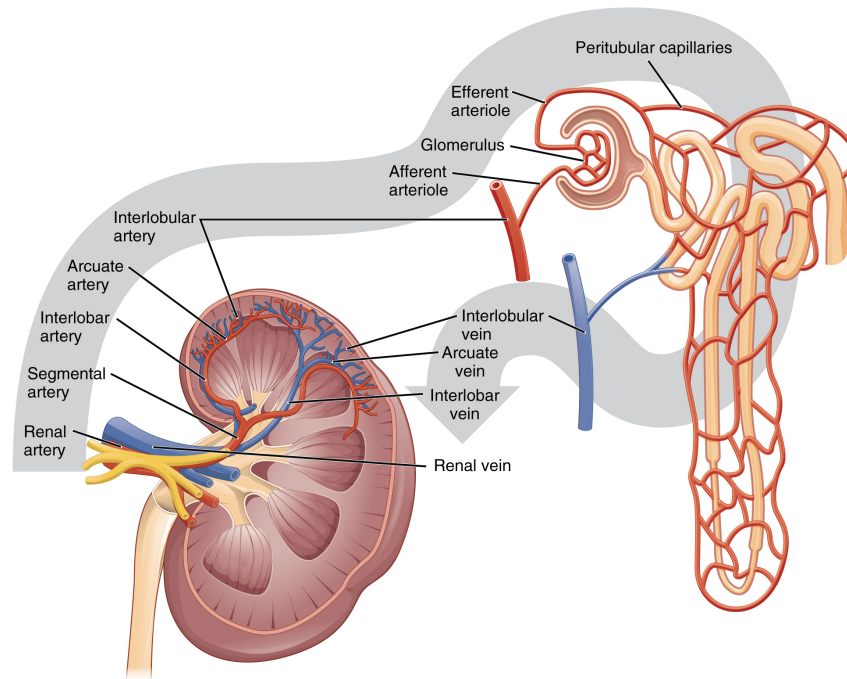


Figure 5.3 Blood Flow in the Kidney. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).
[\[Fig 5.3 Image Description\]](#)

Nephrons are the “functional units” of the kidney; they cleanse the blood and balance the constituents of the circulation. The afferent arterioles form a tuft of high-pressure capillaries about 200 μm in diameter, the **glomerulus**. The rest of the nephron consists of a continuous sophisticated tubule whose proximal end surrounds the glomerulus—this is **Bowman’s capsule**. Together, the glomerulus and Bowman’s capsule form the **renal corpuscle**. As mentioned earlier, these glomerular capillaries filter the blood based on particle size. After passing through the renal corpuscle, the capillaries form a second arteriole, the **efferent arteriole** (see [Figure 5.4](#)). These will next form a capillary network around the more distal portions of the nephron tubule, the **peritubular capillaries** and **vasa recta**, before returning to the venous system. As the glomerular filtrate progresses through the nephron, these capillary networks recover most of the solutes and water, and return them to the circulation. Since a capillary bed (the glomerulus) drains into a vessel that in turn forms a second capillary bed, the definition of a portal system is met. This is the only portal system in which an arteriole is found between the first and second capillary beds. Portal systems also link the hypothalamus to the anterior pituitary, and the blood vessels of the digestive viscera to the liver.

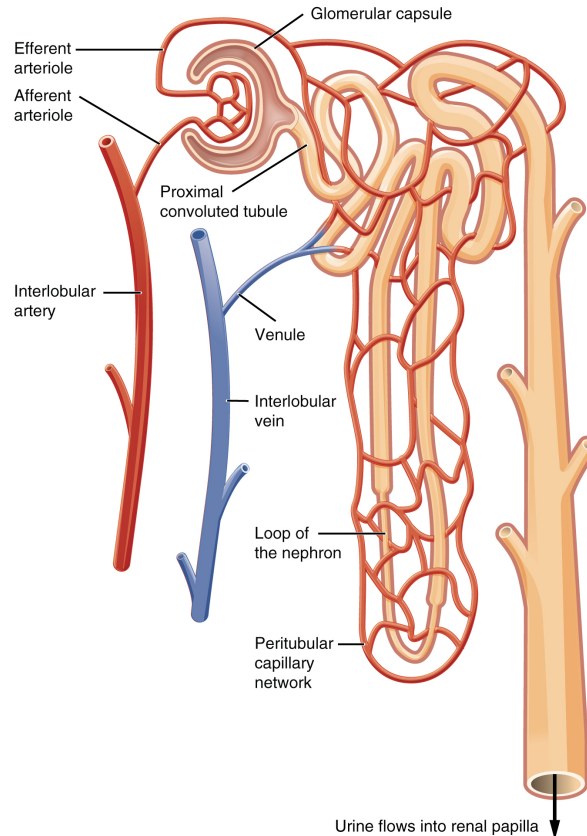


Figure 5.4. Blood Flow in the Nephron. The two capillary beds are clearly shown in this figure. The efferent arteriole is the connecting vessel between the glomerulus and the peritubular capillaries and vasa recta. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).

Ureter(s)

The kidneys and ureters are completely **retroperitoneal**, and the bladder has a **peritoneal** covering only over the dome. As urine is formed, it drains into the **calyces** of the kidney, which merge to form the funnel-shaped renal pelvis in the hilum of each kidney. The hilum narrows to become the **ureter** of each kidney. As urine passes through the ureter, it does not passively drain into the bladder but rather is propelled by waves of **peristalsis**. The ureters are approximately 30 cm long. The inner mucosa is lined with transitional epithelium and scattered **goblet** cells that secrete protective mucus. The muscular layer of the ureter consists of longitudinal and circular smooth muscles that create the peristaltic contractions to move the urine into the bladder without the aid of gravity. Finally, a loose **adventitial** layer composed of **collagen** and fat anchors the ureters between the parietal peritoneum and the posterior abdominal wall.

Bladder

The urinary bladder collects urine from both ureters (see [Figure 5.5](#)). The bladder lies anterior to the uterus in females, posterior to the pubic bone and anterior to the rectum. During late pregnancy, its capacity is reduced due to compression by the enlarging uterus, resulting in increased frequency of urination. In males, the anatomy is similar, minus the uterus, and with the addition of the prostate inferior to the bladder. The bladder is partially retroperitoneal (outside the peritoneal cavity) with its peritoneal-covered “dome” projecting into the abdomen when the bladder is distended with urine.

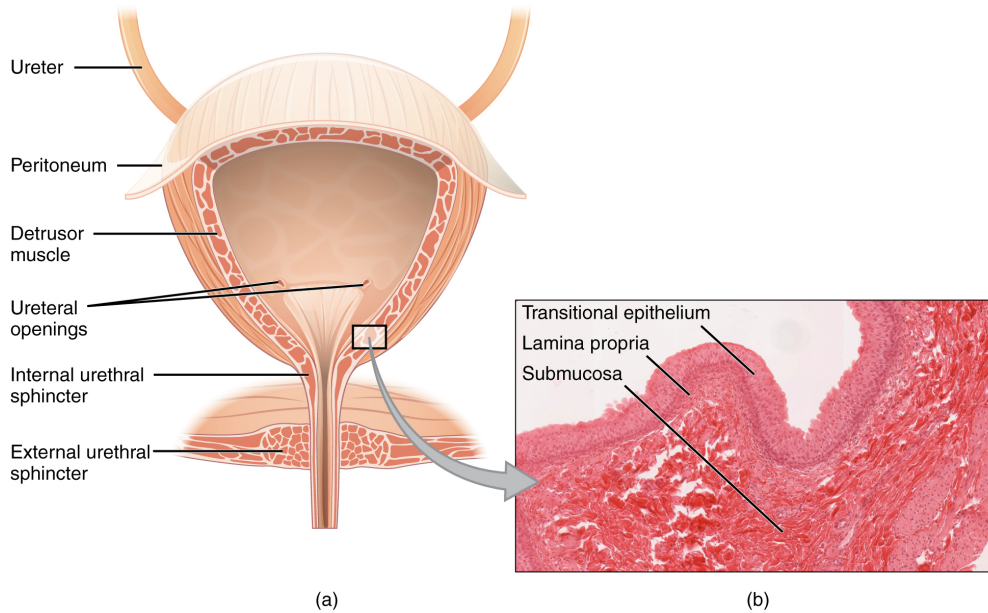


Figure 5.5 Bladder. (a) Anterior cross section of the bladder. (b) The detrusor muscle of the bladder (source: monkey tissue) LM × 448. (Micrograph provided by the Regents of the University of Michigan Medical School © 2012). From Betts, et al., 2013. Licensed under [CC BY 4.0](#).

Urethra

The urethra transports urine from the bladder to the outside of the body for disposal. The urethra is the only urologic organ that shows any significant anatomic difference between males and females; all other urine transport structures are identical (see [Figure 5.6](#)).

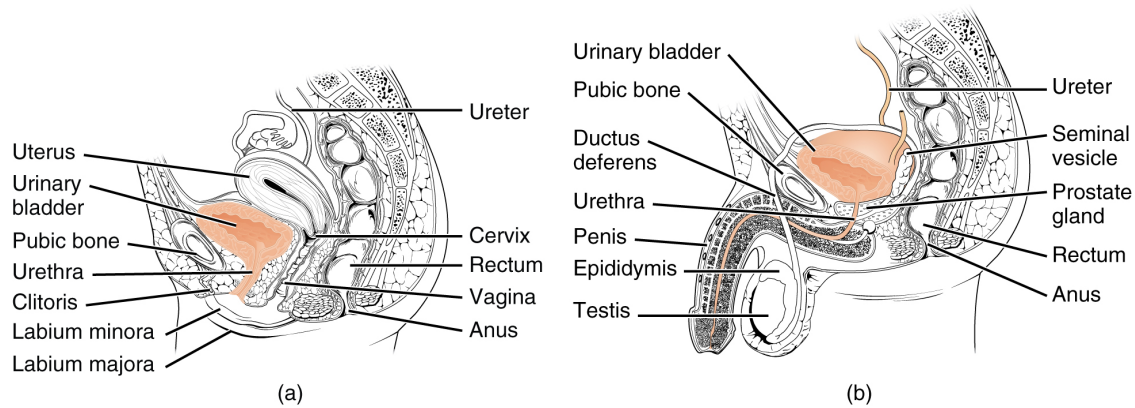


Figure 5.6. Female and Male Urethras. The urethra transports urine from the bladder to the outside of the body. This image shows (a) a female urethra and (b) a male urethra. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).

The urethra in both males and females begins inferior and central to the two ureteral openings forming the three points of a triangular-shaped area at the base of the bladder called the trigone (Greek tri- = “triangle” and the root of the word “trigonometry”). The urethra tracks posterior and inferior to the pubic symphysis (see [Figure 5.6](#)). In both males and females, the proximal urethra is lined by transitional epithelium, whereas the terminal portion is a nonkeratinized, stratified squamous epithelium. In the male, **pseudostratified** columnar epithelium lines the urethra between these two cell types. **Voiding** is regulated by an involuntary **autonomic** nervous system-controlled internal urinary sphincter, consisting of smooth muscle and voluntary skeletal muscle that forms the external urinary sphincter below it.

Micturition Reflex

Micturition is a less-often used, but proper term for **urination** or **voiding**. It results from an interplay of involuntary and voluntary actions by the internal and external urethral sphincters. When bladder volume reaches about 150 mL, an urge to void is sensed but is easily overridden. Voluntary control of urination relies on consciously preventing relaxation of the external urethral sphincter to maintain urinary continence. As the bladder fills, subsequent urges become harder to ignore. Ultimately, voluntary constraint fails with resulting incontinence, which will occur as bladder volume approaches 300 to 400 mL.

- Normal micturition is a result of stretch **receptors** in the bladder wall that transmit nerve impulses to the sacral region of the spinal cord to generate a spinal reflex. The resulting parasympathetic neural outflow causes contraction of the **detrusor** muscle and relaxation of the involuntary internal urethral sphincter.
- At the same time, the spinal cord inhibits somatic motor neurons, resulting in the relaxation of the skeletal muscle of the external urethral **sphincter**.
- The micturition reflex is active in infants but with maturity, children learn to override the reflex by asserting external sphincter control, thereby delaying voiding (potty training). This reflex may be preserved even in the face of spinal cord injury that results in paraplegia or quadriplegia. However, relaxation of the external sphincter may not be possible in all cases, and therefore, periodic catheterization may be necessary for bladder emptying.

Nerves involved in the control of urination include the hypogastric, pelvic, and pudendal. Voluntary micturition requires an intact spinal cord and functional pudendal nerve arising from the sacral micturition center. Since the external urinary sphincter is voluntary skeletal muscle, actions by cholinergic neurons maintain contraction (and thereby continence) during filling of the bladder. At the same time, sympathetic nervous activity via the hypogastric nerves suppresses contraction of the detrusor muscle. With further bladder stretch, afferent signals traveling over sacral pelvic nerves activate parasympathetic neurons. This activates efferent neurons to release acetylcholine at the neuromuscular junctions, producing detrusor contraction and bladder emptying.

Did You Know?

A healthy adult bladder can store up to 455 millilitres of urine for between two to five hours.

Check Your Knowledge of Urinary Systems

Concept Check

- Describe **two** organs or **structures** essential to the urinary system.
- Identify the **structure** within the kidneys which filters blood.
- Name a commonly used term for the **micturition reflex**.

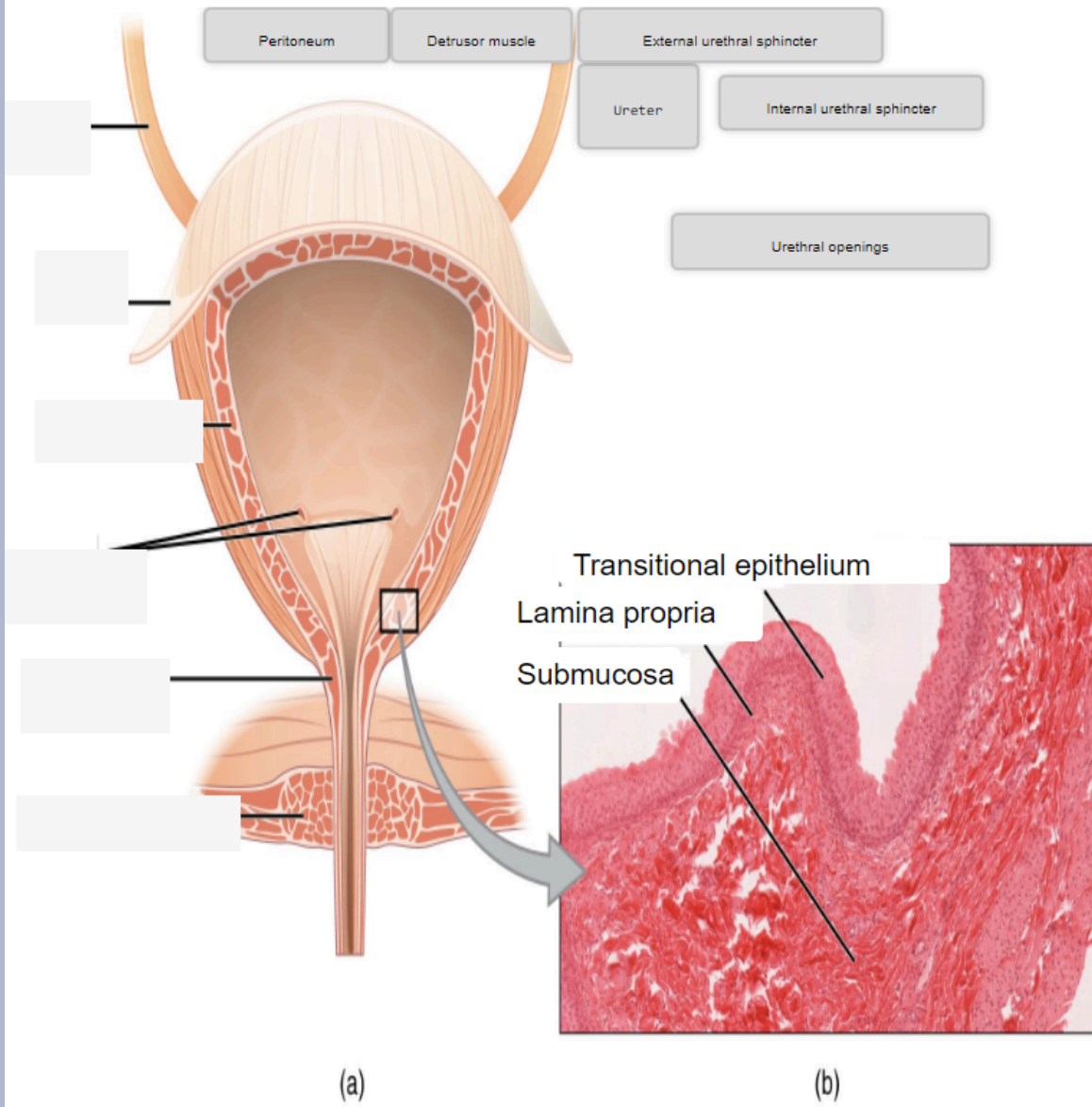
Anatomy Labeling Activity

Urinary System Bladder Anatomy (Text Version)

Label the diagram correctly with the following words:

1. Peritoneum
2. Detrusor muscle
3. External urethral sphincter
4. Ureter
5. Internal urethral sphincter
6. Ureteral opening

Urinary System Bladder Anatomy



Urinary System Bladder Anatomy Diagram (Text Version)

This figure shows the cross section of the bladder, and the major parts are identified from top to bottom. The tube leading to the bladder is known as the _____[Blank 1]. Surrounding the bladder is a membranous cover called the _____[Blank 2]. The walls of the bladder are formed by _____[Blank 3], which allows the bladder to contract to excrete urine or relax to hold urine. The right panel shows a micrograph of the bladder. The _____[Blank 4] are found inside the bladder wall allowing for the ureters to enter and deposit urine formed from the kidneys. In the lower portion of the bladder is two sphincter muscles the internal one is the _____[Blank 5] and the _____[Blank 6]. These sphincter muscles open and close controlling the flow of urine out of the bladder and into the urethra to be carried to the outside of the body.

Check your answers: ¹

Activity source: Urinary System Bladder Anatomy by Kimberlee Carter, from [Building a Medical Terminology Foundation](#), illustration from [Anatomy and Physiology \(OpenStax\)](#), licensed under [CC BY 4.0](#). / Text version added.

Image Descriptions

Figure 5.1 image description: This illustration shows an anterior view of the abdominal area. The liver is prominently positioned in the upper right quadrant, partially overlapping the right kidney. The 12th rib is visible, arching above the upper portion of the kidneys. The ureters are shown descending from the kidneys, running vertically down towards the bladder [\[Return to image 5.1\]](#).

Figure 5.2 image description: This illustration shows a frontal section through a kidney. Working clockwise from the top of the image is the arcuate blood vessels. The minor and major calyx is shown followed by the renal pelvis, pyramid, and papilla. The renal column is connective tissue radiating downward towards the renal cortex. The capsule is a tough outer layer surrounding the kidney. The ureter extends from the kidney towards the bladder. The medulla is the inner component of the kidney. The hilum is a small opening structure, allowing for the renal artery, renal nerve and renal vein to enter and exit the kidney. Above the renal vein is the interlobar blood vessels followed by the cortical blood vessels [\[Return to Figure 5.2\]](#).

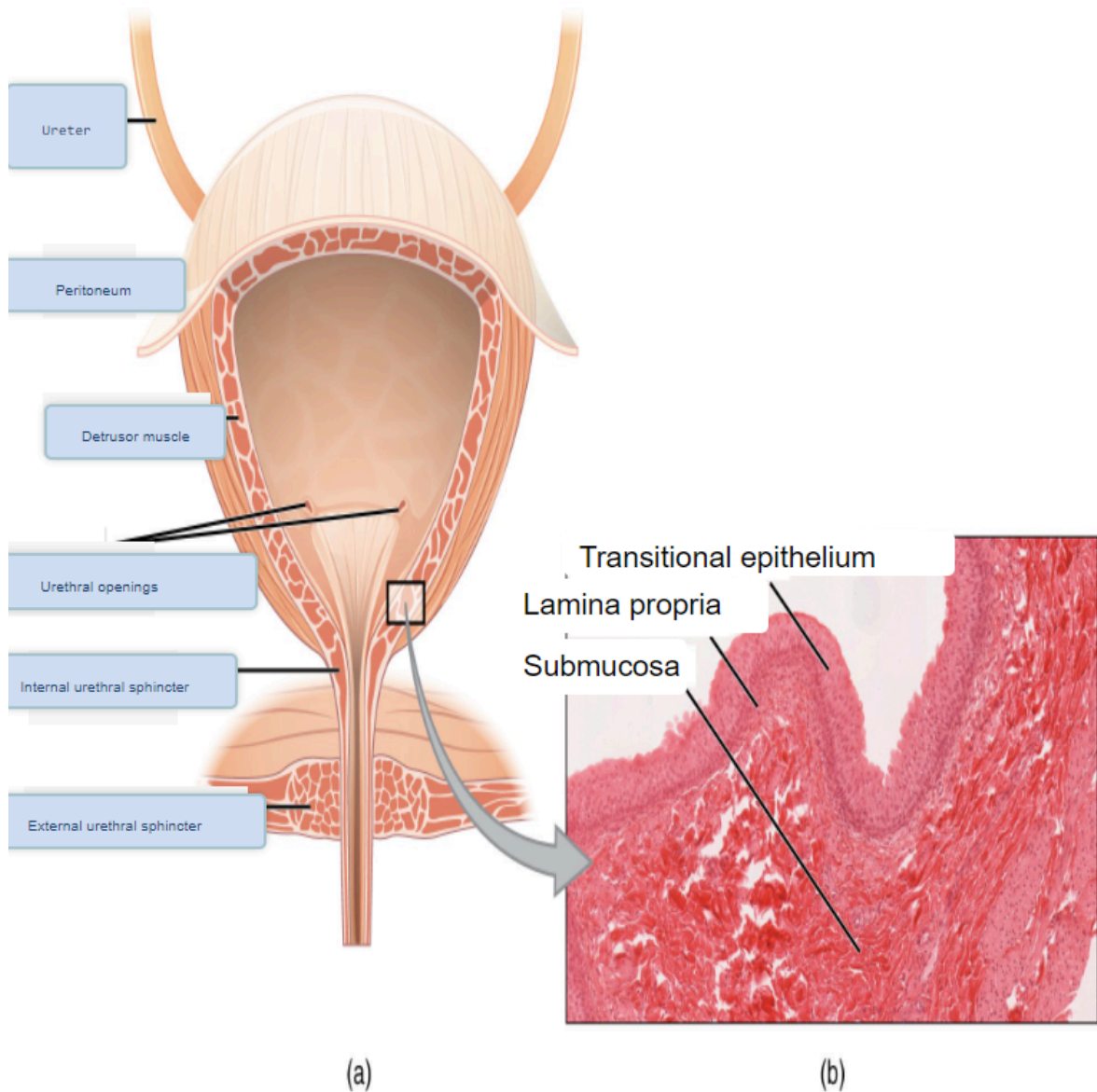
Figure 5.3 image description: The illustration is an anatomical view of the human kidney and its blood supply system. Displayed is the internal structure of the kidney, including the renal artery, interlobar artery, arcuate artery, interlobular artery, and afferent arterioles leading to the glomerulus. The glomerulus is connected to efferent arterioles, which lead to peritubular capillaries. The illustration also depicts the flow of blood from these vessels into the renal vein. [\[Return to Figure 5.3\]](#).

Attribution

Except where otherwise noted, this chapter is adapted from “[Urinary System](#)” In [Building a Medical Terminology Foundation](#) by Kimberlee Carter and Marie Rutherford, licensed under [CC BY 4.0](#). / A derivative of Betts et al., which can be accessed for free from [Anatomy and Physiology \(OpenStax\)](#). Adaptations: dividing Urinary System chapter content into sub-chapters.

Notes

Urinary System Bladder Anatomy



1.

Check your Answer: Urinary System Bladder Anatomy Diagram (Text Version) This figure shows the cross section of the bladder, and the major parts are identified from top to bottom. The tube leading to the bladder is known as the **ureter**. Surrounding the bladder is a membranous cover called the **peritoneum**. The walls of the bladder are formed by **detrusor muscle**, which allows the bladder to contract to excrete urine or relax to hold urine. The right panel shows a micrograph of the bladder. The **ureteral openings** are found inside the bladder wall allowing for the ureters to enter and deposit urine formed from the kidneys. In the lower portion of the bladder is two sphincter muscles the internal one is the **internal urethral sphincter** and the **external urethral sphincter**. These sphincter muscles open and close controlling the flow of urine out of the bladder and into the urethra to be carried to the outside of the body.

5.3 - Physiology (Function) of the Urinary System

- Remove waste products and medicines from the body.
- Balance the body's fluids.
- Balance a variety of electrolytes.
- Release hormones to control blood pressure.
- Release a hormone to control red blood cell production.
- Help with bone health by controlling calcium and phosphorus.

Having reviewed the anatomy of the urinary system, now is the time to focus on physiology. You will discover that different parts of the **nephron** utilize specific processes to produce urine: **filtration**, **reabsorption**, and **secretion**. You will learn how each of these processes works and where they occur along the nephron and collecting ducts. The physiologic goal is to modify the composition of the plasma and, in doing so, produce the waste product: urine.

Nephrons: The Functional Unit

Nephrons take a simple filtrate of the blood and modify it into urine. Many changes take place in the different parts of the nephron before urine is created for disposal. The term “forming urine” will be used hereafter to describe the **filtrate** as it is modified into true urine. The principal task of the nephron population is to balance the **plasma** to homeostatic set points and excrete potential toxins in the urine. They do this by accomplishing three principle functions—filtration, reabsorption, and secretion. They also have additional secondary functions that exert control in three areas: blood pressure (via the production of renin), red blood cell production (via the hormone EPO), and calcium absorption (via the conversion of calcidiol into calcitriol, the active form of vitamin D).

Loop of Henle

The descending and ascending portions of the loop of Henle (sometimes referred to as the **nephron** loop) are, of course, just continuations of the same tubule. They run adjacent and parallel to each other after having made a hairpin turn at the deepest point of their descent. The descending loop of Henle consists of an initial short, thick portion and long, thin portion, whereas the ascending loop consists of an initial short, thin portion followed by a long, thick portion. The descending and ascending thin portions consist of simple squamous epithelium. Different portions of the loop have different **permeabilities** for solutes and water.

Collecting Ducts

The collecting ducts are continuous with the nephron but are not technically part of it. In fact, each duct collects

filtrate from several nephrons for final modification. Collecting ducts merge as they descend deeper in the medulla to form about 30 terminal ducts, which empty at a papilla.

Glomerular Filtration Rate (GFR)

The volume of filtrate formed by both kidneys per minute is termed the **glomerular filtration rate** (GFR). The heart pumps about 5 L of blood per minute under resting conditions. Approximately 20 percent or one litre enters the kidneys to be filtered. On average, this litre results in the production of about 125 mL/minute filtrate produced in men (range of 90 to 140 mL/minute) and 105 mL/minute filtrate produced in women (range of 80 to 125 mL/minute). This amount equates to a volume of about 180 L/day in men and 150 L/day in women. Ninety-nine percent of this filtrate is returned to the circulation by reabsorption so that only about 1–2 litres of urine are produced per day.

GFR is influenced by the hydrostatic pressure and colloid osmotic pressure on either side of the capillary membrane of the glomerulus. Recall that filtration occurs as pressure forces fluid and solutes through a **semipermeable** barrier with the solute movement constrained by particle size. **Hydrostatic** pressure is the pressure produced by a fluid against a surface. If you have fluid on both sides of a barrier, both fluids exert pressure in opposing directions. The net fluid movement will be in the direction of the lower pressure. **Osmosis** is the movement of solvent (water) across a membrane that is **impermeable** to a solute in the solution. This creates osmotic pressure which will exist until the solute concentration is the same on both sides of a semipermeable membrane. As long as the concentration differs, water will move. Glomerular filtration occurs when glomerular hydrostatic pressure exceeds the luminal **hydrostatic** pressure of Bowman's capsule. There is also an opposing force, the osmotic pressure, which is typically higher in the glomerular capillary. To understand why this is so, look more closely at the microenvironment on either side of the filtration membrane.

You will find osmotic pressure exerted by the solutes inside the lumen of the capillary as well as inside of Bowman's capsule. Since the filtration membrane limits the size of particles crossing the membrane, the osmotic pressure inside the glomerular **capillary** is higher than the osmotic pressure in Bowman's capsule. Recall that cells and the medium-to-large proteins cannot pass between the podocyte processes or through the fenestrations of the capillary endothelial cells. This means that red and white blood cells, platelets, **albumins**, and other proteins too large to pass through the filter remain in the capillary, creating an average **colloid** osmotic pressure of 30 mm Hg within the capillary. The absence of proteins in Bowman's space (the lumen within Bowman's capsule) results in an osmotic pressure near zero. Thus, the only pressure moving fluid across the capillary wall into the lumen of Bowman's space is hydrostatic pressure. Hydrostatic (fluid) pressure is sufficient to push water through the membrane despite the osmotic pressure working against it. The sum of all of the influences, both osmotic and hydrostatic, results in a net filtration pressure (NFP) of about 10 mm Hg (see [Figure 5.7](#)).

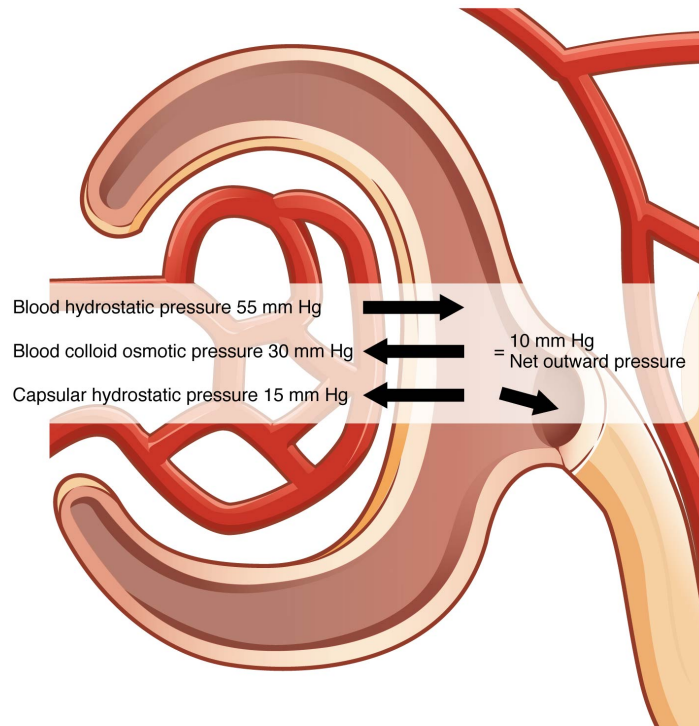


Figure 5.7 Net Filtration Pressure. The NFP is the sum of osmotic and hydrostatic pressures. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [Fig. 5.7 Image description.]

A proper concentration of solutes in the blood is important in maintaining osmotic pressure both in the glomerulus and systemically. There are disorders in which too much protein passes through the filtration slits into the kidney filtrate. This excess protein in the filtrate leads to a deficiency of circulating **plasma** proteins. In turn, the presence of protein in the urine increases its osmolarity; this holds more water in the filtrate and results in an increase in urine volume. Because there is less circulating protein, principally albumin, the osmotic pressure of the blood falls. Less osmotic pressure pulling water into the capillaries tips the balance towards hydrostatic pressure, which tends to push it out of the capillaries. The net effect is that water is lost from the circulation to interstitial tissues and cells. This “plumps up” the tissues and cells, a condition termed systemic edema.

Reabsorption and Secretion

The renal corpuscle filters the blood to create a filtrate that differs from blood mainly in the absence of cells and large proteins. From this point to the ends of the collecting ducts, the filtrate or forming urine is undergoing modification through **secretion** and **reabsorption** before true urine is produced. Here, some substances are reabsorbed, whereas others are secreted. Note the use of the term “reabsorbed.” All of these substances were “absorbed” in the digestive tract—99 percent of the water and most of the solutes filtered by the nephron must be reabsorbed. Water and substances that are reabsorbed are returned to the circulation by the peritubular and vasa recta capillaries.

It is vital that the flow of blood through the kidney is at a suitable rate to allow for filtration. This rate determines how much solute is retained or discarded, how much water is retained or discarded, and ultimately, the **osmolarity** of blood and the blood pressure of the body.

Urinalysis

Urinalysis (urine analysis) often provides clues to renal disease. Normally, only traces of protein are found in urine, and when higher amounts are found, damage to the glomeruli is the likely basis. Unusually large quantities of urine may point to diseases like diabetes mellitus or **hypothalamic** tumors that cause diabetes insipidus. The color of urine is determined mostly by the breakdown products of red blood cell destruction (see [Figure 5.8](#)). The “heme” of **hemoglobin** is converted by the liver into water-soluble forms that can be excreted into the **bile** and indirectly into the urine. This yellow pigment is urochrome. Urine color may also be affected by certain foods like beets, berries, and fava beans. A kidney stone or a cancer of the urinary system may produce sufficient bleeding to manifest as pink or even bright red urine. Diseases of the liver or obstructions of bile drainage from the liver impart a dark “tea” or “cola” hue to the urine. **Dehydration** produces darker, concentrated urine that may also possess the slight odour of **ammonia**. Most of the ammonia produced from protein breakdown is converted into **urea** by the liver, so ammonia is rarely detected in fresh urine. The strong ammonia odour you may detect in bathrooms or alleys is due to the breakdown of urea into ammonia by bacteria in the environment. About one in five people detect a distinctive odour in their urine after consuming asparagus; other foods such as onions, garlic, and fish can impart their own aromas. These food-caused odours are harmless.

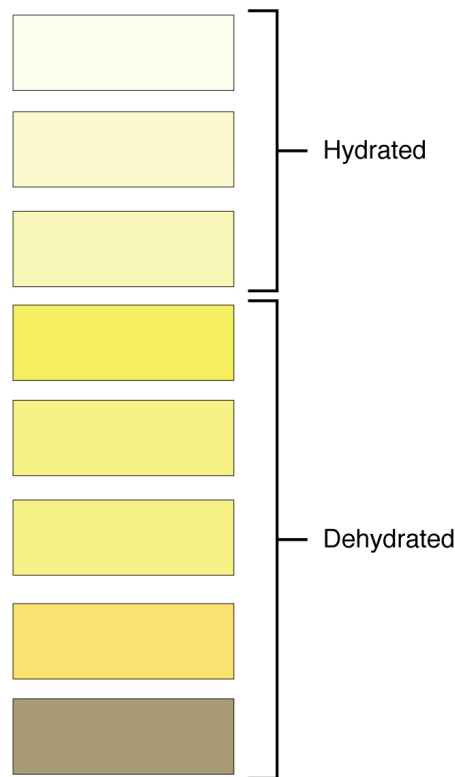


Figure 5.8 Urine Color. From Betts, et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 5.8 Image description.](#)]

The kidneys must produce a minimum urine volume of about 500 mL/day to rid the body of wastes. Output below this level may be caused by severe dehydration or renal disease and is termed **oliguria**. The virtual absence of urine production is termed **anuria**. Excessive urine production is **polyuria**, which may be due to diabetes mellitus or diabetes insipidus. In diabetes mellitus, blood glucose levels exceed the number of available sodium-glucose transporters in the kidney, and glucose appears in the urine. The osmotic nature of glucose attracts water, leading to its loss in the urine. In the case of diabetes insipidus, insufficient pituitary antidiuretic hormone (ADH) release or insufficient numbers of ADH receptors in the collecting ducts means that too few water channels are inserted into the cell membranes that line the collecting ducts of the kidney. Insufficient numbers of water channels (aquaporins) reduce water absorption, resulting in high volumes of very dilute urine.

Concept Check

- Contrast the following terms: **oliguria**, **anuria** and **polyuria**. What are the differences between these terms as they describe urinary output?
- Explain how urine **colour** varies based on food consumed and/or **hydration** levels.

Endocrine Urinary Function

Several hormones have specific, important roles in regulating kidney function. They act to stimulate or inhibit blood flow. Some of these are endocrine, acting from a distance, whereas others are paracrine, acting locally.

Renin–Angiotensin–Aldosterone

Renin is an **enzyme** that is produced by the granular cells of the afferent arteriole. It enzymatically converts angiotensinogen (made by the liver, freely circulating) into angiotensin I. Its release is stimulated by **prostaglandins** to decreased extracellular fluid volume.

Angiotensin II is a potent vasoconstrictor that plays an immediate role in the regulation of blood pressure. It acts systemically to cause vasoconstriction as well as constriction of both the **afferent** and **efferent** arterioles of the glomerulus. In instances of blood loss or dehydration, it reduces both GFR and renal blood flow, thereby limiting fluid loss and preserving blood volume. Its release is usually stimulated by decreases in blood pressure, and so the preservation of adequate blood pressure is its primary role.

Aldosterone, often called the “salt-retaining hormone,” is released from the **adrenal cortex** in response to

angiotensin II or directly in response to increased plasma potassium. It promotes sodium reabsorption by the nephron, promoting the retention of water.

Antidiuretic Hormone (ADH)

Diuretics are drugs that can increase water loss by interfering with the recapture of solutes and water from the forming urine. They are often prescribed to lower blood pressure. ADH, released by the posterior pituitary, works to do the exact opposite. It promotes the recovery of water, decreases urine volume, and maintains plasma osmolarity and blood pressure. It does so by stimulating the movement of **aquaporin** proteins into the **apical** cell membrane of principal cells of the collecting ducts to form water channels, allowing the transcellular movement of water from the lumen of the collecting duct into the interstitial space in the medulla of the kidney by osmosis. From there, it enters the vasa recta capillaries to return to the circulation. Water is attracted by the high osmotic environment of the deep kidney **medulla**.

Parathyroid Hormone

Parathyroid hormone (PTH) is produced by the **parathyroid** glands in response to decreased circulating calcium levels.

Maintaining Homeostasis

Homeostasis requires that volume and **osmolarity** be preserved. Blood volume is important in maintaining sufficient blood pressure, and there are **nonrenal** mechanisms involved in its preservation, including vasoconstriction, which can act within seconds of a drop in pressure. Thirst mechanisms are also activated to promote the consumption of water lost through respiration, evaporation, or urination. Hormonal mechanisms are activated to recover volume while maintaining a normal osmotic environment. These mechanisms act principally on the kidney.

Diuretics and Fluid Volume

A diuretic is a compound that increases urine volume. Three familiar drinks contain diuretic compounds: coffee, tea, and alcohol. The caffeine in coffee and tea works by promoting vasodilation in the nephron, which increases GFR. Alcohol increases GFR by inhibiting ADH release from the posterior pituitary, resulting in less water recovery by the collecting duct. In cases of high blood pressure, diuretics may be prescribed to reduce blood volume and, thereby, reduce blood pressure. The most frequently prescribed anti-hypertensive diuretic is **hydrochlorothiazide**.

Regulation of Nitrogen Wastes

Nitrogen wastes are produced by the breakdown of proteins during normal **metabolism**. Proteins are broken down into amino acids, which in turn are deaminated by having their nitrogen groups removed. **Deamination** converts the amino (NH₂) groups into ammonia (NH₃), ammonium ion (NH₄⁺), urea, or uric acid ([Figure 5.9](#)). Ammonia is extremely toxic, so most of it is very rapidly converted into urea in the liver. Human urinary wastes typically contain primarily urea with small amounts of ammonium and very little uric acid.

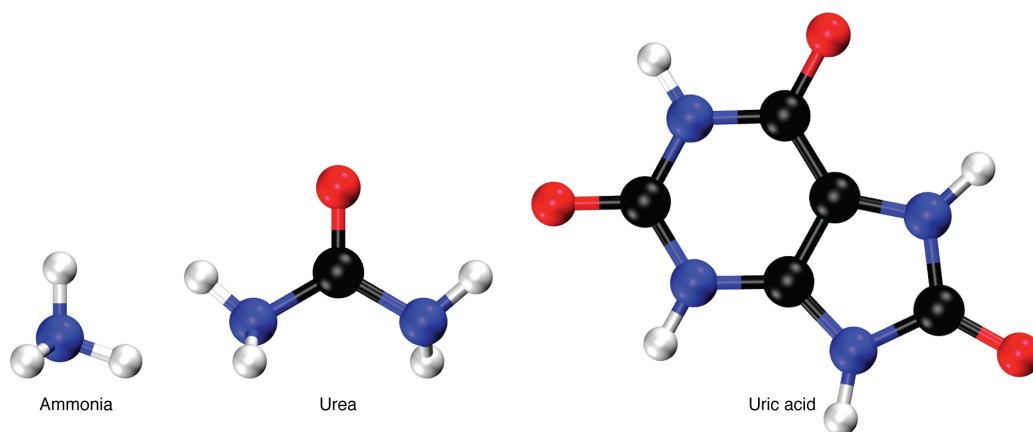


Figure 5.9 Nitrogen Wastes. From Betts, et al., 2013. Licensed under [CC BY 4.0](#).

Elimination of Drugs and Hormones

Water-soluble drugs may be excreted in the urine and are influenced by one or all of the following processes: glomerular filtration, tubular secretion, or tubular reabsorption. Drugs that are structurally small can be filtered by the glomerulus with the filtrate. Large drug molecules such as **heparin** or those that are bound to plasma proteins cannot be filtered and are not readily eliminated. Some drugs can be eliminated by carrier proteins that enable secretion of the drug into the tubule lumen. There are specific carriers that eliminate basic (such as dopamine or histamine) or acidic drugs (such as penicillin or indomethacin). As is the case with other substances, drugs may be both filtered and reabsorbed passively along a concentration gradient.

Watch [Urinary System, Part 2: Crash Course Anatomy & Physiology #39 \(10 min\) on YouTube](#)

Urinary System Medical Terms and Abbreviations

Urinary System Medical Terms Not Easily Broken into Word Parts

Urinary System Medical Terms Not Easily Broken into Word Parts (Text version)

1. **deamination**

- dē-am-ĭ-NĀ-shŏn
- The removal of an amino group from a molecule.

2. **distended**

- dis-TEN-ded (Original Term)
- stretch out

3. **enuresis**

- en-ū-RĒ-sĭs (Original Term)
- involuntary urination

4. **hemodialysis (HD)**

- hē-mō-dī-ĀL-ĭ-sĭs
- procedure for removing impurities from the blood due to an inability of the kidney to function

5. **hydrostatic**

- hĭ-drō-STAT-ik
- Relating to the equilibrium of liquids and the pressure exerted by liquid at rest

6. **incontinence**

- in-KONT-ĭn-ĕns (Original Term)
- inability to control the bladder and/or bowels

7. **micturate**

- MĪK-tū-rāt (Original Term)
- to pass urine

8. **sphincter**

- SFĪNK-tēr

- A circular muscle constricting an orifice

9. **stricture**

- STRIK-chŭr (Original Term)
- abnormal narrowing

10. **urinal**

- Ū-rĭn-ăl (Original Term)
- receptacle for urine

11. **void**

- VOYD (Original Term)
- empty or evacuate waste material, urinate

Activity Source: Urinary System Medical Terms not easily broken into word parts from [Medical Terminology](#) by Grimm et al., licensed under [CC BY 4.0](#). / Some H5P audio re-recorded by David McCuaig and text version added.

Urinary System Abbreviations

Many terms and phrases related to the urinary system are abbreviated. Learn these common abbreviations by expanding the list below.

Urinary System Abbreviations

- **ARF** (acute renal failure)
- **BUN** (blood urea nitrogen)
- **cath** (catheter, catheterization)
- **CKD** (chronic kidney disease)
- **ESRD** (end-stage renal disease)
- **ESWL** (extracorporeal shock wave lithotripsy)
- **HD** (hemodialysis)
- **OAB** (overactive bladder)
- **SG** (specific gravity)
- **UA** (urinalysis)
- **UTI** (urinary tract infection)
- **VCUG** (voiding cystourethrogram or void cystourethrogram)

Activity source: Urinary System Abbreviations by Kimberlee Carter from [Building a Medical Terminology Foundation](#) by Kimberlee Carter and Marie Rutherford, licensed under [CC BY 4.0](#).

Image Descriptions

Figure 5.7 image description: This figure shows the different pressures acting across the glomerulus including blood hydrostatic pressure, blood colloid osmotic pressure, capsular hydrostatic pressure. [\[Return to Figure 5.7\]](#).

Figure 5.8 image description: This color chart shows 8 different shades of yellow and associates each shade with stages of hydration (lightest 3 shades) or dehydration (remaining 5 darker shades). [\[Return to Figure 5.8\]](#).

Attribution

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5.4 - Urinary Diseases, Disorders and Diagnostic Testing

Diabetic Nephropathy

Diabetic nephropathy impacts the kidneys as a result of having diabetes mellitus type 1 or 2. Higher levels of blood sugar can lead to high blood pressure, and this additional pressure exerted on the kidneys causes destruction of the small filtering structures within the kidney (Mayo Clinic Staff, 2019). To learn more about diabetic nephropathy, visit the [Mayo Clinic's Diabetic Nephropathy web page \[New Tab\]](#).

Glomerulonephritis

Glomerulonephritis refers to acute or chronic nephritis that involves inflammation of the capillaries of the renal glomeruli. It has various causes, and is noted especially by blood or protein in the urine and by edema. If untreated, it could lead to kidney failure.

Hydronephrosis

Hydronephrosis is a condition whereby the kidneys begin to swell because of the retention of urine. Several conditions can cause hydronephrosis, such as a kidney stone or blood clot. Treatment will vary, depending on the cause (Cleveland Clinic, 2019). To learn more about hydronephrosis, visit the [Cleveland Clinic's web page on hydronephrosis \[New Tab\]](#).

Polycystic Kidney Disease

Polycystic kidney disease (PKD) is a genetic disease where cysts grow inside the kidneys. The kidneys enlarge from the cystic collections, and damage to the filtering structures of the kidneys can occur. As the disease progresses, it may lead to chronic kidney disease (American Kidney Fund, 2020). To learn more, visit the [Kidney Fund's PKD web page \[New Tab\]](#).

Renal Cell Carcinoma

Renal cell carcinoma is a cancer occurring in the kidney tubes where urine is produced or collected. This one of the most common cancers found within the kidneys. Removal of the cancerous lesions is the typical approach

from a treatment perspective (Innovation for Patient Care, 2018). To learn more, visit [Canadian Cancer Society's page on kidney cancer \[New Tab\]](#).

Renal Failure

Renal failure occurs when kidneys suddenly or gradually become unable to filter waste products from blood. When kidneys stop filtering, high level of wastes may build. Two types exist: acute kidney failure and chronic kidney failure (Mayo Clinic Staff, 2019a). To learn more about kidney failure, visit [the Mayo Clinic's page on Chronic Kidney Failure \[New Tab\]](#).

Cystitis

Cystitis is inflammation of the urinary bladder, often caused by an infection. A chronic form of this condition is known as interstitial cystitis. Symptoms of cystitis include bladder pressure, voiding frequently, and pain (Mayo Clinic Staff, 2019b). To learn more about cystitis, visit [the Mayo Clinic's page on Interstitial Cystitis \[New Tab\]](#).

Urinary Tract Infection

A urinary tract infection (UTI) is an infection caused by bacteria, or sometimes, fungi. The exact type of bacterial growth is determined by conducting urine for culture and sensitivity (C&S) testing. In rare cases, a UTI may be caused by a virus (Lights & Boskey, 2019). For more information, visit [Healthline's web page on Urinary Tract Infections \[New Tab\]](#).

Urinary Incontinence

Urinary incontinence is a loss of bladder control. Those afflicted with the condition will experience urine leakage from the bladder. Weak bladder muscles are a risk factor for developing this condition (Kim & O'Connell, 2017). To learn more about this condition, visit [Healthline's webpage Urologic Diseases \[New Tab\]](#).

Urinary Medical Terms in Use

Medical Terms in Context 1

Urinary System Operative Report (Text Version)

Fill in the consultation report with correct words listed below:

- Ureteral
- bladder
- recovery
- draped
- prepped
- fragmented
- lumen
- proximal

URINARY SYSTEM – OPERATIVE REPORT

PATIENT NAME: Cindy WARD

AGE: 48

DOB: September 19

SEX: Female

DATE OF SURGERY: January 8

SURGEON: Steve Foster, MD, Urologist

ASSISTANT: Michelle Stevenson, MD

ANESTHESIOLOGIST: Ryan Haywood, MD

ANESTHESIA: General

PREOPERATIVE DIAGNOSIS: Left proximal ureteral stones.

POSTOPERATIVE DIAGNOSIS: Left proximal ureteral calculi.

INDICATIONS: The patient is a 48-year-old female with a history of kidney stone disease, who has severe left flank pain and was found to have an obstructing large left proximal _____[Blank 1] stone.

OPERATIVE PROCEDURE: After induction of general anesthesia, the patient was placed in the lithotomy position. Patient was _____[Blank 2] and _____[Blank 3] in the usual sterile fashion. A #19-French cystoscope was inserted under camera vision. The urethra was unremarkable. The scope was passed into the bladder. The _____[Blank 4] mucosa was normal throughout. Under fluoroscopic control, a guidewire was placed up the left ureter and bypassed the stone. This was difficult at first, but the guidewire was eventually manipulated around the stone into the _____[Blank 5] collecting system. A rigid ureteroscope was then negotiated up the left ureter alongside the guidewire up to the stone, which was at the junction.

The stone was quite large and occupied the entire _____[Blank 6] of the ureter. Lithotripsy was then performed under camera vision. Using the Holmium laser, the stone was _____[Blank 7] into multiple fragments, all of which were then individually basketed. Some of the stones were sent for analysis.

Further ureteroscopy up to the kidney failed to reveal any significant sized fragments. Therefore, the ureteroscope was removed.

The procedure was tolerated by the patient without complications. The patient was taken to the _____[Blank 8] room in stable condition.

Steve Foster, MD, Urologist

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers:¹

Activity source: Urinary System – Operative Report by Heather Scudder, licensed under [CC BY 4.0](#). /Text version added.

Medical Terms in Context 2

Urinary System Consultation Report (Text Version)

Fill in the consultation report with correct words listed below:

- Urine
- shortness
- pain
- leukorrhea
- dysuria
- foul
- urinalysis
- nausea
- UTIs

URINARY SYSTEM – CONSULTATION REPORT

PATIENT NAME: Renee WOODS

AGE: 32

SEX: Female

DOB: June 17

DATE OF CONSULTATION: January 8

CONSULTING PHYSICIAN: Steve Foster, MD, Urology

REASON FOR CONSULTATION: Urinary Tract Infection.

HISTORY: The patient is a 32-year-old female who is complaining of pain on urinating. Patient states it began approximately 3 days ago. The patient describes symptoms of _____[Blank 1] and increased frequency to the washroom. Patient states they usually go to the washroom to urinate 4-5 times a day, but starting 3 days ago, she started going 10-12 times per day. Sometimes no _____[Blank 2] comes out. The urine has a _____[Blank 3] odor and is cloudy. States there has been lower abdomen _____[Blank 4] since yesterday, and says it is worse when she tries to go with no result. Patient has had the same sexual partner for 10 years. She has a history of _____[Blank 5] and feels this is the same.

PHYSICAL EXAMINATION: GENERAL: No weakness, or tiredness. VITALS: Blood pressure 120/80, heart rate 70 and respirations 16. Patient weighs 150 pounds. LUNGS: No cough or _____[Blank 6] of breath. GASTRO: Denies _____[Blank 7], vomiting or change in bowel habits. URINARY/REPRODUCTIVE: Denies hematuria, or any _____[Blank 8].

ASSESSMENT: Did a urinalysis on patient. _____[Blank 9] revealed leukocytes 3+.

PLAN

1. Treat with Ampicillin 400 mg q.i.d.
2. Return to office if no improvement within 48 hours.

Steve Foster, MD, Urology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers: ²

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Medical Specialties and Procedures Related to the Urinary System

Urology is a specialty that “addresses the medical and surgical treatment of disorders and diseases of the female urinary tract and the male urogenital system” (Canadian Medical Association, 2018). This specialty focuses on diagnosis, treatment, and surgical repair. Common clinical visits involve kidney stones, kidney failure, and bladder dysfunction. To learn more about urology as a specialty, visit the [Urology Profile \[PDF\]](#) authored by the Canadian Medical Association.

Urologist

A urologist is a medical specialist involved in the diagnosis and treatment of urinary and male genitourinary system conditions, disorders, and diseases such as prostate disease, renal and bladder dysfunctions, and others (Canadian Medical Association, 2019).

Procedures and Testing

Urinalysis

A urinalysis is a microscopic group of urine testing. This test detects and measures several substances in the urine, such as products of normal and abnormal metabolism and bacteria (Lab Tests Online, 2022). To learn more about urinalysis, visit [Lab Tests Online's Urinalysis web page \[New Tab\]](#).

Urine for C&S

Urine for culture and sensitivity. Urine produced by the kidneys is analyzed by way of a urine culture test that can detect and identify bacteria in the urine, which may be causing a urinary tract infection (UTI). If harmful bacteria is found, a sensitivity report is generated. This report lists antibiotics sensitive in the treatment of the bacteria present (Lab Tests Online, 2020a). To learn more about Urine for C&S, visit [Lab Tests Online's Urine Culture web page \[New Tab\]](#).

24 Hour Urine Collection

This is a test whereby all urinary output is collected over a 24-hour period of time. The analysis of urinary output over this extended period of time provides a greater indication of normal or abnormal kidney function (Lab Tests Online, 2017). To learn more, visit [Johns Hopkins Medicine's 24-hour Urine Collection article \[New Tab\]](#).

CT Scan of Kidney

Computed tomography is a diagnostic imaging procedure that uses a combination of x-rays and computer technology to produce a variety of images. It provides detailed images of the kidney looking for disease, cancer, obstructions and other kidney conditions (Johns Hopkins Medicine, n.d.). To learn more about a CT scan of the kidney, visit [Johns Hopkins Medicine's page on Computed Tomography \(CT or CAT\) Scan of the Kidney \[New Tab\]](#).

Cystoscopy

A cystoscopy is a procedure allowing a physician to check for bladder or ureteral problems, such as bladder cancer. An endoscope is used, also known as a cystoscope, containing a camera at the end of it (Canadian Cancer Society, 2020). To learn more about cystoscopy, visit the [Canadian Cancer Society's Cystoscopy and Ureteroscopy web page \[New Page\]](#).

Dialysis

Dialysis is a treatment that removes waste products from the blood when the kidneys are not fully functioning. This type of therapy is available at home or in a hospital or clinic and there are two main types: peritoneal dialysis and hemodialysis (Kidney Foundation, 2020). To learn more about dialysis, visit the [Kidney Foundation's Dialysis web page \[New Tab\]](#).

Intravenous Pyelogram

An intravenous pyelogram (IVP) is a specialized x-ray designed to produce views of the entire urinary tract. A dye is used to secure the enhanced imaging. The x-rays can also show how well the urinary tract is functioning and any identify any blockages (Canadian Cancer Society, 2020a). To learn more about IVP, visit the [Canadian Cancer Society's IVP web page \[New Tab\]](#).

Kidney Scan

A kidney scan is an imaging test which views the kidneys. It is considered a nuclear imaging test, as it uses radioactive tracers to pick up hot or cold spots within the kidney. These variations are considered abnormal.

Kidney Transplant

When kidneys fail or when a person is in end stage chronic kidney disease, a surgical procedure is performed in the form of a kidney transplant. This procedure involves harvesting a donor kidney, which is transplanted into the recipient in need of a functioning kidney to support vital function of the urinary system.

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Notes

1. 1. Ureteral, 2. Prepped, 3. Draped, 4. Bladder, 5. Proximal, 6. Lumen, 7. Fragmented, 8. Recovery.
2. 1. Dysuria, 2. Urine, 3. Foul, 4. Pain, 5. UTIs, 6. Shortness, 7. Nausea, 8. Leukorrhea, 9. Urinalysis

Vocabulary & Check Your Knowledge

Urinary System Vocabulary

Adventitial

The outermost layer of the wall of a blood vessel.

Apical

Relating to or denoting an apex.

Autonomic

Involuntary or unconscious.

Calyces

A cuplike cavity or structure.

Deamination

The removal of an amino group from a molecule.

Detrusor

A muscle which forms a layer of the wall of the bladder.

Excretion

Waste is eliminated from an organism. In vertebrates this is primarily carried out by the lungs, kidneys, and skin.

Homeostasis

A biological process that results in stable equilibrium.

Hydrostatic

Relating to the equilibrium of liquids and the pressure exerted by liquid at rest.

Hypothalamic

A region of the forebrain below the thalamus.

Lethargy

Periods of weakness.

Mitochondria

An organelle found in large numbers in most cells.

Osmosis

A process by which molecules of a solvent tend to pass through a membrane from a less concentrated solution into a more concentrated one.

pH

pH is a measure of how acidic or alkaline a substance is, as determined by the number of free hydrogen ions in the substance.

Prostaglandins

Any of a group of compounds with varying hormone-like effects.

Pseudostratified

Consisting of closely packed cells which appear to be arranged in layers.

Solutes

The minor component in a solution.

Voiding

Excrete (waste matter).

Test Yourself

Urinary System Glossary Reinforcement Activity (Text Version)

1. The removal of an amino group from molecule is called the _____[Blank 1].
 - a. Voiding
 - b. Deamination
 - c. Calyces
2. _____[Blank 2] is a measure of how acidic or alkaline a substance is, as determined by the number of free hydrogen ions in the substance.
 - a. pH
 - b. Apical
 - c. Osmosis
3. _____[Blank 3] relates to the equilibrium of liquids and the pressure exerted by liquid at rest.

- a. Solutes
 - b. Hydrostatic
 - c. Mitochondria
4. The outermost layer of the wall of a blood vessel is called the _____. [Blank 4].
- a. Hydrostatic
 - b. Pseudostratified
 - c. Adventitial
5. Any of a group of compounds with varying hormone-like effects is referred to as _____. [Blank 5].
- a. Solutes
 - b. Excretion
 - c. Prostaglandins

Check your answers:¹

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Notes

1. 1. Deamination, 2.pH, 3. Hydrostatic, 4. Adventitial, 5. Prostaglandins

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CHAPTER 6: MALE REPRODUCTIVE SYSTEM

Building a Medical Terminology Foundation 2e by Kimberlee Carter; Marie Rutherford; and Connie Stevens

- [6.1 – Introduction to the Male Reproductive System](#)
- [6.2 – Anatomy \(Structures\) of the Male Reproductive System](#)
- [6.3 – Physiology \(Function\) of the Male Reproductive System](#)
- [6.4 – Male Reproductive Diseases, Disorders and Diagnostic Testing](#)
- [Vocabulary & Check Your Knowledge](#)
- [References](#)

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Please visit the web version of [Building a Medical Terminology Foundation 2e](#) to access the complete book, interactive activities and ancillary resources.

6.1 - Introduction to the Male Reproductive System

Learning Objectives

- Identify the anatomy and describe the main functions of the male reproductive system
- Analyze, translate, and define medical terms and common abbreviations of the male reproductive system
- Practice the spelling and pronunciation of male reproductive system medical terminology
- Identify the medical specialties associated with the male reproductive system and explore common diseases, disorders, diagnostic tests and procedures

Male Reproductive System Word Parts

Click on prefixes, combining forms, and suffixes to reveal a list of word parts to memorize for the male reproductive system.

Male Reproductive System Word Parts

Prefix

- **a-** (absence of, without)
- **an-** (absence of, without)
- **crypt-** (hidden)
- **dys-** (painful, difficult)
- **en-** (in)
- **epi-** (above)
- **hyper-** (above, excessive)
- **hypo-** (below)

- **par-** (near)
- **trans-** (through, across, beyond)

Combining Forms

- **andr/o** (male)
- **balan/o** (glans penis)
- **epididym/o** (epididymis)
- **gonad/o** (gonad)
- **orch/o** (testis, testicle)
- **orchi/o** (testis, testicle)
- **orchid/o** (testis, testicle)
- **pen/o** (penis)
- **pen/i** (penis)
- **phall/o** (penis)
- **preputi/o** (prepuce, foreskin)
- **posth/o** (prepuce, foreskin)
- **prostat/o** (prostate gland)
- **scrot/o** (scrotum)
- **semin/i** (semen)
- **sperm/o** (sperm, spermatozoon)
- **spermat/o** (sperm, spermatozoon)
- **test/o** (testis, testicle)
- **testicul/o** (testis, testicle)
- **vas/o** (vas deferens, vessel, duct)
- **vesicul/o** (seminal vesicle)
- **urethr/o** (urethra)

Suffix

- **-al** (pertaining to)
- **-algia** (pain)
- **-ar** (pertaining to)
- **-atic** (pertaining to)
- **-cision** (processing of cutting)
- **-ectomy** (excision or surgical removal)
- **-ferous** (pertaining to)
- **-genesis** (production)
- **-gram** (record)
- **-graphy** (process of recording)
- **-ia** (diseased state, abnormal state, condition of, condition)
- **-ic** (pertaining to)
- **-ile** (pertaining to)
- **-ism** (state of, condition)

- **-itis** (inflammation)
- **-logy** (study of)
- **-lysis** (loosening, dissolution, separating)
- **-oma** (tumour, mass)
- **-ous** (pertaining to)
- **-pathy** (disease)
- **-pexy** (surgical fixation, suspension)
- **-plasia** (development, growth)
- **-plasty** (surgical repair)
- **-rrhea** (flow, discharge)
- **-sis** (condition, abnormal condition)
- **-stomy** (creation of new opening, process of new opening)
- **-tion** (process of)
- **-tomy** (cut into, incision)

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Converted to text.

Introduction to the Male Reproductive System

Gametes are the reproductive cells that combine to form a fetus. Organs called **gonads** produce the gametes, along with the hormones that regulate human reproduction. The male gametes are called sperm. **Spermatogenesis** occurs within the **seminiferous tubules** that make up most of the testis (singular). The **scrotum** is a sac that holds the testes (plural) outside of the body cavity.

Watch [Reproductive System, Part 2 - Male Reproductive System: Crash Course Anatomy & Physiology #41 \(11 min\) on YouTube](#)

Male Reproductive Medical Terms

Male Reproductive System terms not easily broken down into word parts (Text version)

1. **ablation**

- a-BLĀ-shǒn (Original Term)
- destruction of abnormal or excessive tissue by eroding, vaporizing or melting

2. **acquired immunodeficiency syndrome (AIDS)**

- ǎ-KWĪRD im-yū-nō-dě-FISH-ěn-sē SĪN-drōm
- advanced, chronic immune system suppression caused by human immunodeficiency virus (HIV) infection.

3. **artificial insemination**

- art-ī-FISH-ǎl in-sem-ī-NĀ-shǒn
- the medical procedure of injecting concentrated sperm into the vagina or uterus.

4. **azoospermia**

- ā-zō-ō-SPĚR-mē-ǎ
- absence of viable sperm in the semen.

5. **chlamydia**

- klǎ-MID-ē-ǎ
- sexually transmitted disease caused by a very small parasitic bacterium (also known as the silent STD).

6. **circumcision**

- sĭr-kŭm-SIZH-ǒn (Original Term)
- surgical removal of the prepuce (foreskin)

7. **coitus**

- KŌ-ī-tús (Original Term)
- sexual intercourse

8. **condom**

- KON-dǒm (Original Term)
- sheath (cover) for penis, worn during coitus to prevent conception and spread of sexually transmitted infection

9. **ejaculation**

- i-jak-yŭ-LĀ-shǒn
- the action of ejecting semen from the body.

10. **enucleation**

- ē-nū-klē-Ā-shŭn (Original Term)

- excision of a whole organ or mass without cutting into it

11. **erectile dysfunction (ED)**

- ě-RĚK-tĭl dis-FŮNGK-shŏn
- the inability of a male to attain or maintain an erection sufficient to perform sexual intercourse

12. **genital herpes**

- JEN-ĭt-āl HĚRP-ĕz
- a sexually transmitted disease characterized by blisters in the genital area, caused by the herpes simplex virus type 2.

13. **gonorrhea**

- gon-ŏ-RĚ-ǎ
- a sexually transmitted disease involving inflammatory discharge from the urethra or vagina.

14. **human immunodeficiency virus (HIV)**

- hu-man im-yŭ-nŏ-dĕ-FISH-ĕn-sĕ VĪ-rŭs
- a retrovirus that attacks the T-helper cells of the immune system. If HIV is not treated, it can lead to AIDS (acquired immunodeficiency syndrome)

15. **human papillomavirus (HPV)**

- hu-man PAP-ĭ-LŌ-mǎ-VĪ-rŭs
- a sexually transmitted disease with over 40 subtypes that cause diseases in humans ranging from common warts to cervical cancer.

16. **hydrocele**

- HĪ-drŏ-sĕl (Original Term)
- fluid-filled sac around the testicle

17. **hydrocelectomy**

- hĪ-drŏ-sĕ-LĚK-tŏ-mĕ (Original Term)
- surgical removal of a fluid-filled sac around the testicle causing scrotal swelling (hydrocele)

18. **infertility**

- in-fĕr-TIL-ĭt-ĕ (Original Term)
- inability to achieve pregnancy

19. **metastasis**

- mĕ-TAS-tǎ-sĭs
- cancer spreading from one part of the body into another.

20. **morcellation**

- mor-sě-LĀ-shǒn
- cutting or grinding solid tissue into smaller pieces for removal

21. **MRI ultrasound fusion biopsy**

- FŪ-zhǒn BĪ-op-sē
- combination of magnetic resonance imaging with transrectal ultrasound (TRUS) to obtain a tissue from a prostate lesion. The combined MRI-TRUS image is used to direct the biopsy needle into the area of the prostate that looked suspicious on MRI.

22. **orgasm**

- OR-gazm
- a climax of sexual stimulation

23. **phimosis**

- fī-MŌ-sis
- a tightness of the prepuce (foreskin of the penis) that prevents its retraction over the glans penis. It may be congenital or the result of balanitis. Circumcision is the usual treatment.

24. **priapism**

- PRĪ-ǎ-pizm
- persistent, abnormal erection of the penis accompanied by pain and tenderness

25. **prostate cancer**

- PROS-tāt KAN-sěr
- cancer of the prostate gland

26. **puberty**

- PŪ-běrt-ē
- the period during which adolescents develop secondary sex characteristics and become capable of reproduction.

27. **robotic surgery**

- rō-BŌ- tĭk SŪRJ-ě-rē
- use of small surgical instruments attached to a computer and operated by the surgeon from a console several feet from the operating table

28. **sexually transmitted disease (STD)**

- SEKS-ŭ-ǎ-lē trǎns-MĪT-ed diz-ĒZ
- infection spread through sexual contact; also known as sexually transmitted infection (STI)

29. **spermatocele**

- spěr-MĀT-ō-sēl
- distention of the epididymis containing an abnormal cyst-like collection of fluid and sperm cells

30. **sterility**

- stě-RIL-īt-ē (Original Term)
- a condition of being unable to conceive or reproduce the species

31. **sterilization**

- ster-ī-lī-ZĀ-shŏn
- procedure that prevents pregnancy, either a female's ability to conceive or a male's ability to induce conception

32. **syphilis**

- SIF-ī-līs
- a chronic bacterial disease spread primarily through sexual intercourse, but also congenitally by infection of a developing fetus. Rapidly spreads through the body and if left untreated becomes systemic.

33. **testicular cancer**

- tēs-TĪK-ū-lār KAN-sěr
- cancer of the testicle

34. **testicular torsion**

- tēs-TĪK-ū-lār TOR-shŏn
- twisting of the spermatic cord causing decreased blood flow to the testis. Considered a surgical emergency and accompanied by sudden onset of severe scrotal pain.

35. **transurethral**

- trans-ū-RE-thrāl
- pertaining to through the urethra

36. **transurethral incision of the prostate gland (TUIP)**

- surgical procedure that widens the urethra by making a few small incisions in the bladder neck and the prostate gland.

37. **transurethral resection of the prostate gland (TURP)**

- surgical removal of pieces of the prostate gland tissue by using an instrument inserted through the urethra.

38. **transurethral microwave thermotherapy (TUMT)**

- treatment that eliminates excess tissue present in benign prostatic hyperplasia by using heat generated by microwave.

39. **trichomoniasis**

- trīk-ō-mō-NĪ-ă-sīs
- sexually transmitted disease caused by the one-cell organism *Trichomonas*. Chiefly affects the urinary tract, vagina, or digestive system.

40. **varicocele**

- VAR-īō-sēl (Original Term)
- enlarged veins of the spermatic cord, which may cause scrotal swelling

Activity Source: Male Reproductive System terms not easily broken down into word parts from [Medical Terminology](#) by Grimm et al., licensed under [CC BY 4.0](#). / Some H5P audio re-recorded by Tania Deane and David McCuaig and text version added.

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6.2 - Anatomy (Structures) of the Male Reproductive System

The structures of the male reproductive system include the **testes**, the epididymis, the penis, and the ducts and glands that produce and carry semen. Sperm exit the scrotum through the vas deferens. The spermatic cord is an enclosed sheath which includes the vas deferens, **arteries**, **veins** and **nerves**. The seminal vesicles and **prostate gland** add fluids to the **sperm** to create **semen**.

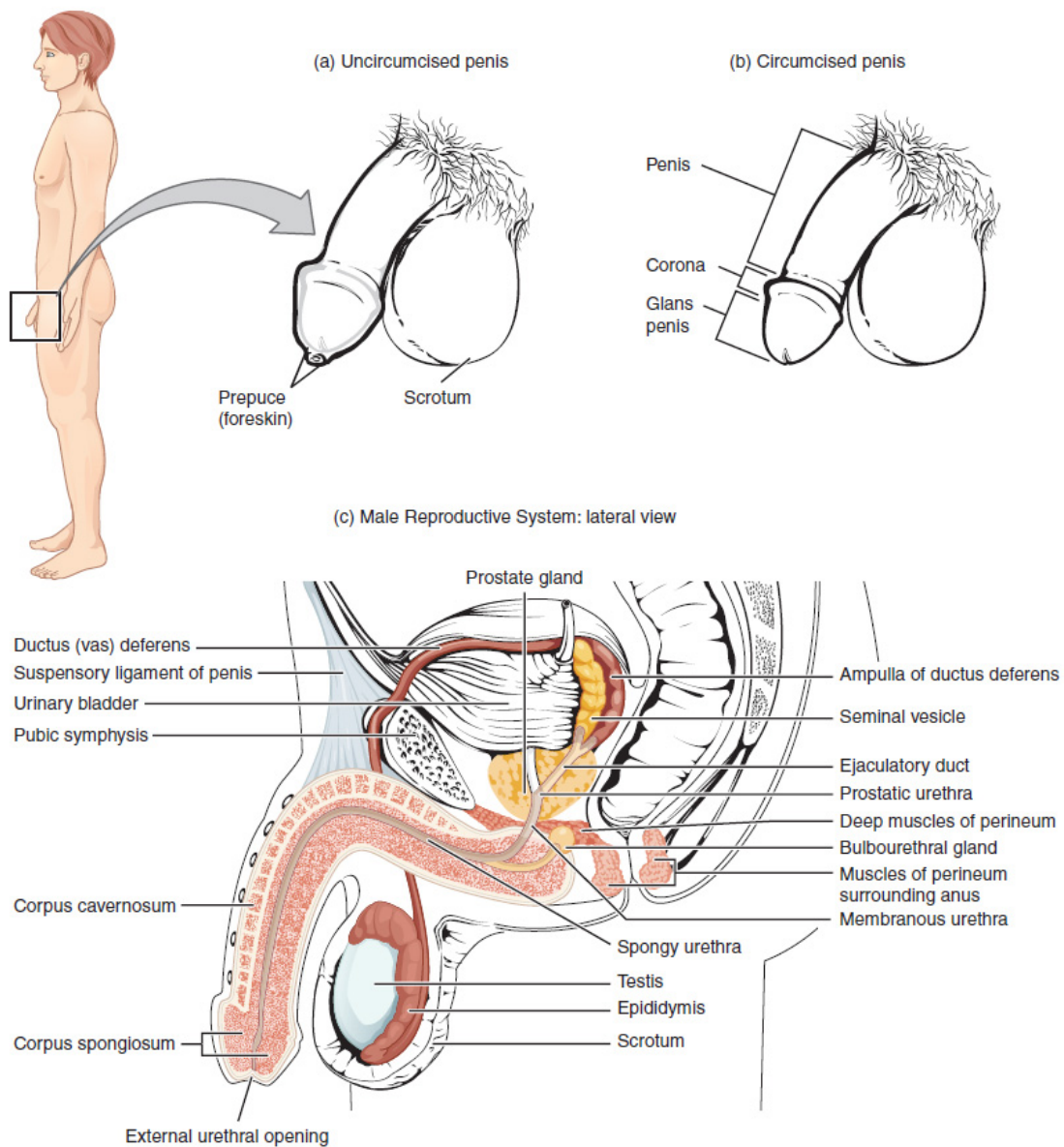


Figure 6.1. Male Reproductive System. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [Fig. 6.1 Image description.]

Image Descriptions

Figure 6.1 image description: This figure shows the different organs in the male reproductive system. The top panel shows the side view of a man and an uncircumcised and a circumcised penis. The bottom panel shows the lateral view of the male reproductive system and the major parts are labeled. [\[Return to Figure 6.1\]](#).

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6.3 - Physiology (Function) of the Male Reproductive System

Reproductive System

Spermatogenesis

Spermatogenesis occurs in the **seminiferous tubules** that form the bulk of each testis. The process begins at puberty, after which time sperm are produced constantly throughout a man's life. One production cycle takes approximately 64 days. One production cycle is considered from **spermatogonia** through to formed sperm. A new cycle starts approximately every 16 days, although this timing is not synchronous across the **seminiferous tubules**.

Did You Know?

Sperm counts slowly decline after age 35, and some studies suggest that smoking can lower sperm counts irrespective of age.

Sperm

Sperm are smaller than most cells in the body; in fact, the volume of a sperm cell is 85,000 times smaller than that of the female gamete. Approximately 100 to 300 million sperm are produced each day, whereas women typically ovulate only one **oocyte** per month. As is true for most cells in the body, the structure of sperm cells speaks to their function. Sperm have a distinctive head, mid-piece, and tail region (see [Figure 6.2](#)).

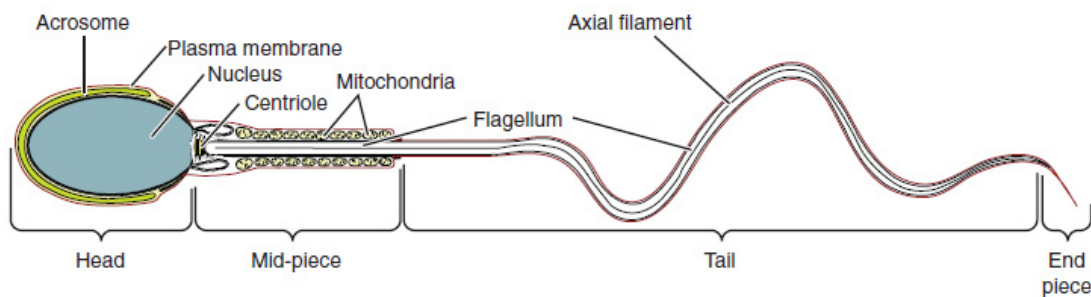


Figure 6.2. Structure of Sperm. Sperm cells are divided into a head, containing DNA; a mid-piece, containing mitochondria; and a tail, providing motility. The acrosome is oval and somewhat flattened. From Betts, et al., 2013. Licensed under [CC BY 4.0](#). [[Fig. 6.2 Image description.](#)]

Sperm Transport

To fertilize an egg, sperm must be moved from the **seminiferous tubules** in the testes, through the **epididymis**, and—later during ejaculation—along the length of the penis and out into the female reproductive tract. It takes an average of 12 days for sperm to move through the coils of the **epididymis**, with the shortest recorded transit time in humans being one day.

Epididymis

Sperm enter the head of the epididymis and are moved by the contraction of smooth muscles lining the **epididymal** tubes. As the sperm mature they acquire the ability to move under their own power. Once inside the female reproductive tract, they will use this ability to move independently toward the unfertilized egg. The more mature sperm are then stored in the tail of the epididymis until ejaculation occurs.

Ducts

During ejaculation, sperm exit the tail of the epididymis and are pushed by smooth muscle contraction to the **vas deferens** (also called the ductus deferens). The **vas deferens** is a thick, muscular tube that is bundled together inside the scrotum with connective tissue, blood vessels, and nerves into a structure called the **spermatic cord**. From each epididymis, each vas deferens extends through the inguinal canal in the abdominal wall and continues to a region called the ampulla. The sperm is mixed with fluid from the paired seminal vesicles and moves into its associated ejaculatory duct. The ejaculatory ducts transport the seminal fluid to the prostate gland.

Prostate Gland

The **prostate gland** secretes an alkaline, milky fluid to the passing seminal fluid (referred to as semen) to first coagulate and then decoagulate the semen following ejaculation. The temporary thickening of semen helps retain it within the female reproductive tract and once decoagulated the sperm can pass farther into the female reproductive tract.

Bulbourethral Glands

Bulbourethral glands release a thick, salty fluid that lubricates the end of the urethra and vagina, and helps to clean urine residues from the penile urethra.

Check Your Knowledge of the Male Reproductive System

Concept Check

- Write or draw out the components of the **pathway** that sperm takes from beginning until the end.
- Consider fertility challenges that may be experienced if a large number of defective sperm are produced.

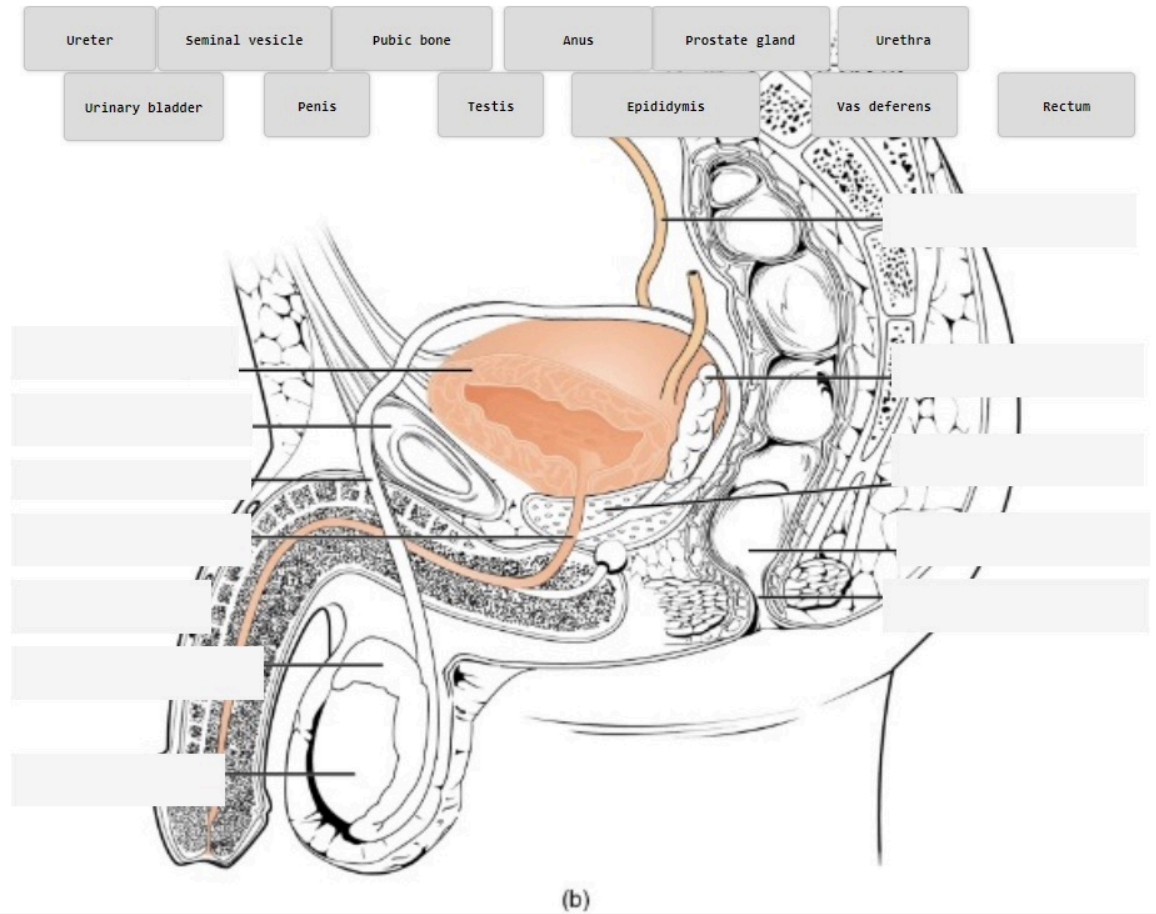
Anatomy Labeling Activity

Anatomy Labeling Activity (Text Version)

Label the following diagram correctly with words:

- | | | |
|--------------------|--------------------|------------------|
| 1. Ureter | 5. Prostate Gland | 9. Testis |
| 2. Seminal Vesicle | 6. Urethra | 10. Epididymis |
| 3. Pubic Bone | 7. Urinary Bladder | 11. Vas Deferens |
| 4. Anus | 8. Penis | 12. Rectum |

Male Reproductive System Anatomy



Anatomy Labeling Activity Diagram (Text Version)

Detailed anatomical diagram of the male reproductive system from a lateral viewpoint. The diagram highlights the location of key components from top of the diagram is the _____[Blank 1]. Then from right to left is the _____[Blank 2] followed by the _____[Blank 3] which are a pair of glands that secrete fluid making up a substantial portion of seminal fluid. The _____[Blank 4] is one of the three bones making up the pelvis. The _____[Blank 5] is a carrying vessel that transports sperm from the testes to the urethra. Located at the base of the bladder is _____[Blank 6], this gland secretes nourishing fluid for sperm and becomes a component of semen. The _____[Blank 7] extends from the urinary bladder and carries the semen towards the penis. The _____[Blank 8], the external male sex organ used to inseminate a female during reproduction. The _____[Blank 9] is the straight portion of the lower large intestines, and the _____[Blank 10] expels fecal matter. Located under the penis is the _____[Blank 11] and extending from the testes is a cordlike structure known as the _____[Blank 12].

Check your answers: ¹

Activity source: Male Reproductive System Anatomy by Gisele Tuzon, from [Building a Medical](#)

Male Reproductive Terms Not Easily Broken into Word Parts

Male Reproductive System terms not easily broken down into word parts (Text Version)

1. **hydrocele**
 - fluid-filled sac around the testicle
2. **varicocele**
 - enlarged veins of the spermatic cord
3. **ablation**
 - destruction of abnormal or excessive tissue by eroding, vaporizing or melting
4. **circumcision**
 - surgical removal of the prepuce (foreskin)
5. **enucleation**
 - excision of a whole organ or mass without cutting into it
6. **hydrocelectomy**
 - surgical removal of a fluid-filled sac around the testicle causing scrotal swelling (hydrocele)
7. **coitus**
 - sexual intercourse between male and female
8. **condom**
 - sheath (cover) for penis worn during coitus to prevent conception and spread of sexually transmitted infection
9. **infertility**

- inability to achieve pregnancy

10. **sterility**

- a condition of being unable to conceive or reproduce the species

Activity Source: Male Reproductive System terms not easily broken down into word parts by Kimberlee Carter, from [Building a Medical Terminology Foundation](#) by Kimberlee Carter and Marie Rutherford, licensed under [CC BY 4.0](#). / Text version added.

Common Male Reproductive System Abbreviations

Common Male Reproductive System Abbreviations

- **AIDS** (acquired immunodeficiency syndrome)
- **BPH** (benign prostatic hyperplasia, benign prostatic hypertrophy)
- **Bx** (biopsy)
- **CT** (chlamydia)
- **DRE** (digital rectal examination)
- **ED** (erectile dysfunction)
- **FTA-ABS** (florescent treponemal antibody absorption test)
- **GC** (gonococcus)
- **GU** (genitourinary)
- **HIV** (human immunodeficiency virus)
- **HoLEP** (holmium laser enucleation of the prostate gland)
- **HPV** (human papillomavirus)
- **HSV-2** (herpes simplex virus 2)
- **LUTS** (lower urinary tract symptoms)
- **NGU** (nongonococcal urethritis)
- **PSA** (prostate-specific antigen)
- **PVP** (photoselective vaporization of the prostate gland)
- **RP** (radical prostatectomy)
- **STD** (sexually transmitted disease)
- **STI** (sexually transmitted infection)
- **TRUS** (transrectal ultrasound)
- **TSE** (testicular self-examination)

- **TUIP** (transurethral incision of the prostate gland)
- **TUMT** (transurethral microwave thermotherapy)
- **TURP** (transurethral resection of the prostate gland)
- **VD** (venereal disease)
- **VDRL** (Venereal Disease Research Laboratory)

Activity source: Male Reproductive System Common Abbreviations by Kimberlee Carter, from [Building a Medical Terminology Foundation](#) by Kimberlee Carter and Marie Rutherford licensed under [CC BY 4.0](#). / Text version.

Image Descriptions

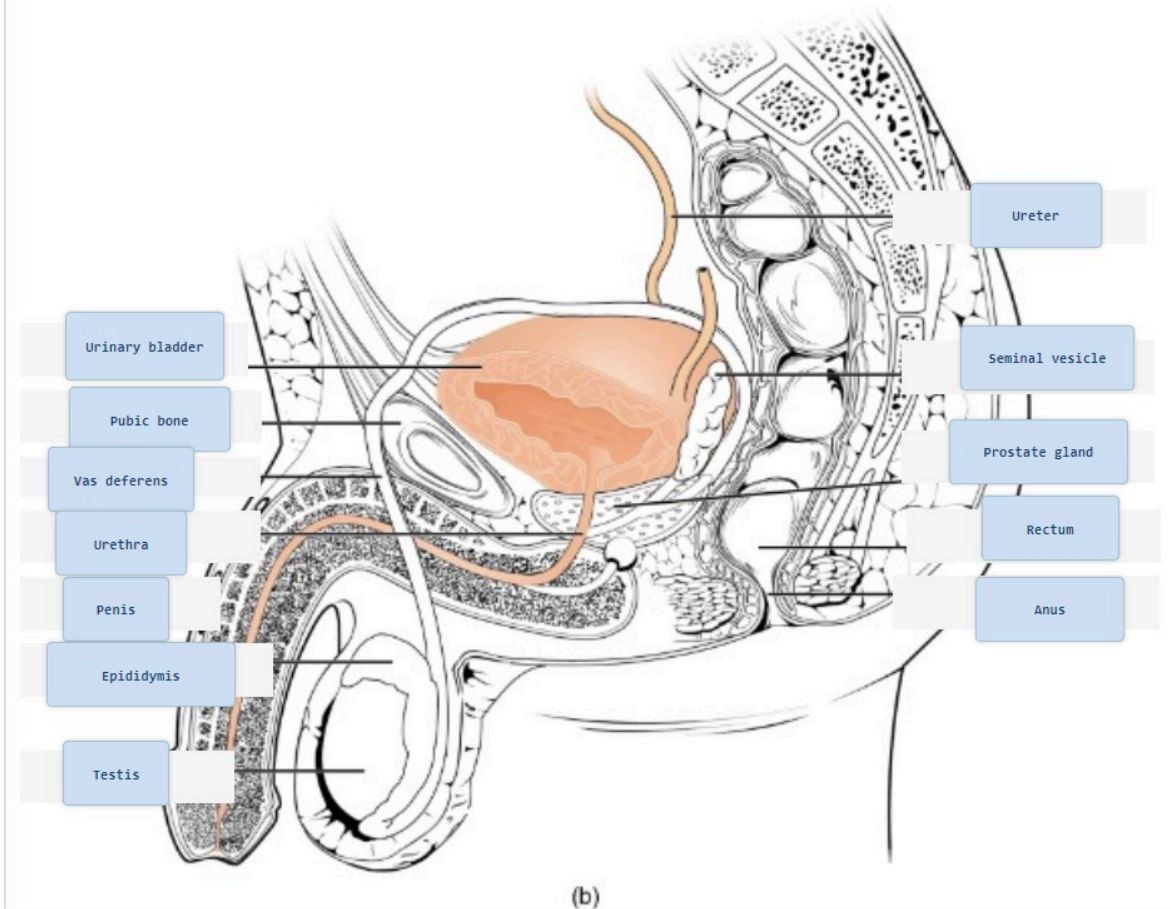
Figure 6.2 image description: This diagram shows the structure of sperm; the major parts are labeled (from left to right): head section (acrosome, plasma membrane, nucleus), mid-piece (centriole, mitochondria, flagellum), tail (flagellum, axial filament), end piece (end piece). [\[Return to Figure 6.2\]](#).

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Notes

Male Reproductive System Anatomy



1.

Check your answer: Anatomy Labeling Activity Diagram (Text Version) Detailed anatomical diagram of the male reproductive system from a lateral viewpoint. The diagram highlights the location of key components from top of the diagram is the **ureter**. Then from right to left is the **urinary bladder** followed by the **seminal vesicles** which are a pair of glands that secrete fluid making up a substantial portion of seminal fluid. The **pubic bone** is one of the three bones making up the pelvis. The **vas deferens** is a carrying vessel that transports sperm from the testes to the urethra. Located at the base of the bladder is **prostate gland**, this gland secretes nourishing fluid for sperm and becomes a component of semen. The **urethra** extends from the urinary bladder and carries the semen towards the penis. The **penis**, the external male sex organ used to inseminate a female during reproduction. The **rectum** is the straight portion of the lower large intestines, and the **anus** expels fecal matter. Located under the penis is the **testes** and extending from the testes is a cordlike structure known as the **epididymis**.

6.4 - Male Reproductive Diseases, Disorders and Diagnostic Testing

Erectile Dysfunction Disorder (EDD)

Erectile dysfunction (ED) is a condition in which a male has difficulty either initiating or maintaining an erection. The combined prevalence of minimal, moderate, and complete ED is approximately 40% in men at age 40 and reaches nearly 70% by 70 years of age. In addition to aging, ED is associated with diabetes, vascular disease, psychiatric disorders, prostate disorders, the use of some drugs such as certain antidepressants, and problems with the testes resulting in low testosterone concentrations. These physical and emotional conditions can lead to disruptions in the vasodilation pathway and result in an inability to achieve an erection (Betts, et al., 2013).

Cancer

Prostate Cancer

According to the Centers for Disease Control and Prevention (CDC), prostate cancer is the second most common cancer occurring in men. However, some forms of prostate cancer grow very slowly and may not require treatment. In contrast, aggressive forms of prostate cancer involve **metastasis** to organs like the lungs and brain. There is no link between Benign Prostatic Hyperplasia and prostate cancer, but the symptoms are similar. Prostate cancer is detected by medical history, a blood test, and a digital rectal exam that allows physicians to palpate the prostate and check for unusual masses. If a mass is detected, the cancer diagnosis is confirmed by biopsy of the cells (Betts, et al., 2013).

Did You Know?

Family history is a common risk factor for testicular cancer.

Testicular Cancer

Testicular cancer begins in the **testicle** or testis. It is most often found in men age 15 to 44 years, although it can be diagnosed at any age (Canadian Cancer Society, 2020). Testicular cancer is rare and treatable when diagnosed early. Common signs and symptoms include a painless lump in the testicle, swelling, a heavy feeling in the **scrotum** or abdomen, amongst others. Sometimes, testicular cancer is found during infertility testing. An **orchiectomy** is the most common procedure for diagnosing and treating testicular cancer (Canadian Cancer Society, 2020). To learn more about testicular cancer, diagnosis, and treatments, please go to the [Canadian Cancer Society's web page on testicular cancer \[New Tab\]](#).

Sexually Transmitted Infections (STIs)

The terms for sexually transmitted infections (STI) and sexuality transmitted diseases (STD) are often used interchangeably. Sexuality transmitted disease (STD) implies the disease was acquired through sexual transmission. A disease is a disorder of structure or function in a human, which produces specific signs or symptoms. A disease must be managed, as with the case of human immunodeficiency virus (which can also be acquired through the transmission of other bodily fluids; thus not solely sexual transmission). The treatment may include **antiretrovirals** or **anti-virals** (Urology Care Foundation, 2019).

Chlamydia (CT)

Chlamydia is one of the most common sexually transmitted infections (STIs) caused by bacteria that infect the cervix, urethra, and other reproductive organs. Chlamydia is easy to treat and can be cured. Many people with chlamydia do not have any symptoms and unknowingly pass the infection to their sexual partner(s). If symptoms develop, they usually appear two to six weeks after sexual contact with an infected person. Males may have penial discharge and itching around the urethra. The urethra is the opening in the penis. Males may also experience **dysuria**, **polyuria**, urethral pain and **urethritis** (Ontario Agency for Health Protection and Promotion, 2019; Region of Peel, 2007).

Chlamydia spreads through unprotected oral, anal or vaginal sex with an infected person. Chlamydia can be spread to the eyes via the hands with direct contact of infected fluids. Until a patient finishes their treatment, they continue to have the infection and can continue to pass it to others. Chlamydia is treated with antibiotic pills. If the patient has **epididymitis**, they may need to be hospitalized and be treated with intravenous (IV) antibiotics. All sexual partners within the past 60 days should be examined, treated, and informed that having no symptoms does not mean there is no infection (Ontario Agency for Health Protection and Promotion, 2019; Region of Peel, 2007).

Gonorrhea (Gonococcus) – (GC)

Gonorrhea is a sexually transmitted infection (STI) caused by bacteria that infects the cervix, urethra, and other

reproductive organs. Infections can also infect the throat and anus. Gonorrhea can be treated and cured. Many people infected with gonorrhea have no symptoms and can unknowingly pass the infection on to their sexual partner(s). If symptoms develop, they may appear two to seven days after sexual contact with an infected person. Symptoms vary depending on which part of the body is infected. Males may have yellowish-white discharge from the penis. They may also have **dysuria**, **polyuria**, testicular pain and **testitis**. Gonorrhea infection from oral sex may lead to sore throat and swollen glands. Gonorrhea infection from anal sex may cause itchiness and discharge from the anus. Gonorrhea is spread through unprotected oral, vaginal or anal sex with an infected person. Until the patient finishes their treatment, they continue to have the infection and can pass it to others (Ontario Agency for Health Protection and Promotion, 2019a; Region of Peel, 2007).

Gonorrhea is treated with oral **antibiotics** in combination with an **intramuscular (IM)** injection. It is important that one completes the treatment and abstain from unprotected sexual activity for at least seven days following treatment. If the patient develops **epididymitis**, the patient may need to go to a hospital and be treated with intravenous antibiotics. All sexual partners within the past 60 days should be examined, treated, and informed that having no symptoms does not mean there is no infection (Ontario Agency for Health Protection and Promotion, 2019a; Region of Peel, 2007).

Reportable Diseases

Both chlamydia and gonorrhea are reportable diseases to the Ministry of Health and Long Term Care. Therefore, the local health department will be calling the doctor's office or patient to ensure correct treatment was received and sexual partners have been followed up with testing and treatment (Ontario Agency for Health Protection and Promotion, 2019a; Region of Peel, 2007). To learn more about STIs and STDs such as chlamydia and gonorrhea, please go to the [Public Health Ontario website \[New Tab\]](#).

Human Papillomavirus- HPV

HPV is another common sexually transmitted infection (STI). Both males and females can be infected with HPV. Around three quarters of sexually active individuals have been exposed to HPV during their lifetime. There are over 100 strains of HPV and some strains of HPV can cause visible genital warts. The warts are usually painless but may be itchy, uncomfortable, and hard to treat. Some strains of HPV cause genital, anal, throat, and cervical cancers. HPV spreads through sexual activity and skin-to-skin contact in the genital area with an infected person. Since some people are **asymptomatic**, they don't know they have the virus and consequently pass the virus to their sexual partners. Treatments are available for genital warts but there is no cure for HPV (York Region Health Connect, n.d.). To learn more about HPV symptoms, treatments, and prognosis, visit the [CDC Fact Sheet on HPV \[PDF\]](#).

HPV Vaccine

A vaccine called Gardasil® 9 is available for 9 HPV strains. This vaccine assists the immune system in protecting

the body against infections and diseases caused by HPV (York Region Health Connection, n.d.). To learn more about Gardasil® 9 treatments, please visit the [Gardasil® 9 website \[New Tab\]](#).

Herpes Simplex Virus (HSV)

Genital herpes is a sexually transmitted infection (STI) that is caused by a virus called herpes simplex virus (HSV). There are two types of herpes simplex viruses:

- Type 1- oral herpes or cold sores (HSV-1)
- Type 2- genital herpes (HSV-2)

These viruses are very similar and either type can cause genital herpes or cold sores. Symptoms might include **dysuria**, enlarged glands, **myalgia**, **arthralgia** and fever. Once a patient is infected with HSV, the virus remains in their body even after the symptoms are gone and can cause recurring outbreaks. When the virus becomes active again, the symptoms return but are usually less painful and heal faster. Recurring outbreaks vary from person-to-person, however they can be triggered by emotional or physical stress, exposure to sunlight, hormonal changes, poor nutrition, sexual intercourse, lack of sleep or a low immune system.

Herpes is spread through direct contact with the sores or blisters of an infected person. Contact (and transfer of the virus) can occur from genitals-to-genitals, mouth-to-genitals or mouth-to-mouth. Herpes can also be passed to the anal area. Herpes spreads easily during sexual contact while symptoms are present, or just before an outbreak of symptoms. An infected person may spread herpes even when they have *no* symptoms; this is called **asymptomatic** shedding. One can spread the herpes virus to other parts of their body after touching the sores, which is referred to as **autoinoculation**. The fingers, eyes, and other body areas can accidentally become infected in this way. Hand washing after touching sores and blisters is recommended to prevent spreading the virus.

There is no cure for herpes. Antiviral pills help to reduce symptoms and speed the healing of blisters or sores and are prescribed by a doctor. Treatment of symptoms may be managed with medication for pain, bath salts, cold compresses, and urinating in water may help to relieve discomfort. Keep the infected area clean and dry, wear cotton underwear and loose clothing to reduce discomfort. All sexual partner(s) should be informed. The only way to reduce the risk, of transmission of herpes is to avoid direct contact with the sores and to use condoms. Condoms will reduce but not eliminate risk as the virus can be present and shed from the skin in the genital area (Ontario Ministry of Health and Long-Term Care, 2015).

To learn more about the symptoms, complications, treatments and prognosis of HSV, please visit the [Mayo Clinic's page on Genital Herpes \[New Tab\]](#) website or [Public Health Ontario's Testing Index \[New Tab\]](#).

STI Medical Abbreviations

Reproductive Sexually Transmitted Infections (STIs) Abbreviations

- **AB** (Antibiotic)
- **CT** (Chlamydia)
- **GC** (Gonorrhea)
- **HPV** (Human Papillomavirus)
- **HSV** (Herpes Simplex Virus)
- **PID** (Pelvic Inflammatory Disease)
- **STD** (Sexually Transmitted Diseases)
- **STI** (Sexually Transmitted Infections)

Activity source: Reproductive Sexually Transmitted Infections (STIs) Abbreviations by Kimberlee Carter, licensed under [CC BY 4.0](#). /Text version added.

Medical Terms in Context

Male Reproductive System Medical Report (Text Version)

Fill in the consultation report with correct words listed below:

- Urethral
- Prostatitis
- Complete
- by mouth
- circumcised

MALE REPRODUCTIVE SYSTEM – MEDICAL REPORT

PATIENT NAME: George SMITH

AGE: 57

SEX: Male

HISTORY (Hx): George Smith is a 57-year-old male who was referred to the urologist for a vasectomy.

FAMILY HISTORY: Has three living children. Occasional condom use for birth control.

PAST HISTORY

1. Herpes Simples Virus-2 (HSV-2) diagnosis (Dx) in 2002 and treated sexually transmitted infection (STI) in 2014.
2. Transurethral resection of the prostate (TURP) in 2019.
3. Current prostate specific antigen (PSA) is 15.6, with a previous result of 4.2.

PHYSICAL EXAMINATION/ASSESSMENT: Upon examination, normal male anatomy with _____[Blank 1] penis, normal foreskin and one testicle is descended. Leukorrhea is evident from the tip of the urethral os.

Complains of (c/o) urinary retention, nocturia and dysuria. He has had unprotected sexual intercourse four days ago. Digital rectal exam (DRE) indicated _____[Blank 2] with proctalgia.

DIAGNOSIS (Dx)

1. Urethral swab for gonorrhea/chlamydia (GC/CT).
2. Serology: PSA, _____[Blank 3] blood count (CBC).
3. Urine: Urinalysis, GC/CT, culture, and sensitivity (C&S).
4. Sonography for the undescended testicle.

MEDICATIONS (Rx)

1. Ceftriaxone 250 mg intramuscular immediately (IM STAT)
2. Azithromycin 1 g _____[Blank 4] immediately (po STAT)

PRELIMINARY CONCERNS

1. Rising PSA.
2. _____[Blank 5] discharge.
3. Undescended.

FOLLOW UP: Call office in 5 days for test results and follow up appointment in 2 weeks to discuss further booking of vasectomy and potential Bx (biopsy) of prostate.

Steve Fosters, MD, Urology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers: ¹

Activity source: Male Reproduction – Medical Report by Connie Stevens and Heather Scudder, licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)./Text version added.

Medical Specialties and Procedures related to the Male Reproductive System

Vasectomy

Watch the video:

Watch the **[Animated Dissection of Anatomy for Medicine's \(A.D.A.M.\) \[Video\]](#)** to learn about a vasectomy. As described in this video, a vasectomy is a procedure in which a small section of the ductus (vas) deferens is removed from the scrotum. This cuts off the path taken by sperm through the ductus deferens (as cited in Betts, et al., 2013).

No-Scalpel Vasectomy (NSV)

An alternative to a traditional vasectomy is the no-scalpel vasectomy (NSV). This is a minimally invasive procedure and an added benefit is that the recovery time is shorter. All vasectomies are completed by a urologist (Gentle Procedures Clinic, n.d.). To learn more about the NSV procedure, visit [No-Scalpel Vasectomy Procedure Info \[New Tab\]](#) by the Gentle Procedures Clinic in Toronto, Ontario.

Urology

Urology is a surgical subspecialty in which the surgeon has additional training in the treatments of diseases and disorders of the male and female urogenital systems (Canadian Medical Association, 2018). To learn more about urology and the training involved to become a urologist, visit the [Canadian Medical Association's Urology Profile \[New Tab\]](#).

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Notes

1. 1. Circumcised, 2. Prostatitis, 3. Complete, 4. By mouth, 5. Urethral

Vocabulary & Check Your Knowledge

Male Reproductive Vocabulary

Arthralgia

Joint pain.

Bulbourethral glands

(Also, Cowper's glands) glands that secrete a lubricating mucus that cleans and lubricates the urethra prior to and during ejaculation.

Corpus cavernosum

Either of two columns of erectile tissue in the penis that fill with blood during an erection.

Corpus spongiosum

(Plural = corpora cavernosa) column of erectile tissue in the penis that fills with blood during an erection and surrounds the penile urethra on the ventral portion of the penis.

Ductus deferens

(also, vas deferens) duct that transports sperm from the epididymis through the spermatic cord and into the ejaculatory duct; also referred as the vas deferens.

Dysuria

Painful urination.

Ejaculatory duct

Duct that connects the ampulla of the ductus deferens with the duct of the seminal vesicle at the prostatic urethra.

Epididymis

(plural = epididymides) coiled tubular structure in which sperm start to mature and are stored until ejaculation.

Epididymitis

Inflammation/swelling of the epididymis.

Gamete

Haploid reproductive cell that contributes genetic material to form an offspring.

Glans penis

Bulbous end of the penis that contains a large number of nerve endings.

Gonadotropin-releasing hormone (GnRH)

Hormone released by the hypothalamus that regulates the production of follicle-stimulating hormone and luteinizing hormone from the pituitary gland.

Gonads

Reproductive organs (testes in men and ovaries in women) that produce gametes and reproductive hormones.

Inguinal canal

Opening in abdominal wall that connects the testes to the abdominal cavity.

Leydig cells

Cells between the seminiferous tubules of the testes that produce testosterone, a type of interstitial cell.

Myalgia

Muscle pain.

Penis

Male organ of copulation.

Polyuria

Frequent urination.

Prepuce

(Also, foreskin) flap of skin that forms a collar around, and thus protects and lubricates, the glans penis; also referred as the foreskin.

Prostate gland

Doughnut-shaped gland at the base of the bladder surrounding the urethra and contributing fluid to semen during ejaculation.

Scrotum

External pouch of skin and muscle that houses the testes.

Semen

Ejaculatory fluid composed of sperm and secretions from the seminal vesicles, prostate, and bulbourethral glands.

Seminal vesicle

Gland that produces seminal fluid, which contributes to semen.

Seminiferous tubules

Tube structures within the testes where spermatogenesis occurs.

Sertoli cells

Cells that support germ cells through the process of spermatogenesis; a type of sustentacular cell.

Sperm

(Also, spermatozoon) male gamete.

Spermatic cord

Bundle of nerves and blood vessels that supplies the testes; contains ductus deferens.

Spermatid

Immature sperm cells produced by meiosis II of secondary spermatocytes.

Spermatocyte

Cell that results from the division of spermatogonium and undergoes meiosis I and meiosis II to form spermatids.

Spermatogenesis

Formation of new sperm, occurs in the seminiferous tubules of the testes.

Spermatogonia

Diploid precursor cells that become sperm (singular = spermatogonium).

Spermiogenesis

Transformation of spermatids to spermatozoa during spermatogenesis.

Testes

Male gonads (singular = testis).

Testitis

Inflammation of the testicles.

Urethritis

Inflammation of the urethra.

Test Yourself

Male Reproductive System Glossary Reinforcement Activity (Text Version)

1. The reproductive organs (testes in men and ovaries in women) that produce gametes and reproductive hormones is called the _____[Blank 1].
 - a. Penis
 - b. Semen
 - c. Gonads
2. The transformation of spermatids to spermatozoa during spermatogenesis is called _____[Blank 2].
 - a. Spermatogenesis
 - b. Prepuce
 - c. Ductus deferens
3. Glands that secrete a lubricating mucus that cleans and lubricates the urethra prior to and during ejaculation are called _____[Blank 3].
 - a. Testes
 - b. Bulbourethral glands
 - c. Scrotum
4. A doughnut-shaped gland at the base of the bladder surrounding the urethra and contributing fluid to semen during ejaculation is called the _____[Blank 4].
 - a. Seminal vesicle
 - b. Epididymis
 - c. Prostate gland
5. Opening in the abdominal wall that connects the testes to the abdominal cavity is called the _____[Blank 5].
 - a. Inguinal canal
 - b. Sertoli cells
 - c. Gamete

Check your answers: ¹

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Notes

1. 1. Gonads, 2. Spermatogenesis, 3. Bulbourethral glands, 4. Prostate gland, 5. Inguinal Canal

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CHAPTER 7: FEMALE REPRODUCTIVE SYSTEM

Building a Medical Terminology Foundation 2e by Kimberlee Carter; Marie Rutherford; and Connie Stevens

- [7.1 – Introduction to the Female Reproductive System](#)
- [7.2 – Anatomy \(Structures\) of the Female Reproductive System](#)
- [7.3 – Physiology \(Function\) of the Female Reproductive System](#)
- [7.4 – Female Reproductive Diseases, Disorders and Diagnostic Testing](#)
- [Vocabulary & Check Your Knowledge](#)
- [References](#)

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Please visit the web version of [Building a Medical Terminology Foundation 2e](#) to access the complete book, interactive activities and ancillary resources.

7.1 - Introduction to the Female Reproductive System

Learning Objectives

- Identify the anatomy and describe the main functions of the female reproductive system
- Analyze, translate, and define medical terms and common abbreviations of the female reproductive system
- Practice the spelling and pronunciation of female reproductive system medical terminology
- Identify the medical specialties associated with the female reproductive system and explore common diseases, disorders, diagnostic tests and procedures

Female Reproductive System Word Parts

Click on prefixes, combining forms, and suffixes to reveal a list of word parts to memorize for the female reproductive system.

Female Reproductive System Word Parts

Prefix

- **peri-** (surrounding)
- **endo-** (within, inside)
- **a-** (absence of, without)
- **an-** (absence of, without)
- **dys-** (painful, difficult, abnormal, laboured)

Combining Form

- **archo/o** (first, beginning)

- **cervic/o** (cervix)
- **colp/o** (vagina)
- **endometri/o** (endometrium)
- **episi/o** (vulva)
- **gyn/o** (woman)
- **gynec/o** (woman)
- **hymen/o** (hymen)
- **hyster/o** (uterus)
- **mamm/o** (breast)
- **mast/o** (breast)
- **men/o** (menstruation)
- **metr/o** (uterus)
- **metr/i** (uterus)
- **oophor/o** (ovary)
- **pelv/i** (pelvis, pelvic bones, pelvic cavity)
- **perine/o** (perineum)
- **salping/o** (fallopian tube)
- **trachel/o** (cervix)
- **vagin/o** (vagina)
- **vulv/o** (vulva)

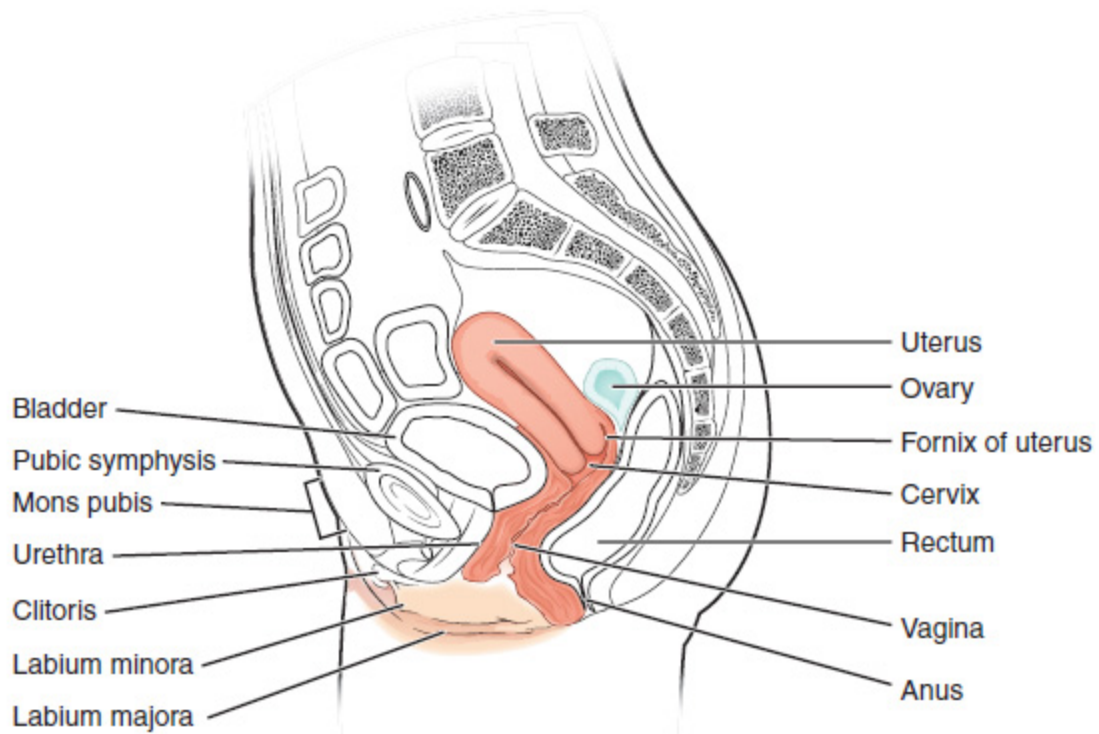
Suffix

- **-al** (pertaining to)
- **-atresia** (occlusion, closure)
- **-clesis** (surgical closure)
- **-ectomy** (excision, surgical removal)
- **-gram** (the record, radiographic image)
- **-graphy** (process of recording, radiographic imaging)
- **-itis** (inflammation)
- **-logist** (specialist or physician who studies and treats)
- **-logy** (study of)
- **-osis** (abnormal condition)
- **-pexy** (surgical fixation, suspension)
- **-plasty** (surgical repair)
- **-rrhaphy** (suturing, repairing)
- **-rrhea** (flow, discharge)
- **-salpinx** (fallopian tube)
- **-scope** (instrument used for visual examination)
- **-scopy** (visually examining)
- **-tomy** (cut into, incision)

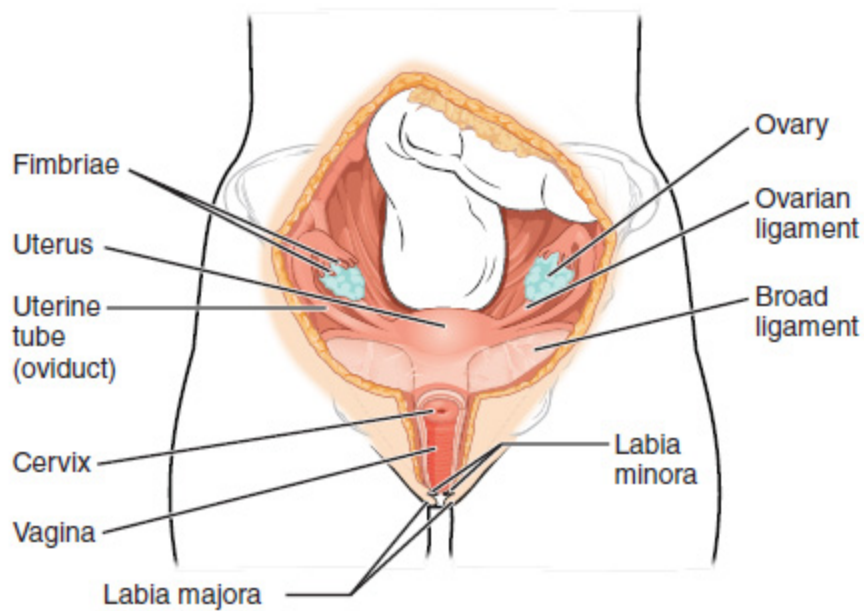
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Introduction to the Female Reproductive System

The female reproductive system produces **gametes** and reproductive hormones. In addition, the female reproductive system supports the developing fetus and delivers it to the outside world. The female reproductive system is located primarily inside the pelvic cavity. The female gonads are called ovaries and the gamete they produce is called an oocyte.



(a) Human female reproductive system: lateral view



(b) Human female reproductive system: anterior view

Figure 7.1 Female Reproductive System. The major organs of the female reproductive system are located inside the pelvic cavity. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [[Fig. 7.1 Image description.](#)]

Watch [Reproductive System, Part 1 – Female Reproductive System: Crash Course Anatomy & Physiology #40 \(10 min\) on YouTube](#)

Female Reproductive System Medical Terms

Female Reproductive System Medical Terms (Text version)

Practice the following female reproductive system words by breaking into word parts and pronouncing.

1. **menarche**

- men/arche
- beginning of menstruation

2. **cervicitis**

- cervic/itis
- inflammation of the cervix

3. **endocervical**

- endo/cervic/al
- pertaining to within the cervix

4. **colpocleisis**

- colp/o/cleisis
- surgical closure of the vagina

5. **colpoperineorrhaphy**

- colp/o/perine/o/rrhaphy
- suturing of the vagina and the perineum

6. **colpoplasty**

- colp/o/plasty
- surgical repair of the vagina

7. **colporrhaphy**

- colp/o/rrhaphy
- suturing of (a tear in) the vagina

8. **colposcope**
 - colp/o/scope
 - instrument used to view the vagina and the cervix
9. **colposcopy**
 - colp/o/scopy
 - process of viewing the vagina
10. **endometriosis**
 - endometri/osis
 - abnormal condition of the endometrium
11. **endometritis**
 - endometr/itis
 - inflammation of the endometrium
12. **episiorrhaphy**
 - episi/o/rrhaphy
 - suturing of the vulva
13. **episioperineoplasty**
 - episi/o/perine/o/plasty
 - surgical repair of the vulva and the perineum
14. **gynopathic**
 - gyn/o/pathic
 - disease pertaining to the women
15. **gynecologist**
 - gynec/o/logist
 - specialist or physician who studies and treats disorders and diseases of women
16. **gynecology**
 - gynec/o/logy
 - study of women
17. **hymenectomy**
 - hymen/ectomy
 - excision of the hymen
18. **hymenotomy**

- hymen/o/tomy
 - incision into the hymen
19. **hysterectomy**
- hyster/ectomy
 - excision of the uterus
20. **hysteropexy**
- hyster/o/pexy
 - surgical fixation of the uterus
21. **hysterosalpingo-oophorectomy**
- hyster/o/salping/o/-oophor/ectomy
 - excision of the uterus, uterine tubes, and ovaries
22. **hysterosalpingogram (HSG)**
- hyster/o/salping/o/gram
 - radiographic image of the uterus and uterine tubes
23. **hysteroscope**
- hyster/o/scope
 - instrument used for visual examination of the uterus
24. **hysteroscopy**
- hyster/o/scopy
 - visual examination of the uterus
25. **sonohysterography (SHG)**
- son/o/hyster/o/graphy (SHG)
 - process of recording the uterus by use of sound
26. **mammoplasty**
- mamm/o/plasty
 - surgical repair of the breast
27. **mammogram**
- mamm/o/gram
 - radiographic image of the breast
28. **mammography**
- mamm/o/graphy

- radiographic imaging of the breast
29. **mastitis**
- mast/itis
 - inflammation of the breast
30. **mastectomy**
- mast/ectomy
 - surgical removal of the breast
31. **mastopexy**
- mast/o/pexy
 - surgical fixation of the breast
32. **mastalgia**
- mast/algia
 - pain in the breast
33. **dysmenorrhea**
- dys/men/o/rrhea
 - painful menstrual flow
34. **amenorrhea**
- a/men/o/rrhea
 - absence of menstrual flow
35. **menometrorrhagia**
- men/o/metr/o/rrhagia
 - excessive bleeding from the uterus at menstruation
36. **menorrhagia**
- men/o/rrhagia
 - excessive bleeding at menstruation
37. **metrorrhagia**
- metr/o/rrhagia
 - excessive bleeding from the uterus
38. **oligomenorrhea**
- olig/o/men/o/rrhea
 - scanty menstrual flow

39. **myometritis**
- my/o/metr/itis
 - inflammation of the uterine muscle
40. **perimetritis**
- peri/metr/itis
 - inflammation surrounding the uterus
41. **oophoritis**
- oophor/itis
 - inflammation of the ovary
42. **oophorectomy**
- oophor/ectomy
 - excision of the ovary
43. **pelviscopic**
- pelv/i/scop/ic
 - pertaining to visual examination of the pelvic cavity
44. **pelviscopy**
- pelv/i/scopy
 - visual examination of the pelvic cavity
45. **perineorrhaphy**
- perine/o/rrhaphy
 - suturing of (a tear in) the perineum
46. **salpingitis**
- salping/itis
 - inflammation of a fallopian/uterine tube
47. **salpingectomy**
- salping/ectomy
 - excision of the uterine/fallopian tube
48. **salpingo-oophorectomy**
- salping/o/-oophor/ectomy
 - excision of the uterine tube and ovary
49. **salpingostomy**

- salping/o/stomy
 - creation of an artificial opening in the uterine tube
50. **trachelectomy**
- trachel/ectomy
 - excision of the cervix
51. **trachelorrhaphy**
- trachel/o/rrhaphy
 - suturing of the cervix
52. **vaginitis**
- vagin/itis
 - inflammation of the vagina
53. **vaginosis**
- vagin/osis
 - abnormal condition of the vagina
54. **vulvovaginitis**
- vulv/o/vagin/itis
 - inflammation of the vulva and vagina
55. **vaginal**
- vagin/al
 - pertaining to the vagina
56. **vesicovaginal**
- vesic/o/vagin/al
 - pertaining to the bladder and the vagina
57. **vulvovaginal**
- vulv/o/vagin/al
 - pertaining to the vulva and vagina
58. **vulvectomy**
- vulv/ectomy
 - excision of the vulva
59. **hematosalpinx**
- hemat/o/salpinx

- blood in the uterine/fallopian tube
60. **hydrosalpinx**
- hydro/salpinx
 - water in the uterine/fallopian tube
61. **pyosalpinx**
- py/o/salpinx
 - pus in the uterine/fallopian tube
62. **leukorrhea**
- leuk/o/rrhea
 - white discharge
63. **menopause**
- men/o/pause
 - cessation on menstruation
64. **menses**
- men/ses
 - the monthly bleeding from the uterus
65. **perimenopause**
- peri/men/o/pause
 - period of time before and after menopause

Activity Source: Female Reproductive System Medical Terms by Kimberlee Carter, licensed under [CC BY 4.0](#).

Image Descriptions

Figure 7.1 image description: This figure shows the structure and the different organs in the female reproductive system. The top panel shows the lateral view with labels (clockwise from top): uterus, ovary, fornix of uterus, cervix, rectum, vagina, anus, labium majora, labium minora, clitoris, urethra, mons pubis, pubic symphysis, bladder; and the bottom panel shows the anterior view with labels (clockwise from top): ovary, ovarian ligament, broad ligament, labia minora, labia majora, vagina, cervix, uterine tube, uterus, fimbriae. [\[Return to Figure 7.1\]](#).

Attribution

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7.2 - Anatomy (Structures) of the Female Reproductive System

External Female Genitals

The external female reproductive structures are referred to collectively as the **vulva** and they include:

- The **mons pubis** is a pad of fat that is located at the anterior, over the pubic bone. After puberty, it becomes covered in pubic hair.
- The **labia majora** (labia = “lips”; majora = “larger”) are folds of hair-covered skin that begin just posterior to the mons pubis.
- The **labia minora** (labia = “lips”; minora = “smaller”) is thinner and more pigmented and extends medially to the labia majora.
 - Although they naturally vary in shape and size from woman to woman, the labia minora serve to protect the female urethra and the entrance to the female reproductive tract.
 - The superior, anterior portions of the labia minora come together to encircle the **clitoris** (or glans clitoris), an organ that originates from the same cells as the glans penis and has abundant nerves that make it important in sexual sensation and orgasm. The **hymen** is a thin membrane that sometimes partially covers the entrance to the **vagina**.
- The vaginal opening is located between the opening of the urethra and the anus. It is flanked by outlets to the **Bartholin's glands**.

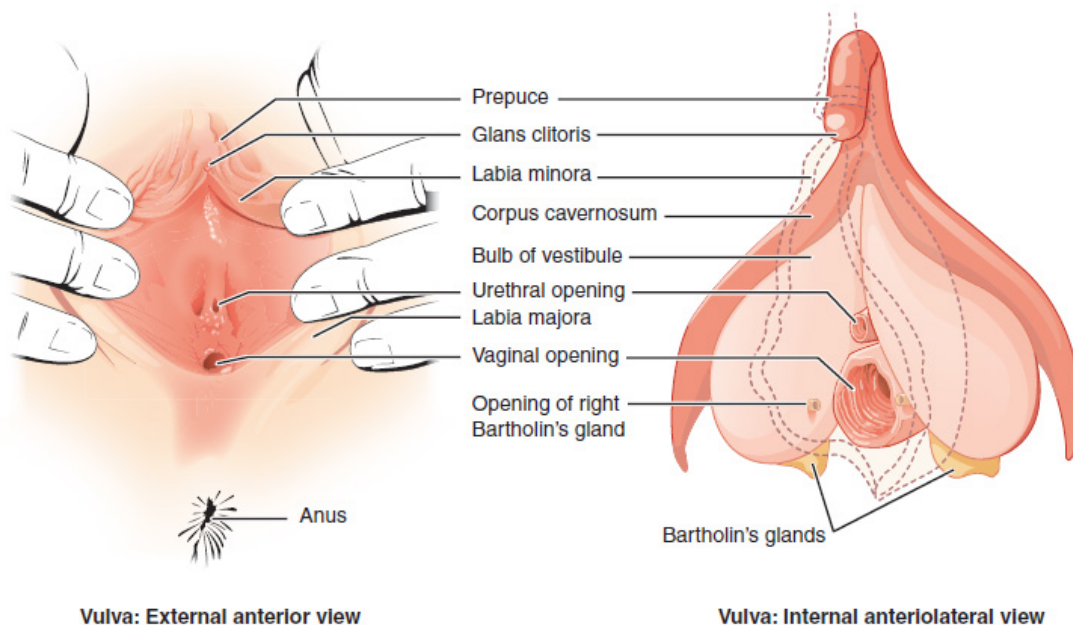


Figure 7.2. The Vulva. The external female genitalia are referred to collectively as the vulva. From Betts, et al., 2013. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/). [Fig. 7.2 Image description.]

Internal Female Reproductive Organs

Vagina

The **vagina** is a muscular canal (approximately 10 cm long) that is the entrance to the reproductive tract. It also serves as the exit from the uterus during menses and childbirth. The outer walls of the anterior and posterior vagina are columns with ridges. The superior **fornix** meets the uterine cervix. The cervix is the opening to the uterus.

The walls of the vagina are lined with:

- An outer, fibrous adventitia
- A middle layer of smooth muscle
- An inner mucous membrane with transverse folds called **rugae**

Together, the middle and inner layers allow the expansion of the vagina to accommodate intercourse and childbirth. The thin, perforated hymen can partially surround the opening to the vaginal orifice. The **Bartholin's glands** and the lesser vestibular glands (located near the clitoris) secrete mucus, which keeps the vestibular area moist.

The vagina has a normal population of microorganisms that help to **protect** against infection. There is both pathogenic bacteria and yeast in the vagina. In a healthy woman, the most predominant type of vaginal bacteria is from the genus *Lactobacillus*, which secretes lactic acid. The lactic acid protects the vagina by maintaining an acidic pH (below 4.5).

Lactic acid, in combination with other vaginal secretions, makes the vagina a self-cleansing organ. However, **douching** can disrupt the normal balance of healthy microorganisms, and increase a woman's risk for infections and irritation. It is recommended that women do not douche and that they allow the vagina to maintain its normal healthy population of protective microbial flora.

Ovaries

The **ovaries** are the female gonads. There are two, one at each entrance to the fallopian tube. They are each about 2 to 3 cm in length, about the size of an almond. The ovaries are located within the pelvic cavity. The ovary itself is attached to the uterus via the ovarian ligament. The ovarian stroma forms the bulk of the adult ovary. Oocytes develop within the outer layer of this stroma, each surrounded by supporting cells. This grouping of an oocyte and its supporting cells is called a **follicle**.

The Fallopian Tubes

The fallopian tubes are the conduit of the **oocyte** from the ovary to the uterus. Each of the two fallopian tubes is close to, but not directly connected to, the ovary.

- The **isthmus** is the narrow medial end of each uterine tube that is connected to the uterus.
- The wide distal **infundibulum** flares out with slender, finger-like projections called **fimbriae**.
- The middle region of the tube, called the **ampulla**, is where fertilization often occurs.

The fallopian tubes have three layers:

- An outer serosa
- A middle smooth muscle layer
- An inner mucosal layer
 - In addition to its mucus-secreting cells, the inner mucosa contains ciliated cells that beat in the direction of the uterus, producing a current that will be critical to moving the **oocyte**.

Did You Know?

Fallopian tubes are not connected to the ovaries. Instead fimbriae catch the oocyte like a baseball in a glove.

The Uterus and Cervix

The **uterus** is the muscular organ that nourishes and supports the growing embryo. Its average size is approximately 5 cm wide by 7 cm long and it has three sections.

- The portion of the uterus **superior** to the opening of the uterine tubes is called the **fundus**.
- The middle section of the uterus is called the **body of uterus** (or corpus).
- The **cervix** is the narrow **inferior** portion of the uterus that projects into the vagina.
 - The cervix produces mucus secretions that become thin and stringy under the influence of high systemic plasma estrogen concentrations, and these secretions can facilitate sperm movement through the reproductive tract.

The wall of the uterus is made up of three layers:

- **Perimetrium:** the most superficial layer and serous membrane.
- **Myometrium:** a thick layer of smooth muscle responsible for uterine contractions.
- **Endometrium:** the innermost layer containing a connective tissue lining covered by epithelial tissue that lines the lumen. It provides the site of implantation for a fertilized egg and sheds during menstruation if no egg is fertilized.

Check Your Knowledge of the Female Reproductive System

Female Reproductive System Medical Abbreviations

Learn the abbreviations using the list below.

Female Reproductive System Medical Abbreviations

- **BC** (birth control)
- **BSO** (bilateral salpingo-oophorectomy)
- **Cx** (cervix)
- **D&C** (dilation and curettage)
- **FCC** (fibrocystic changes to the breast)
- **GYN** (gynecology)
- **HPV** (human papillomavirus)
- **HRT** (hormone replacement therapy)
- **HSG** (hysterosalpingogram)
- **IUD** (intrauterine device)
- **LAVH** (laparoscopically assisted vaginal hysterectomy)
- **PCOS** (polycystic ovarian syndrome)
- **PID** (pelvic inflammatory disease)
- **PMS** (premenstrual syndrome)
- **SGH** (sonohysterography)
- **TAH** (total abdominal hysterectomy)
- **TLH** (total laparoscopic hysterectomy)
- **TSS** (toxic shock syndrome)
- **TVH** (total vaginal hysterectomy)
- **TVS** (transvaginal sonography)
- **UAE** (uterine artery embolization)

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Concept Check

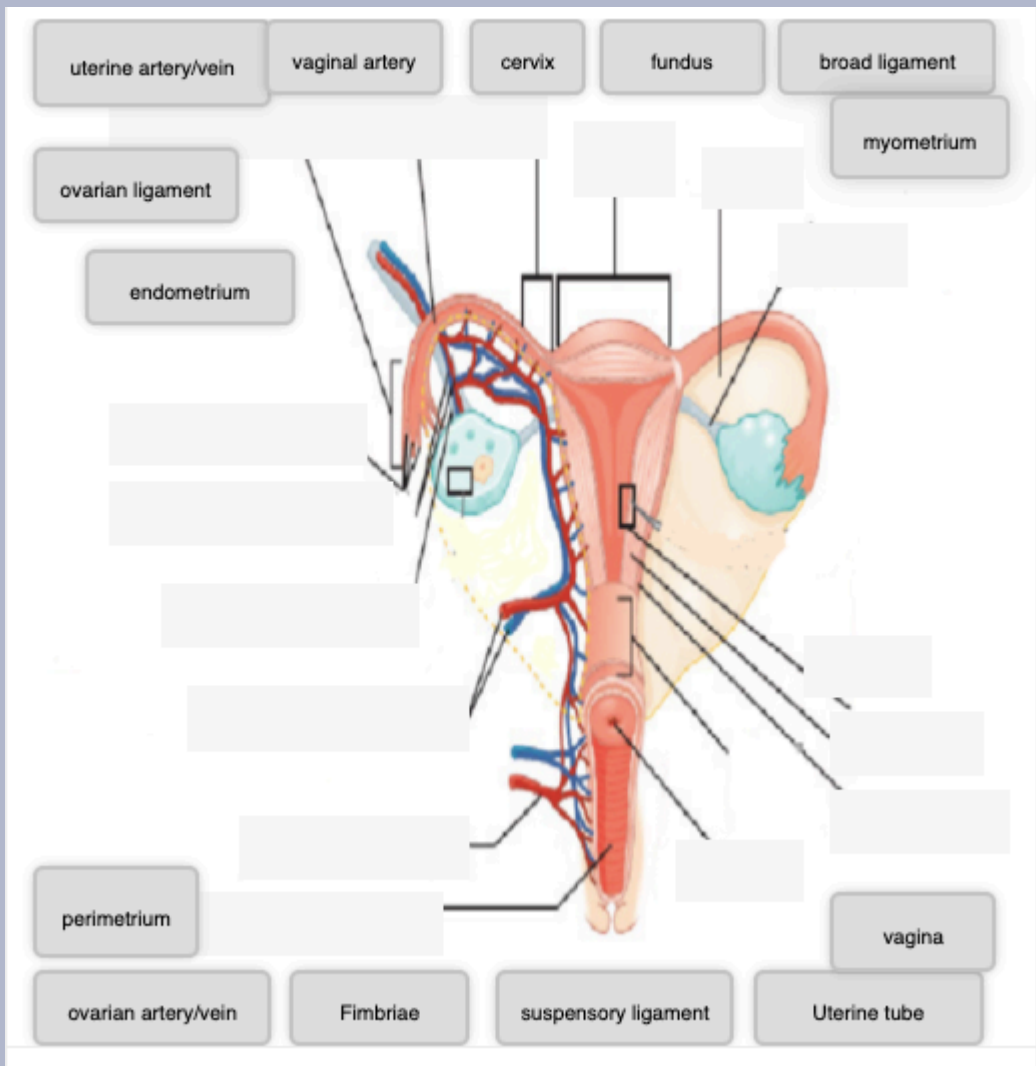
- Write or draw out the components of the pathway that an **oocyte** takes from beginning to end.
- Why do you think the **fallopian tubes** are not connected to the **ovaries**?

Anatomy Labeling Activity

Anatomy Labeling Activity (Text Version)

Label the diagram correctly with the following words:

- | | | |
|------------------------|---------------------|-------------------------|
| 1. Broad Ligament | 6. Cervix | 11. Ovarian artery/vein |
| 2. Fundus | 7. Myometrium | 12. Fimbrae |
| 3. Uterine Tube | 8. Ovarian Ligament | 13. Suspensory Ligament |
| 4. Uterine artery/vein | 9. Endometrium | 14. Vagina |
| 5. Vaginal Artery | 10. Perimetrium | |



Anatomy Labeling Activity Diagram (Text Version)

Diagram of female reproductive system featuring anatomy organs and structures. The _____[Blank 1] also known as the fallopian tubes are positioned at the right top portion of the diagram. Extending from the uterine tube is finger-like projects known as _____[Blank 2]. The _____[Blank 3] is also known as the womb, is a hollow, muscular organ located in the pelvis between the bladder and rectum. The _____[Blank 4] supplies blood to the uterus. The _____[Blank 5] of uterus, also called the uterine fundus, refers to the dome-shaped, rounded superior part of the body of the uterus that lies above the opening. The _____[Blank 6] and the round ligaments of the uterus serve as secondary support for the uterus within the pelvis. The _____[Blank 7] is a fold of tissue arising from the peritoneum and extends out from the ovaries. The _____[Blank 8] connects the ovaries to the lateral surface of the uterus. The _____[Blank 9] supplies blood to the ovaries. The three layers of the uterus from outside to inside are the _____[Blank 10], _____[Blank 11], _____[Blank 12]. The neck of the uterus is called the cervix. The _____[Blank 13] is a muscular canal connecting the

cervix of the uterus and serves as the birth canal during childbirth. The _____[Blank 14] supplies the vagina with blood.

Check your answers:¹

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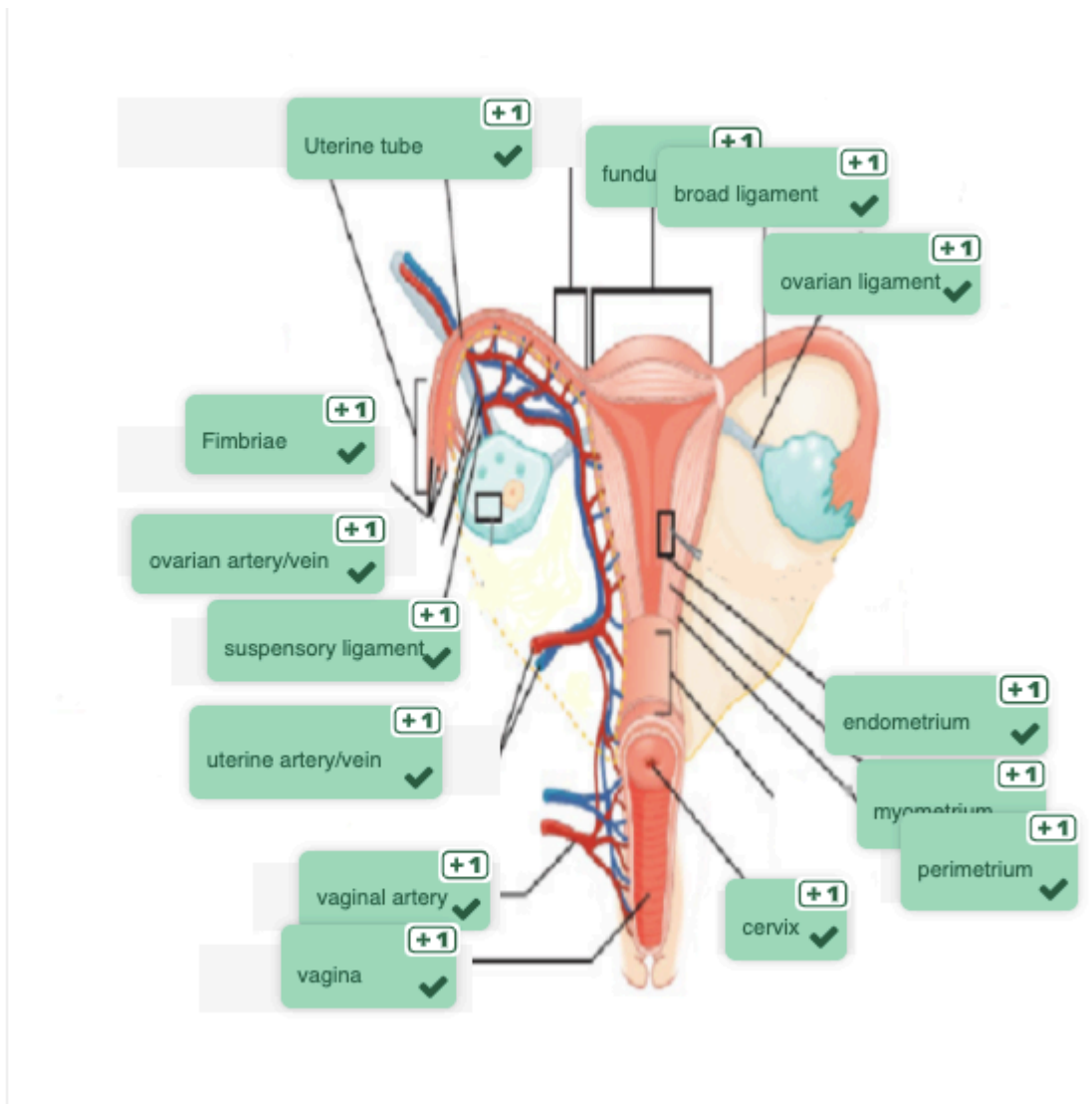
Image Descriptions

Figure 7.2 image description: This figure shows the parts of the vulva. The right panel shows the external anterior view and the left panel shows the internal anteriolateral view. The major parts are labeled (from top): prepuce, glans clitoridis, labia minora, corpus cavernosum, bulb of vestibule, urethral opening, labia majora, vaginal opening, opening of right Bartholin's gland, Bartholin's glands, anus. [\[Return to Figure 7.2\]](#).

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Notes



1.

Anatomy Labeling Activity Diagram (Text Version) Diagram of female reproductive system featuring anatomy organs and structures. The **uterine tube** also known as the fallopian tubes are positioned at the right top portion of the diagram. Extending from the uterine tube is finger-like projects known as **fimbriae**. The **uterus** is also known as the womb, is a hollow, muscular organ located in the pelvis between the bladder and rectum. The **uterine artery/vein** supplies blood to the uterus. The **fundus** of uterus, also called the uterine fundus, refers to the dome-shaped, rounded superior part of the body of the uterus that lies above the opening. The **broad ligament** and the round ligaments of the uterus serve as secondary support for the uterus within the pelvis. The **suspensory ligament** is a fold of tissue arising from the peritoneum and extends out from the ovaries. The **ovarian ligament** connects the ovaries to the lateral surface of the uterus. The **ovarian artery/vein** supplies blood to the ovaries. The three layers of the uterus from outside to inside are the **endometrium**, **myometrium**, **perimetrium**. The neck of the uterus is called the cervix. The **vagina** is a muscular canal connecting the cervix of the uterus and serves as the birth canal during childbirth. The **vaginal artery** supplies the vagina with blood.

7.3 - Physiology (Function) of the Female Reproductive System

Ovulation

Following ovulation, the Fallopian tube receives the oocyte. Oocytes lack flagella, and therefore cannot move on their own.

- High concentrations of estrogen that occur around the time of ovulation induce contractions of the smooth muscle along the length of the Fallopian tube.
- These contractions occur every 4 to 8 seconds, causing the oocyte to flow towards the uterus, through the coordinated beating of the cilia that line the outside and lumen of the length of the Fallopian tube, which pulls the oocyte into the interior of the tube.
- Once inside, the muscular contractions and beating cilia move the oocyte slowly toward the uterus.
- When fertilization does occur, sperm typically meet the egg while it is still moving through the ampulla.

Watch this video

Watch the MedLine Plus video [Ovulation \[Video\]](#) to observe ovulation and its initiation in response to the release of FSH and LH from the pituitary gland.

Media 7.2: Ovulation. From Betts, et al., 2013. Licensed under [CC BY 4.0](#).

The Menstrual Cycle

The menstrual cycle is a series of changes the female body goes through monthly to prepare for pregnancy. There are three phases of the menstrual cycle.

1. The **menses phase** of the menstrual cycle is the phase during which reproductive hormone levels are low, the woman menstruates, and the lining is shed. The menses phase lasts between 2 – 7 days with an average of 5 days.
2. The **proliferative phase** is when menstrual flow ceases and the endometrium begins to **proliferate**. During this phase, reproductive hormones are working in **homeostasi** to trigger ovulation on approximately day 14 of a typical 28-day menstrual cycle. Ovulation marks the end of the proliferative phase.
3. The **secretory phase** is when the endometrial lining prepares for implantation of a fertilized egg. If no pregnancy occurs within approximately 10- 12 days, the endometrium will grow thinner and shed starting

the first day of the next cycle.

Menopause

Menopause is the period of life when a woman will permanently stop having menstrual flows. The menopause is determined after the woman has gone 1 year with no menstruation periods. Menopause is a natural process of a woman growing older. It does not require treatment unless the woman is suffering frequent or severe symptoms. Common menopause symptoms are hot flashes, vaginal dryness, trouble sleeping, and mood changes. Symptoms may improve in the second year after menopause.

Medical Terms in Use

Female Reproductive System Terms Not Easily Broken into Word Parts

Female Reproductive System (Text version)

Practice these female reproductive medical terms that are not easily broken into word parts.

1. **adenomyosis**

- (ad-ě-nō-mī-Ō-sis)
- growth of endometrium into the other muscular portion of the uterus

2. **anovulation**

- (an-ov-yŭ-LĀ-shŏn)
- absence of ovulation

3. **Bartholin's glands**

- (BAR-tō-lĭns glĀns)
- Also known as greater vestibular glands they are responsible to secrete mucus to keep the vestibular area moist

4. **breast cancer**

- brest KAN-sĕr

- malignant tumor of the breast
5. **cervical cancer**
 - SĚR-vi-kāl KAN-sěr
 - malignant tumor of the cervix, which progresses from cervical dysplasia to carcinoma. Its cause is linked to human papillomavirus (HPV) infection.
 6. **contraception**
 - kon-trā-SEP-shōn
 - intentional prevention of conception (pregnancy)
 7. **dyspareunia**
 - dis-pǎ-ROO-nē-ǎ
 - difficult or painful intercourse
 8. **endometrial cancer**
 - en-dō-MĚ-trē-āl KAN-sěr
 - malignant tumor of the endometrium (also called uterine cancer)
 9. **fibrocystic changes of the breast (FCC)**
 - fī-brō-SĪS-tīk brest
 - fibrosis, benign cysts, and pain or tenderness in one or both breasts (also called fibrocystic breasts)
 10. **fistula**
 - FIS-chŭ-lǎ
 - abnormal passageway between two organs or an internal organ and the body surface
 11. **hormonal replacement therapy (HRT)**
 - replacement of hormones, estrogen, and progesterone, typically to treat symptoms associated with menopause
 12. **menopause**
 - MEN-ō-poz
 - cessation of menstruation
 13. **oligoovulation**
 - ol-i-gō-ov-yŭ-LĀ-shōn
 - infrequent ovulation
 14. **ovarian cancer**

- ō-VAR-ē-ăn KAN-sěr
 - malignant tumor of the ovary
15. **ovulation**
- ov-yŭ-LĀ-shŏn
 - release of ovum from a mature Graafian follicle
16. **Papanicolaou smear**
- pĀp-ă-NĒ-kă-low smēr
 - PAP test – A smear method for examining cells, that is used to detect cancers of the cervix
17. **pelvic inflammatory disease (PID)**
- inflammation of some or all of the female pelvic organs
18. **polycystic ovary syndrome (PCOS)**
- pŏl-ē-SĪS-tĭk Ō-vă-rē SĪN-drŏm
 - condition typically characterized by hormonal imbalances, ovulatory dysfunction, and multiple ovarian cysts.
19. **premenstrual syndrome**
- prē-MĒN-stroo-ăl SĪN-drŏm
 - syndrome involving physical and emotional symptoms occurring up to 10 days before menstruation. Symptoms include nervous tension, irritability, mastalgia, edema, and headache.
20. **prolapse**
- PRŌ-laps
 - displacement of an organ or anatomic structure from its normal position
21. **speculum**
- SPEK-yŭ-lŭm
 - instrument for opening a body cavity to allow visual inspection
22. **toxic shock syndrome**
- severe illness characterized by high fever, rash, vomiting, diarrhea, and myalgia followed by hypotension and, in severe cases, shock and death. Typically occurs in women using tampons and caused by Staphylococcus aureus and Streptococcus pyogenes
23. **tubal ligation**
- TOO-băl lĭ-GĀ-shŏn
 - surgical closure of the fallopian tubes for sterilization

24. **uterine fibroid**

- ŪT-ě-rīn FIB-royd
- benign tumor of the uterine muscle

25. **uterine prolapse**

- ŪT-ě-rīn PRŌ-laps
- downward displacement of the uterus into the vagina

26. **vaginal fistula**

- VAJ-īn-āl FIS-chŭ-lā
- abnormal opening between the vagina and another organ, such as the urinary bladder, colon, or rectum

Activity Source: Female Reproductive System terms not built from word parts from [Medical Terminology](#) by Grimm et al., licensed under [CC BY 4.0](#)./Some H5P audio re-recorded by Tania Deane and David McCuaig and text version added.

Medical Terms in Context 1

Medical Terms in Context (Text Version)

Use the words below to fill in the medical report:

- | | | |
|----------------|---------------|-----------------|
| • Transvaginal | • Pain | • Cysts |
| • Laparoscopy | • Endometrial | • Pelvic |
| • Dysmenorrhea | • Tissue | • Endometriosis |

FEMALE REPRODUCTIVE SYSTEM – MEDICAL REPORT

PATIENT NAME: Stacey ROBERTS

AGE: 28 Sex: Female

DOB: October 27

DATE OF ASSESSMENT: July 22

ADMITTING PHYSICIAN: Adam Vance, MD, Gynecology

DIAGNOSIS: Endometriosis

HISTORY: This 28-year-old white female came to me with symptoms of _____ [Blank 1]. She presented with _____[Blank 2], menorrhagia, and pain with intercourse.

PHYSICAL EXAMINATION: During a _____[Blank 3] exam, abnormalities were felt. A _____[Blank 4] ultrasound was performed, and _____[Blank 5] were identified.

TREATMENT: I have discussed the results of the ultrasound and have recommended a laparoscopy to provide more information on the location, extent, and size of the _____[Blank 6] implants. A _____[Blank 7] sample will be sent for further testing. If possible, the endometriosis implants will be removed.

PLAN: Ms. Roberts has agreed to the laparoscopy. I have prescribed Orilissa to help with the _____[Blank 8]. My office will set up an appointment for the _____[Blank 9].

Adam Vance, MD, Gynecology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers: ¹

Activity source: Female Reproductive System – Medical Report by Heather Scudder, licensed under [CC BY 4.0](#). /Text version added.

Medical Terms in Context 2

Medical Terms in Context (Text Version)

Use the words below to fill in the medical report:

- Edema
- Blood Pressure
- Ovarian
- Menorrhagia
- Auscultation
- Murmur
- Spotting
- Chronic
- Oophoritis
- Urination
- Abdominal
- RLQ

FEMALE REPRODUCTIVE SYSTEM – MEDICAL REPORT

PATIENT NAME: Megan WESTOVER

AGE: 29

SEX: Female

DOB: November 22

DATE OF ASSESSMENT: June 4

ATTENDING PHYSICIAN: Adam Vance, MD, Gynecology

HISTORY: A 29-year-old woman complains of right _____[Blank 1] pain. She has fever with chills, nausea, and pain during _____[Blank 2] for 3 days. She is in the 4th day of her menstrual cycle and has _____[Blank 3]. She has had intermenstrual _____[Blank 4] for the last 3 menstrual cycles. She had a hysterectomy due to a breast cancer 9 years ago. She has no other history of _____[Blank 5] illness.

PHYSICAL AND EXAMINATION: VITAL SIGNS: Temperature 102.2, _____[Blank 6] 115/75, and pulse 92, regular. Respiratory rate 16. LUNGS: Normal breath sounds. HEART: No _____[Blank 7], regular rhythm. ABDOMEN: There is a tenderness to deep palpation in the _____[Blank 8]. Pain triggers when the patient bends forward. Normal to _____[Blank 9]. BACK: No flank tenderness. EXTREMITIES: Normal with no _____[Blank 10].

LABORATORY: No UTI, urinalysis done in the clinic negative.

ASSESSMENT: Rule out _____[Blank 11]. No evidence of UTI currently.

PLAN

1. CBC lab testing.
2. Pelvic ultrasound focused on _____ [Blank 12] structures, transvaginal ultrasound.
3. Begin treatment empirically with Ampicillin 500 mg daily.
4. Follow up with the patient after the blood and ultrasound results.

Adam Vance, MD, Gynecology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers: ²

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Medical Terms in Context 3

Medical Terms in Context (Text Version)

Using the words below fill in the consultation report:

- Cyanosis
- Mastectomy
- Chemotherapy
- Breast
- HEENT
- Murmurs
- Weight
- Distended
- Erythema
- Lesion

FEMALE REPRODUCTIVE SYSTEM – CONSULTATION REPORT

PATIENT NAME: Abigail LANGMAN

AGE: 51

SEX: Female

DOB: July 27

DATE OF CONSULTATION: October 8

CONSULTING PHYSICIAN: Adam Vance, MD, OB/GYN

REASON FOR CONSULTATION: Possible breast cancer.

HISTORY: Patient is a 51-year-old woman here for a check-up because of a suspicious lump that was found on her yearly mammogram. Patient is worried about possible _____[Blank 1] cancer.

PHYSICAL EXAMINATION: GENERAL: No acute distress. VITAL SIGNS: Temperature is 98.1°F. Pulse is 72, BP is 110/72 mm Hg. Respirations 16. _____[Blank 2] is 186 pounds, height is 5 feet, 8 inches.

_____ [Blank 3]: Eyes are equal and responsive. Ears are normal, no discharge. Nose is normal. Throat is normal and without _____[Blank 4]. LUNGS: Clear to auscultation. CARDIOVASCULAR: Regular rate and rhythm, no _____[Blank 5]. ABDOMEN: Palpation is soft, not _____[Blank 6], nontender.

BREAST: RIGHT: Tender to the touch on right side and has a hard lump about the size of a golf ball near the axilla. LEFT: Normal to the touch, no discomfort. EXTREMITIES: Without edema, _____[Blank 7], or clubbing.

SOCIAL HISTORY: Mother had breast cancer at the age of 48 and had a _____[Blank 8] to remove the left breast. Patient has been scheduled for yearly mammograms since the age of 45 to check for possible signs of early breast cancer. Father has a history of stage 1 rectal cancer treated with 3 rounds of _____[Blank 9]. The patient does not smoke or use recreational drugs, she does like a glass of wine 3-4 nights a week.

Patient states she is quite worried since scheduling an appointment to follow up her mammogram results. Patient has experiencing anxiety which is affecting her eating and sleeping routine.

ASSESSMENT: Patient is a 51-year-old woman here for a check-up because a suspicious lump found on her yearly mammogram. Patient is otherwise healthy and is not currently on any medications.

PLAN

1. 1. Ultrasound of the right breast.
2. 2. Biopsy of the _____[Blank 10] for pathology. Avoid overexertion or lifting of arms above shoulder height after the biopsy
3. 3. Follow-up appointment in 2-3 weeks for results.

Adam Vance, MD, OB/GYN

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers:³

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Notes

1. 1. Endometriosis 2. Dysmenorrhea 3. Pelvic 4. Transvaginal 5. Cysts 6. Endometrial 7. Tissue 8. Pain 9. Laparoscopy
2. 1. Abdominal 2. Urination 3. Menorrhagia 4. Spotting 5. Chronic 6. Blood Pressure 7. Murmur 8. RLQ 9. Auscultation 10. Edema 11. Oophoritis 12. Ovarian
3. 1. Breast, 2. Weight, 3. HEENT 4. Erythema, 5. Murmurs, 6. Distended, 7. Cyanosis, 8. Mastectomy, 9. Chemotherapy, 10. Lesion

7.4 - Female Reproductive Diseases, Disorders and Diagnostic Testing

Cancer

Breast Cancer

Breast cancer starts in the cells that line the ducts or the lobule of the breast. Some warning signs include a new lump in the breast or **axilla**, thickening or swelling, irritation or dimpling of the breast skin, redness or flaky skin, pain, discharge (all in the breast or nipple area), and change in breast size. Risk factors include family history, obesity, hormonal treatment, and changes in breast cancer-related genes (BRCA1 or BRCA2) (Centers for Disease Control and Prevention, n.d.; Cancer Care Ontario, n.d.).

Treatment options include chemotherapy, radiation, and surgical interventions, such as **mastectomy**, biopsy, incision and drainage, and **mammoplasty** (Centers for Disease Control and Prevention, n.d.; Cancer Care Ontario, n.d.). To learn more about breast cancer, view the [Cancer Care Ontario: Breast Cancer web page \[New Tab\]](#).

Cervical Cancer

Cervical cancer is a typically slow-growing cancer and is highly curable when found and treated early. Advanced cervical cancer may cause abnormal bleeding or discharge from the vagina, such as bleeding after sex. It is diagnosed during a Papanicolaou test (or Pap smear), which looks for precancers (cell changes) on the cervix. The Pap test can find cervical cancer early, when treatment is most effective. The Pap test only screens for cervical cancer (Centers for Disease Control and Prevention, 2019).

The HPV (Human papillomavirus) test looks for HPV strains, which is the virus that can cause precancerous cell changes. Almost all cervical cancers are caused by HPV. HPV is a common virus that is passed from one person to another during sexual contact. In Canada, there is the HPV vaccine. The age of administration varies between the provinces and territories. See below under HPV for more information about the HPV vaccine (York Region Health Connect, n.d.). To learn more about cervical cancer, please visit the [Centers for Disease Control and Prevention's cervical cancer factsheet \[PDF\]](#).

Endometriosis

Endometriosis is an abnormal condition of the **endometrium**. Endometriosis occurs when a tissue similar to the endometrium grows and implants outside the uterus. The female hormone estrogen causes these implants to grow, bleed, and break down. They are implanted outside the uterus and have no way to leave the body. They

become painful, inflamed, and swollen. The inflammation causes scar tissue around nearby organs, which can interfere with their normal functioning and cause pain (Canadian Women's Health Network, 2012).

Endometriosis generally appears between the ages of 15 and 50. Signs and symptoms may include **dysmenorrhea**, **lumbago**, **dyspareunia**, menstrual irregularity, and infertility. One third of women diagnosed with endometriosis have no symptoms at all. Diagnosis may include **laparoscopy** and endometrial biopsy. Treatment may include medication and surgical interventions such as **hysterectomy** and **oophorectomy**. The cause of endometriosis is unknown (Canadian Women's Health Network, 2012). To learn more about endometriosis, visit the [World Health Organization's page on Endometriosis \[New Tab\]](#).

PCOS

Polycystic Ovary Syndrome (PCOS) has no known etiology, but researchers have linked it to excessive insulin production. Excessive insulin in the body can release extra male hormones in women. Since the ovaries produce high levels of **androgens**, this causes the eggs to develop into cysts and instead of releasing during ovulation, the cysts build up and enlarge. The most common symptoms of PCOS include **oligomenorrhea**, **amenorrhea**, **polymenorrhea**, enlarged ovaries with multiple small painless cysts or follicles that form in the ovary, **acrochordons**, **acanthosis nigricans**, **hirsutism**, thinning hair, acne, weight gain, anxiety, depression, hyperglycemia, and infertility (Canadian Women's Health Network, 2012a).

Treatments like medications such as birth control pills or **antiandrogens** can help balance the patient's hormones and relieve some of the symptoms (Canadian Women's Health Network, 2012a). To learn more about PCOS, visit the [World Health Organization's page on PCOS \[New Tab\]](#).

Sexually Transmitted Infections (STIs)

The terms for Sexually Transmitted Infections (STI) and Sexuality Transmitted Diseases (STD) are often used interchangeably. Sexuality Transmitted Diseases (STD) implies the disease was acquired through sexual transmission. A disease is a disorder of structure or function in a human, which produces specific signs or symptoms. A disease must be managed, as in the case of Human Immunodeficiency Virus (which can also be acquired through the transmission of other bodily fluids; thus not solely sexual transmission). The treatment may include **antiretrovirals** or **anti-virals** (Urology Care Foundation, 2019).

Chlamydia (CT)

Chlamydia is one of the most common sexually transmitted infections (STIs) caused by bacteria that infect the cervix, urethra, and other reproductive organs. Chlamydia is easy to treat and can be cured. Many people with chlamydia do not have any symptoms and unknowingly pass the infection to their sexual partner(s). If symptoms develop, they usually appear two to six weeks after sexual contact with an infected person. While females are most often asymptomatic, they may experience **cervicitis**. Left untreated, chlamydia in females can lead to Pelvic

Inflammatory Disease (PID), which can cause permanent damage to the reproductive organs and subsequent infertility (Sexually Transmitted Infections (STIs) Chlamydia, 2018) (Chlamydia and Gonorrhoea, n.d.).

Chlamydia spreads through unprotected oral, anal or vaginal sex with an infected person. Chlamydia can be spread to the eyes via the hands with direct contact with infected fluids. Until a patient finishes their treatment, they continue to have the infection and can continue to pass it to others. Chlamydia is treated with antibiotic pills. If the patient has **epididymitis**, they may need to be hospitalized and be treated with intravenous (IV) antibiotics. All sexual partners within the past 60 days should be examined, treated, and informed that having no symptoms does not mean there is no infection (Klein, 2023).

Gonorrhoea (Gonococcus) – (GC)

Gonorrhoea is a sexually transmitted infection (STI) caused by bacteria that infects the cervix, urethra, and other reproductive organs. Infections can also infect the throat and anus. Gonorrhoea can be treated and cured. Many people infected with Gonorrhoea have no symptoms and can unknowingly pass the infection on to their sexual partner(s). If symptoms develop, they may appear two to seven days after sexual contact with an infected person. Symptoms vary depending on which part of the body is infected. Females may experience abnormal vaginal bleeding, discharge, or **dysuria**. Left untreated, Gonorrhoea in females may lead to pelvic inflammatory disease and fertility complications, such as ectopic pregnancy. Gonorrhoea infection from oral sex may lead to sore throat and swollen glands. Gonorrhoea infection from anal sex may cause itchiness and discharge from the anus. Gonorrhoea is spread through unprotected oral, vaginal or anal sex with an infected person. Until the patient finishes their treatment, they continue to have the infection and can pass it to others (Klein, 2023).

Gonorrhoea is treated with oral **antibiotics** in combination with an **intramuscular** (IM) injection. It is important that one complete the treatment and abstain from unprotected sexual activity for at least seven days following treatment. All sexual partners within the past 60 days should be examined, treated, and informed that having no symptoms does not mean there is no infection (Klein, 2023).

Reportable Diseases

Both chlamydia and gonorrhoea are reportable diseases to the Ministry of Health. Therefore, the local health department will be calling the doctors office or patient to ensure correct treatment was received and sexual partners have been followed up with testing and treatment. To learn more about STIs and STDs such as chlamydia and gonorrhoea, please go to the [Public Health Ontario web page on sexually transmitted infections \[New Tab\]](#).

Human Papillomavirus- HPV

HPV is a common sexually transmitted infection (STI). Both males and females can be infected with HPV. Almost three quarters of sexually active individuals have been exposed to HPV during their lifetime. There are over 100 strains of HPV and some strains of HPV can cause visible genital warts. The warts are usually painless, but may

be itchy, uncomfortable, and hard to treat. Some strains of HPV cause genital, anal, throat, and cervical cancers. HPV spreads through sexual activity and skin-to-skin contact in the genital area with an infected person. Since some people are **asymptomatic**, they don't know they have the virus and consequently pass the virus to their sexual partners. Treatments are available for genital warts, but there is no cure for HPV (York Region Health Connect, n.d.). To learn more about HPV symptoms, treatments, and prognosis, visit the [Mayo Clinic page on HPV Infection \[New Tab\]](#).

HPV Vaccine

A vaccine called Gardasil® 9 is available for 9 HPV strains. This vaccine assists the immune system in protecting the body against infections and diseases caused by HPV (York Region Health Connect, n.d.). To learn more about Gardasil® 9 treatments, please visit the [Gardasil® 9 website \[New Tab\]](#).

Herpes Simplex Virus (HSV)

Genital herpes is a sexually transmitted infection (STI) that is caused by a virus called herpes simplex virus (HSV). There are two types of herpes simplex viruses:

- Type 1- oral herpes or cold sores (HSV-1)
- Type 2- genital herpes (HSV-2)

These viruses are very similar and either type can cause genital herpes or cold sores. Symptoms might include **dysuria**, enlarged glands, **myalgia**, **arthralgia** and fever. Once a patient is infected with HSV, the virus remains in their body even after the symptoms are gone and can cause recurring outbreaks. Between the outbreaks, the virus stays in their body. When the virus becomes active again, the symptoms return but are usually less painful and heal faster. Recurring outbreaks vary from person-to-person, however they can be triggered by emotional or physical stress, exposure to sunlight, hormonal changes, poor nutrition, sexual intercourse, lack of sleep or a low immune system (Mayo Clinic Staff, 2022).

Herpes is spread through direct contact with the sores or blisters of an infected person. Contact (and transfer of the virus) can occur from genitals-to-genitals, mouth-to-genitals or mouth-to-mouth. Herpes can also be passed to the anal area. Herpes spreads easily during sexual contact while symptoms are present or just before an outbreak of symptoms. An infected person may spread herpes even when they have *no* symptoms; this is called **asymptomatic** shedding. One can spread the herpes virus to other parts of their body after touching the sores; **autoinoculation**. The fingers, eyes, and other body areas can accidentally become infected in this way. Hand washing after touching sores and blisters is recommended to prevent spreading the virus (Mayo Clinic Staff, 2022).

There is no cure for herpes. Antiviral pills help to reduce symptoms and speed the healing of blisters or sores and are prescribed by a doctor. Treatment of symptoms may be managed with medication for pain, bath salts, cold compresses, and urinating in water may help to relieve discomfort. Keep the infected area clean and dry, wear cotton underwear and loose clothing to reduce discomfort. All sexual partner(s) should be informed. The only way to reduce the risk of transmission of herpes is to avoid direct contact with the sores and to use condoms.

Condoms will reduce but not eliminate risk as the virus can be present and shed from the skin in the genital area (Mayo Clinic Staff, 2022).

To learn more about the symptoms, complications, treatments and prognosis of HSV please visit the Mayo Clinic's page on [Genital Herpes \[New Tab\]](#), or [Public Health Ontario's Testing Index \[New Tab\]](#).

Female Reproductive System Medical Abbreviations

Reproductive Sexually Transmitted Infections (STIs) Abbreviations

- **AB** (Antibiotic)
- **CT** (Chlamydia)
- **GC** (Gonorrhea)
- **HPV** (Human Papillomavirus)
- **HSV** (Herpes Simplex Virus)
- **PID** (Pelvic Inflammatory Disease)
- **STD** (Sexually Transmitted Diseases)
- **STI** (Sexually Transmitted Infections)

Activity source: Reproductive Sexually Transmitted Infections (STIs) Abbreviations by Kimberlee Carter, licensed under [CC BY 4.0](#). /Text version added.

Medical Specialties and Procedures related to the Female Reproductive System

Gynecology

A **gynecologist** is a specialist in the area of **gynecology**, focusing on the diagnosis, treatment, management and prevention of diseases and disorders of the female reproductive system. Obstetrics is a specialty that provides care through pregnancy, labour, and **puerperium**. Further subspecialties in women's health include contraception, reproductive **endocrinology**, infertility, adolescent gynecology, **endoscopy** and gynecological oncology (Canadian Medical Association, 2018). To learn more about obstetrics or gynecology, please follow visit the [Canadian Medical Association's Obstetrics/Gynecology Profile page \[PDF\]](#).

Hysterectomy

A **hysterectomy** [/pb_glossary](#) is done to stage or treat female reproductive cancers, treat precancerous conditions of the cervix and some non-cancerous conditions that have not responded to other forms of treatment. There are three types of hysterectomy:

- A **total hysterectomy** removes both the uterus and the cervix.
- A **subtotal hysterectomy** removes the uterus only.
- A **radical hysterectomy** removes uterus, cervix, part of the vagina, and ligaments.

Sometimes the ovaries and fallopian tubes are removed at the same time that a hysterectomy is done. A [\[pb_glossary id="220"\]](#)bilateral salpingo-oophorectomy (BSO) removes both ovaries and fallopian tubes. A **unilateral** salpingo-oophorectomy removes one ovary and one Fallopian tube (Canadian Cancer Society, 2020). To learn more about hysterectomy, please visit the [Canadian Cancer Society's page on hysterectomies](#) [\[New Tab\]](#).

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Vocabulary & Check Your Knowledge

Female Reproductive System Vocabulary

Acanthosis Nigricans

A disorder that causes darkening and thickening of the skin on the neck, groin, underarms or skin folds.

Acrochordons

Skin tags, teardrop-sized pieces of skin that can be as large as raisins and are typically found in the armpits or neck area.

Amenorrhea

Absence of periods.

Androgens

Male hormones.

Antiandrogens

A group of medications that counteract the effects of male hormones.

Antibiotics

Medications that stop bacterial infections.

Antiretrovirals

Treatment that works against the virus replication.

Anti-virals

Treatments that work effectively against a virus.

Asymptomatic

Pertaining to without symptoms.

Autoinoculation

Self inoculation.

Axilla

The armpit.

Bartholin's glands

Also known as greater vestibular glands they are responsible to secrete mucus to keep the vestibular area moist.

Bilateral

Pertaining to both sides.

Douching

Washing the vagina with fluid.

Dysmenorrhea

Painful periods.

Dyspareunia

Painful intercourse.

Dysuria

Painful urination.

Endocrinology

The study of the endocrine glands and hormones.

Endometrium

The innermost layer containing a connective tissue lining covered by epithelial tissue that lines the lumen. Provides the site of implantation for a fertilized egg. Sheds during menstruation if no egg is fertilized.

Endoscopy

Process of viewing internally.

Fornix

Superior portion of the vagina.

Gametes

Haploid reproductive cells that contribute genetic material to form an offspring.

Gynecologist

Specialist in the study and treatment of the female reproductive system.

Gynecology

The study of the female reproductive system.

Hirsutism

Excessive hair growth in a pattern typically seen in males.

Homeostasis

Biological process that results in stable equilibrium.

Hysterectomy

Surgical removal of the uterus.

Inferior

Pertaining to below.

Intramuscular

Pertaining to within the muscle.

Laparoscopy

Process of viewing internal organs.

Lumbago

Lower back pain.

Mammoplasty

Surgical repair of the breast particularly after a mastectomy.

Mastectomy

Excision of breast(s) and or breast tissue.

Oligomenorrhea

Infrequent or irregular periods.

Oocyte

Female gamete.

Oophorectomy

Surgical removal of one or both ovaries.

Polymenorrhea

Excessive bleeding during one's period.

Polyuria

Frequent urination.

Proliferate

Reproduce rapidly.

Puerperium

Time directly after childbirth.

Superior

Pertaining to above.

Unilateral

Pertaining to one side.

Urethritis

Inflammation of the urethra.

Test Yourself

Female Reproductive System Glossary Reinforcement Activity (Text Version)

1. The site of implantation for a fertilized egg or the layer that sheds during menstruation if no egg is fertilized is called _____. [Blank 1].
 - a. Endometrium
 - b. Oocyte
 - c. Puerperium
2. Hysterectomy is the _____. [Blank 2].
 - a. Surgical removal of the breast(s)
 - b. Surgical removal of the uterus
 - c. Surgical removal of the fallopian/uterine tubes
3. Pain periods is called _____. [Blank 3].
 - a. Dysmenorrhea
 - b. Amenorrhea
 - c. Oligomenorrhea
4. Painful Intercourse is called _____. [Blank 4].
 - a. Dysuria
 - b. Dyspareunia
 - c. Dysmenorrhea

5. The superior portion of the vagina is called _____ [Blank 5].
- a. Axilla
 - b. Bartholin's glands
 - c. Fornix

Check your answers: ¹

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Attribution

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Notes

1. 1. Endometrium 2. Surgical removal of the uterus 3. Dysmenorrhea 4. Dyspareunia 5. Fornix

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