NAILS

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CONTRIBUTING AUTHORS:
Alisha Rimando Botero
Tiffani Douglas
Nancy King
Malinda McHenry
Jeryl E. Spear

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Milady Standard Nail Technology,
Eighth Edition
Alisha Rimando Botero, Tiffani Douglas, Nancy King, Malinda McHenry, Jeryl E. Spear

Vice President and General Manager, Milady: Sandra Bruce

Product Director: Kara Melillo

Product Manager: David Santillan

Learning Design Manager: Jessica Mahoney

Senior Content Manager: Sarah Koumourdas

Product Assistant: Emma Fishbein

Learning Designer: Beth Williams

Marketing Manager: Kim Berube

Marketing Director: Slavik Volinsky

Creative Studio Designer: Felicia Bennett

Interior Designer: Joe Devine

Cover Image Art and Design: Alisha Rimando Botero

Cover Image Photographer: Grey Zisser

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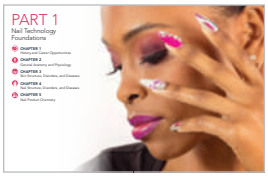
Table of Contents



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Preface

A Letter to you: our Fabulous Student

Well done! You have made a terrific decision to study nail technology. Career opportunities for nail technicians will continue to surprise and excite you every day. As with many choices, it will be important to follow that which you are drawn to, rather than feeling pushed in any one direction. Naturally, there are subjects and components of study that you may find more interesting than others; however, you will now find ways to learn and grow beyond any of those limitations, and most of all you will surprise yourself. Nail care is an art, and you are the artist.

Your Milady Team

A team of Milady mentors, reviewers, authors, and educators have collaborated to lend decades of education and experience to this new edition of *Milady Standard Nail Technology*. We have worked hard to provide you with the very best in education based on foundational nail techniques and current industry research. We commit to continue to learn and grow with the industry and work to provide you with the tools you need to succeed.

Your Classmates

Your classmates will become important in your study of nail technology, as you will learn quickly that you need each other. For some of you, this experience in school may be your first career. For others it may be a fourth or fifth career, and one that you have always dreamed about. Have patience with your fellow learners and, mostly, with yourself. You will serve as models for each other in practicing techniques and nail services and role-playing client interactions. You may find that you become best friends.

What you Will Learn About

In the 8th edition of *Milady Standard Nail Technology,* you will find the most current information on the sciences, nail services, and nail enhancements. You will learn a variety of techniques, from the basic

manicure and pedicure to nail art and add-on services. You will also learn how to identify unhealthy conditions of the skin and nails to keep you and your clients safe and healthy.

The Future

The future of nail care is exciting, and the industry is changing and growing as you learn. Keep your pulse on the industry and embrace change. Your future is bright so, study hard, use your creativity, don't give up, and allow yourself to grow.

The Industry Standard

Sandra Bruce

Since 1927, Milady has been committed to quality education for beauty professionals. Over the years, tens of millions of licensed professionals have begun their careers studying from Milady's industry-leading textbooks.

We at Milady are dedicated to providing the most comprehensive learning solutions in the widest variety of formats to serve you, today's learner. The newest edition of *Milady Standard Nail Technology* is available to you in multiple formats, including the traditional print version, an e-book, and MindTap, which provides an interactive learning experience complete with activities, learning tools, and brand-new video content.

Milady would like to thank the educators and professionals who participated in surveys and reviews to best determine the changes that needed to be made for this edition. We would also like to thank learners, past and present, for being vocal about your needs and giving Milady the opportunity to provide you with the very best in nail technology education.

Thank you for trusting Milady to provide the valuable information you need to build a foundation for your career. Our content combined with your passion, creativity, and devotion to your craft and your customers will set you on the path to a lifetime of success. Congratulations on taking the first step toward your future as a nail technology and beauty professional!

Sandra Bruce
Vice President and General Manager, Milady

Meet the Contributors

Message to the Authors

Milady recognizes the many gifts and talents of its authors worldwide. We heartily thank these very special authors of the 8th edition of *Milady Standard Nail Technology* for their dedication to writing this volume; without their contributions, it would not be the great educational resource that it has become. We are pleased to share their biographies, which no doubt provide just a glimpse of all that they have accomplished. Well done!

Alisha Rimando Botero

Chapter 9, Nail Tips and Forms
Chapter 10, Nail Resin Systems
Chapter 11, Monomer Liquid and Polymer Powder Nail Enhancements
Chapter 12, Gel Nail Enhancements
Chapter 13, Nail Art

Alisha Rimando Botero

Alisha Rimando Botero is a world champion nail artist, educator, and author. She has competed in over 100 nail competitions in 10 countries, winning a world championship in 2005. She has been a licensed nail specialist since 1995, a certified permanent makeup artist since 1998, and a certified reflexologist since 2008.

As a world-renowned educator, Rimando Botero has developed and conducted training seminars for nail students, nail professionals, and top nail educators in more than 25 countries. An industry leader and educator, she has created education for hundreds of innovative products and artistic procedures and written training programs for manufacturers, private labels, and salon franchises. She has also researched, developed, packaged, and launched artificial nail enhancement products, nano technology skin care, gel polish and hybrid polish collections, and natural nail treatments for professional nail product manufacturers.

Rimando Botero authored *Milady Standard Nail Technology Workbook* (6th and 7th editions) and contributed to *Milady Standard Nail Technology* and *Milady Standard Cosmetology* textbooks from 2010 through 2020. She has been a featured artist in hundreds of nail application videos for multiple manufacturers and has served as host, artist, and subject-matter expert for *Milady Standard Nail Technology* and *MiladyPro* videos. She has been featured in more than 150 trade publications worldwide, such as *People*, *Teen Vogue*, *Bridal Guide*, *Self*, *Fitness*, and *Seventeen* magazines, as well as industry magazines like *Nails*, *Nailpro*, *Scratch* (UK), and *Stylish Nail* (Japan). Rimando Botero is also a featured artist for New York Fashion Week and has worked with many LA celebrities, such as Jennifer Hudson, Ekaterina Gordeeva, Akiko Ogawa, Isaac Mizrahi, Diane Von Furstenberg, Zac Posen, Annabelle Dexter Jones, and Erin Featherston.

Tiffani Douglas

Tiffani Douglas

Chapter 6, Manicuring
Chapter 7, Pedicuring

Tiffani Douglas is an author, writer, speaker, and licensed nail technician with over 20 years of experience in the beauty and marketing industries. A graduate of Bluegrass Community & Technical College, she obtained her associate degree in cosmetology in 1996. She worked as a manicurist while completing her bachelor of arts degree in journalism from the University of Kentucky in 2002.

Dedicated to raising the professional bar in the industry, Douglas has been active in the beauty community in the areas of marketing and education. She has written two e-books, *Social Media Marketing: A Guide for Beauty Professionals* and *Are You a True Beauty Professional: 7 Practical Steps to Being More Professional, Upgrading Your Business, and Increasing Your Revenue*. In 2016, she published her first book, *Straight Outta Beauty School: 10 Things You Should Know and Do After You Graduate*.

Douglas has worked with top beauty brands, well-known trade magazines, and major beauty education companies and associations. She remains steadfast in her mission to inspire and educate beauty professionals.

Nancy King

Nancy King

Chapter 4, Nail Structure, Disorders, and Diseases
Chapter 6, Manicuring (accessibility content)
Chapter 7, Pedicuring (accessibility content)
Chapter 8, Electric Filing

Nancy King is a leading salon expert on safe salon standards. She began her regulatory experience on the Maryland State Board of Cosmetologists. King has provided research, support data, and testimony—at the state and federal levels—on a variety of regulatory issues pertaining to salon practices. Having worked with state boards, state and federal agencies, and industry associations, as well as schools and salons, she has held prestigious positions with numerous industry organizations. King is a champion nail competitor and international competition judge, and has been a cover artist and author of many articles for international industry publications. She has been a contributing author of industry textbooks and a subject-matter expert for state licensing exams and has trained state exam proctors. King has provided standardized education on many subjects, including writing national standards for safe electric filing and pedicure cleaning and disinfecting.

King has served as a consultant to and has appeared in many television network stories about safe salon practices, including the story about the infection outbreak in Watsonville, California, and others that ran on ABC's *20/20, CNN*, and *Paula Zahn Now*. She has twice appeared on

the *Rachael Ray Show*. King has been retained by prominent law firms throughout the United States as an expert witness in salon malpractice cases in state and federal courts. She has even been named in a Texas Supreme Court decision as an expert not only in all aspects of cosmetology, but also in salon management.

Malinda McHenry

Chapter 3, Skin Structure, Disorders, and Diseases
Chapter 5, Nail Product Chemistry


Malinda McHenry

Malinda McHenry graduated from College of Coiffure Arts in Billings, Montana, and Von Lee School of Esthetics in Baltimore. She earned her instructor license from the International School of Hair Design in Great Falls, Montana. Ms. McHenry has been a product educator since 1987 for brands such as Brocato, L'ANZA, Tressa, Alpha 9 Nails, Vicki Peters Beautiful Nails, SoundSkin Microdermabrasion, Candela Lasers, Vivace Microneedling with RF, Neurotris Microcurrent, Épillyss, GlyMed, Image Skincare, and Lira Clinical. From 2004 to 2014, she co-owned The Academy of Aesthetic Arts, an accredited beauty college located in Shawnee, Kansas, with Cathy Berrian. Together they proudly graduated 600 plus students into the field of esthetics.

In 2008, McHenry went before the Kansas Legislature to read into law the scope of practice and the increase from 650 hours to 1,000 hours for Kansas estheticians. In 2009, she won Telly and David Awards for her contributions to Aesthetic Video Source as a technical video creator with nine titles on chemical peels, body treatments, and ultrasound applications. She was a contributing author of *The Esthetician's Guide to Outstanding Esthetics*, released September 2017. McHenry, known as the "Esthetic Professor," has been a regular guest educator for the AACS and CEA for the past 10 years and for Face & Body Trade shows for 2 years. She serves as the master of ceremonies at the annual Beauty Business Summit in St. Pete, Florida. McHenry currently owns Bronzed N Beautiful Spa and Academy of Advanced Aesthetic Arts, a postgraduate training center in Overland Park, Kansas.

Jeryl E. Spear

Chapter 1, History and Career Opportunities


Jeryl E. Spear

Known throughout the industry as a leader and a champion of professional beauty, Jeryl Spear has dedicated most of her adult life to furthering our industry through education, innovation, and the firm belief that all beauty professionals should continually nurture their creativity, independent nature, and pro-beauty skills.

Spear began her journey as a cosmetologist in California and soon added "salon owner" to her growing resume. In the mid 1990s, she launched her career as a writer when Milady accepted her proposal for an industry-themed business book. She later became a writer and

freelance editor for major pro-beauty publications and eventually assumed the role of editor-in-chief for her own magazine.

Today, Spear marries her skills as a beauty professional and a marketer, with her talent for social media. On Instagram, her main page is @hotonbeauty; she also hosts several other professional beauty pages that attract over one million organic followers. Her client base includes major beauty companies; her passion remains focused on promoting the careers of dedicated beauty professionals.

Contributing Authors for Previous Editions of Milady Standard Nail Technology

We want to sincerely thank the following individuals who have contributed their skin care expertise and business knowledge to students and educators in past editions.

Alisha Rimando Botero

John Halal

Mary Ann Kilgore

Jim McConnell

Janet McCormick, MS, CIDESCO

Vicki Peters

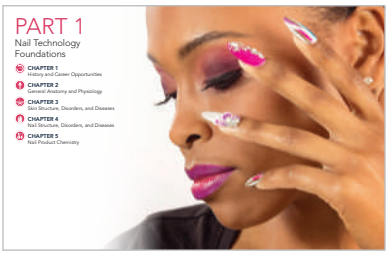
Douglas Schoon

Jeryl E. Spear

New Organization of Chapters

By learning about and using the tools in this text together with your teachers' instruction, you will develop the abilities needed to build a loyal and satisfied clientele. To help you locate information more easily, the chapters are now grouped into two main parts:

Part 1: Nail Technology Foundations



This section includes five chapters that cover the past, present, and future of the field of nail technology. Chapter 1, "History and Career Opportunities," outlines the exciting career options available in the nail industry as well as the origin of nail care, and its evolution to today. Chapter 2, "General Anatomy and Physiology," provides essential information that will help guide your work with clients and enable you to make decisions about services. Chapter 3, "Skin Structure, Disorders, and Diseases," covers skin anatomy and skin function details and how to recognize skin conditions that can and cannot be worked on. Chapter 4, "Nail Structure, Disorders, and Diseases," explores the intricate details of the nail and how to identify unhealthy conditions on the hands and feet of your clients. Chapter 5, "Nail Product Chemistry," identifies the differences between nail products and details how they work.

Part 2: Nail Services

This section focuses on the services offered by a nail technician. From the basic manicure and pedicure, to nail art, Part 2 examines the details of the nail profession. Chapter 6, "Manicuring" walks you through what you need to set up a nail station and the basic treatments for the hands offered by a nail technician. The foundational nail skills learned in this chapter can be built upon for additional enhancements. Chapter 7, "Pedicuring" covers treatment of the feet and the basic services offered. Chapter 8, "Electric Filing," provides instruction on the advantages and precautions of using the electric file. Chapter 9, "Nail Tips and Forms," details how to prepare the nails for enhancements and extensions. Chapter 10, "Nail Resin Systems," new in this edition, and devoted to the types of resins available for enhancements. Chapter 11, "Monomer Liquid and Polymer Powder Nail Enhancements," covers the critical information you need to use this product and build beautiful nails. Chapter 12, "Gel Nail Enhancements" covers some of the most popular product enhancements used in salons, from gel polish to polymer gels. In closing, Chapter 13, "Nail Art," lets you build on the basics and product details from the previous chapters and opens up your world to the creativity the nail industry has to offer.

Features of this Edition

In response to advances in learning science and the growing importance of competency-based education, several changes have been made to the *Nail Technology* text that you may be familiar with. Features have been added or tweaked with the hope of making your learning experience more intuitive, more effective, and, above all, more relevant.

Photography and Art

Milady conducted photo and video shoots to capture the hundreds of new four-color photographs that appear throughout the book, in both chapter content and step-by-step procedures.

Table of Contents

Whether you're getting started, reviewing for your exams, or just feeling lost, the table of contents at the beginning of this text will be your learning roadmap through the content. The contents section shows you the structure of the text as a whole, making it easier to find the section you're looking for. In addition, because the section headers double as learning objectives, this table of contents also shows you at a glance all the objectives you will need to achieve in order to master each chapter.

Chapter Icons

Each chapter of *Nail Technology* has its own icon, which connects it across all of the supplements. Think of these icons as badges—once you've achieved all of a chapter's learning objectives, you've successfully earned a chapter icon!

Learning Objectives

A list of learning objectives at the beginning of each chapter tells you what important information you will be expected to know after studying the chapter. The learning objectives are also used as the titles of the major sections themselves throughout these chapters. This is done for ease of reference and to reinforce the main competencies that are critical to learn in each chapter to prepare for licensure. In addition, learning objectives focus on measurable results, helping you know what you should be able to do after mastering each section.

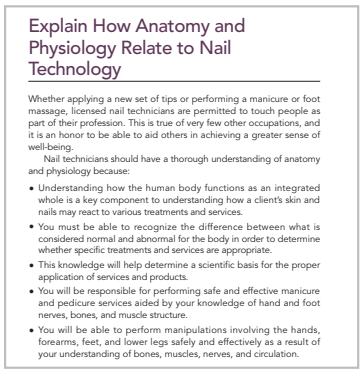
Learning Objectives

After completing this chapter, you will be able to:

1. Explain why an understanding of the history of nail technology is important to future career success.
2. Summarize the cultural influences of nail technology in ancient history.
3. Outline the key milestones of the history of nail technology in the twentieth century.
4. Describe the advancements in nail technology in the twenty-first century.
5. Compare the career opportunities available to licensed nail technicians.

The First Learning Objective

Milady knows, understands, and appreciates how excited students are to delve into the newest and most exciting products and equipment. We recognize that students can sometimes feel restless spending time learning the basics of the profession. The first objective in every chapter helps you understand why you are learning each chapter's material and the role it will play in your future career as an esthetician. Bullet points in the section tell you why the material is important and how you will use it in your professional career.



Explain How Anatomy and Physiology Relate to Nail Technology

Whether applying a new set of tips or performing a manicure or foot massage, licensed nail technicians are permitted to touch people as part of their profession. This is true of very few other occupations, and it is an honor to be able to aid others in achieving a greater sense of well-being.

Nail technicians should have a thorough understanding of anatomy and physiology because:

- Understanding how the human body functions as an integrated whole is a key component to understanding how a client's skin and nails may react to various treatments and services.
- You must be able to recognize the difference between what is considered normal and abnormal for the body in order to determine whether specific treatments and services are appropriate.
- This knowledge will help determine a scientific basis for the proper application of services and products.
- You will be responsible for performing safe and effective manicure and pedicure services aided by your knowledge of hand and foot nerves, bones, and muscle structure.
- You will be able to perform manipulations involving the hands, forearms, feet, and lower legs safely and effectively as a result of your understanding of bones, muscles, nerves, and circulation.

Check-In Questions

Instead of placing review questions at the end of each chapter, check-in questions have been added to the end of the relevant section. In this way, you can check your understanding as you progress through a chapter rather than waiting until the end. Check-in questions also make it easier to uncover areas you need help with. The answers to the check-in questions are provided for your instructor.

CHECK IN

1. Identify at least three different ways that nails were colored in ancient times.
2. What resources would Chinese aristocrats use to create crimson or ebony colors?
3. When was the first nail salon opened in the U.S?

Competency Progress

The list of learning objectives is repeated at the end of each chapter, with added checkboxes. At this point, you will be invited to review your progress through the content you have just covered, including checking off the learning objectives you feel you have mastered. Anything not checked off will stand out as a clear reminder of work you still need to do to complete that chapter.

How are you doing with history and career opportunities? **Check the Chapter 1 Learning Objectives below that you feel you have mastered; leave unchecked those objectives you will need to return to:**

- ☐ Explain why an understanding of the history of nail technology is important to future career success.
- ☐ Summarize the cultural influences of nail technology in ancient history.
- ☐ Outline the key milestones of the history of nail technology in the twentieth century.
- ☐ Describe the advancements in nail technology in the twenty-first century.
- ☐ Compare the career opportunities available to licensed nail technicians.

Procedures

All step-by-step procedures offer clear, easy-to-understand directions and multiple photographs to help you learn the techniques. At the beginning of each procedure, you will find a list of the needed implements and materials, along with any preparation that must be completed before beginning the procedure.

In order to avoid interrupting the flow of the main content, all of the procedures have been moved to a **Procedures** section at the end of each chapter.

Procedure 6–1
Pre-Service Procedure

Equipment, Implements, and Materials List

EQUIPMENT
☐ Manicure Table
☐ Adjustable Lamp
☐ Chair
☐ Finger bowl (optional)
☐ Disinfection Container
☐ Client's Arm Cushion
☐ Service Cushion
☐ Disposable wipe Container
☐ Covered Trash Container
☐ Supply Tray

IMPLEMENTS
☐ Metal Pusher
☐ Nail Nippers
☐ Tweezers
☐ Nail Clippers
☐ Brushes and Applicators
☐ Wooden Pusher
☐ Nail Brushes
☐ Disposable Product Application Brushes

MATERIALS
☐ Gloves
☐ Dust Mask
☐ Abrasive Nail Files and Buffers
☐ Single-Use or Terry Cloth Towels
☐ Lint-Free wipes, Gauze, Cotton Balls, Pledgets, or Plastic-Backed Pads
☐ Plastic, Wooden, or Metal Spatulas

PRODUCTS
☐ Any products needed for upcoming service

A. Infection Control

1 Refer to Procedure 5–1: Cleaning and Disinfection Nonporous, Reusable Items in *Milady Standard Foundations*.

B. Basic Table Setup

2 Before you begin a service, clean and disinfect the manicure table and drawer with an EPA-approved disinfectant, according to the directions on the product label.

(Continued)

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(Continued)

3 Position a cushion or a folded towel on the edge of the table in front of the client.

4 Next, place a lint-free disposable cloth on the table. This cloth can be replaced as needed throughout the service.

5 Place the abrasives and buffers of your choice on the table to your right (or to the left, if you are left-handed).

HERE'S A TIP
If you're not immediately starting your service, wrap your files neatly in a towel to keep them free of dust and potential contaminants.

6 Set out your tools and implements.

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Pre- and Post-Service Procedures

To drive home the point that pre-service cleaning, disinfecting, and preparing for the client are important, you will find that a unique *pre-service procedure* has been created in Chapter 6, "*Manicuring.*" Also in Chapter 6, a *post-service procedure* addresses cleaning, disinfecting, and organizing after servicing a client.

Perform Icons

Some students may want to review a procedure when it is mentioned in the main content. To make it easy for you to find each procedure, Milady has added Perform icons. These icons appear when a procedure is mentioned within the main content of the chapter and direct you to the part of the chapter where the entire procedure appears.

PERFORM
Procedure 7–1:
Performing a Basic Pedicure

PERFORM
Procedure 7–2:
Foot and Leg Massage

Additional Features of this Edition

Other features are included in this edition to help you master key concepts and techniques.

Focus On

Throughout the text, short, boxed sections draw attention to various skills and concepts that will help you reach your goals. The **Focus On** pieces target sharpening technical skills, new research, further explanation of complex subjects, and interesting facts. These topics are key to your success as a student and as a professional.

FOCUS ON

Tools Needed for Nail Services

As a professional nail technician, it is important that you learn to work with the tools required for nail services and know all safety, cleaning, and disinfection procedures as stated in your state's regulations.

The four types of nail technology tools that you will incorporate into your services include:

1. Equipment
2. Implements
3. Materials
4. Professional nail products

Did You Know?

These features provide interesting information that will enhance your understanding of the material in the text and call attention to special points.

DID YOU KNOW?

Many experienced nail technicians prefer using pure acetone to remove polish for three reasons: 1) They feel the added ingredients in polish removers slow the removal process; 2) they believe the added ingredients unnecessarily increase the cost of the product; and 3) they can remove the product quickly.

Caution!

Some information is so critical for your safety and the safety of your clients that it deserves special attention. The text directs you to this information in the **CAUTION!** boxes.

CAUTION!

All base coats, topcoats, nail polishes, and hardeners are highly flammable.

Activity

The Activity boxes describe hands-on classroom exercises that will help you understand the concepts explained in the text.

ACTIVITY

Set Up your Table

Practice setting up your manicuring table with all the necessary equipment, implements, and materials. Do this for a basic manicure and a spa manicure.

Web Resources

The **Web Resources** features provide you with web addresses where you can find more information on a topic as well as references to additional sites for more information.

Web Resource

For more information, contact the American Cancer Society at http://www.cancer.org or (800) ACS-2345.

Combination Key Terms and Glossary List

A complete list of key terms appears in the glossary at the end of each chapter. In addition to the key terms, you will find the *page reference* for where the key terms are defined and discussed in the chapter material. *Phonetic spellings* for all terms are included along with the glossary definition. The combined key term and chapter glossary is a way to learn important terms that are used in the beauty and wellness industry and to prepare for licensure. This list is a one-stop resource to help you create flash cards or study for quizzes on a particular chapter.

All key terms are included in the **Chapter Glossary** as well as in the **Glossary/Index** at the end of the text.

CHAPTER GLOSSARY

cosmetology cawz-meh-TALL-oh-jee	p. 5	The art and science of beautifying and improving the skin, nails, and hair; the study of cosmetics and their application.
nail technology nayl tek-NAWL-oh-jee	p. 5	The art and science of beautifying and improving the nails and skin of the hands and feet.
lunula LOON-yah-la	p. 8	The whitish half-moon shape at the base of the nail plate.

Acknowledgments

Milady recognizes, with gratitude and respect, the many professionals who have contributed to this edition of *Milady Standard Nail Technology.* We wish to extend enormous thanks to the following people:

- The professionals who prepared and performed the procedures at our photo shoot:
  - Alisha Rimando Botero
  - Lisa Boone
  - Jacquelyn Lomax-Jones
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  - Gelish
  - Valentino Pure
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Reviewers of Milady Standard Nail Technology, 8th Edition

A special thank you to our Milady Reviewers, who took time out of their busy lives to review the content of this edition of *Milady Standard Nail Technology.*

- Jullie Angell, *Nail Technician and Educator, FL*
- Frances I. Archer, *Columbia, SC*

- Maria Aune, *manicurist instructor/educator, Nail Alliance, Crestview, FL*
- Kimberly K. Brantley
- Jesse Bruner, owner, *JDB Nail Shop, Wilmington, DE*
- Tara Tess Tidwell Conway, *school director, Jackson, AL*
- Georgina Davis, *Cosmetology Education Group, MN*
- Jennifer DeCarlo-Froese, *licensed nail technician/esthetician, Pueblo, CO*
- Shawna Dempsey, *manicuring instructor, Arkansas Beauty School, Little Rock, AR*
- Linda Fero, *hair stylist/nail technician/salon owner, Corning/Painted Post, NY*
- Ashley Gregory, *Chicago, IL*
- Krysti Hammon, *nail specialist program director, Ogden, UT*
- Mare Horak, *national director of education, Nailite/nail instructor, American Institute of Beauty, Dunedin, FL*
- Julie Kandalec, *celebrity manicurist and founder, Masterclass Nail Academy, New York City, NY*
- Pariskevi Kekatos, *DPM, Dix Hills, NY*
- Gracie King, *instructor/beauty school owner, San Antonio, TX*
- Amber Klein, *account executive, Murfreesboro, TN*
- Emily Lewis, *Chicago, IL*
- Irma Lieras, *lead spa nail educator, Poway, CA*
- NinaDawn Patton, *Jonesborough, TN*
- Natasha Ray, *manicurist/CEO, Noir Men's Hand and Foot Grooming Lounge, Beverly Hills, CA*
- Marni Ribnick, *New Hope, MN*
- Jean M. Schlaiss, *school director, Waxhaw, NC*
- Douglas Schoon, *president of Schoon Scientific and Regulatory Consulting, LLC, Dana Point, CA*
- Marie Strauch, *Education Specialist, Pingree Grove, IL*
- Sara Thompson, *pharmaceutical biotech support specialist, Albany, NY*
- Shelly Torniainen, *account executive/educator, Minneapolis, MN*
- Debbie Wensman, *salon owner/educator, Fort Collins, CO*
- Patricia (Pattie) Yankee, *celebrity nail artist/industry consultant, New York City, NY*

PART 1

Nail Technology Foundations

CHAPTER 1
History and Career Opportunities

"The more you know about the past, the better prepared you are for the future."

–Theodore Roosevelt

Learning Objectives

After completing this chapter, you will be able to:

1. Explain why an understanding of the history of nail technology is important to future career success.
2. Summarize the cultural influences of nail technology in ancient history.
3. Outline the key milestones of the history of nail technology in the twentieth century.
4. Describe the advancements in nail technology in the twenty-first century.
5. Compare the career opportunities available to licensed nail technicians.

Explain Why an Understanding of the History of Nail Technology is Important to Future Career Success

The history of **nail technology** (nayl tek-NAWL-oh-jee) describes an evolution of products, tools, and techniques, as well as career opportunities, that continue to grow and improve to this day. In previous centuries, nail care was considered to have been part of the hygiene and medical industries. Today, it is a specialty within the field of **cosmetology** (cawz-meh-TALL-oh-jee).

Nail technicians should have a thorough understanding of the history of nail technology, as well as available career opportunities, because:

- Knowing the history of your profession can help you predict and understand upcoming trends.
- Knowing the history of nail technology helps you understand the development of techniques and services that are used today.
- Learning about the many different nail care services will help broaden your offerings or assist you in developing one or more specialties within your practice.
- Learning about the many possible career paths will help you take advantage of the wide range of opportunities available to nail technicians.

Summarize the Cultural Influences of Nail Technology in ANCIENT HISTORY

Nail technology dates to at least 3000 BC, with each subsequent period contributing new approaches to beautifying the nails. While scientists and beauty visionaries in the twenty-first century have made many breakthroughs in beauty products, even they have been heavily influenced by past uses and achievements.

Ancient Babylonia

- Royal Babylonian tombs dating back to 3200 BC have yielded lavish, solid gold nail care implements for the hands and feet.
- Prior to major battles, ancient Babylonian warriors manicured their nails and darkened them with kohl.

Ancient Egypt

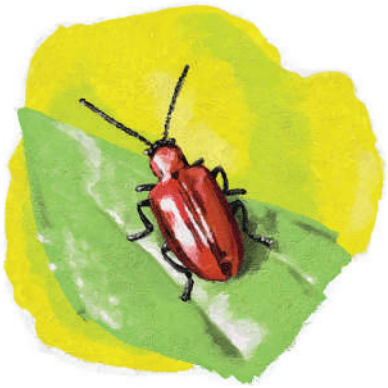
- Queen Nefertiti (circa 1400 BC) used a henna paste to stain her fingertips a deep red, while Queen Cleopatra (circa 50 BC) used henna to stain her nails a rust-red hue.
- In ancient Egypt, only royalty were allowed to wear red nails. Lower classes, such as scribes and merchants, were permitted to wear pale colors.

Ancient China

- During the Shang Dynasty (1600 BC), Chinese aristocrats rubbed a tinted mixture of gum arabic, gelatin, beeswax, and egg whites onto their nails to turn them crimson or ebony.
- Throughout the Zhou Dynasty (1100 BC), gold and silver nails were worn by royal family members only.
- Chinese decorated nail guards were used as early as the Han Dynasty (206 BC) by royalty to protect their long nails and symbolize their wealth.

Ancient Greece

- During the Golden Age of Greece (500–300 BC), mistresses of wealthy patrons used yellow flower petals, pollen, and potassium salt to create a pale nail color to signify innocence, superior social status, and sexual desirability.
- Ancient Greek soldiers applied matching red colors to their lips and nails when preparing for battle.



Ancient Rome

- In ancient Rome (circa 200 BC), barbershops offered nail trimming and shaping for wealthy patrons.
- Men and women used lac—a varnish-like substance produced by the lac insect—as well as sheep blood mixed with fat to color their nails.

The Middle Ages

- During the Middle Ages (AD 476–1450), the European upper class kept their nails trimmed short and buffed with suede leather.
- In the late Middle Ages, Europeans commonly used knives to cut their nails. They referred to this rough-hewn method as "paring."

Ancient Inca

- In the 1400s, Incan tribespeople used sharpened wood sticks and natural dyes to decorate their nails, often with symbols of eagles or sun gods.

The Renaissance

- During the Renaissance period (AD 1450–1600), most Europeans avoided colored nail cosmetics; however, wealthy citizens still manicured their nails.
- Archeological digs have uncovered nail cleaners—some doubling as ear scoops—made of bone or metal in a wide variety of designs.

The Victorian Age

- During the reign of Queen Victoria of England (AD 1837–1901), nails were short, clean, and natural, or tinted with red scented oil and buffed with a chamois cloth.
- In the 1870s, the first commercial nail salons opened in Paris.
- In 1878, Mary E. Cobb opened the first American nail care salon—Mrs. Pray's Manicure—in New York City.

CHECK IN

1. Identify at least three different ways that nails were colored in ancient times.
2. What resources would Chinese aristocrats use to create crimson or ebony colors?
3. When was the first nail salon opened in the U.S?

Outline the Key Milestones of the History of Nail Technology in the Twentieth Century

ACTIVITY

History of Nails

In a group, choose two different ancient cultures. Research the ancient cultures you chose and prepare a presentation based on nail trends and nail services. Create a report, skit, collage, or power point presentation that depicts key elements of your research.

During the twentieth century, the rapid growth of nail care technology kept pace with all other industries that accomplished everything from introducing mass-produced automobiles to space exploration. In this section, you will be able to recognize and describe many of the amazing advances in nail care: from modern implements and nail polish to artificial nail services and the rebirth and elevation of manicures and pedicures.

1900–1919

The California Perfume Company (now the Avon Company) marketed the *Manicuring Set*, which included nail bleach and rose pomade nail tint. Cutex released clear and rose-tinted liquid nail polishes. Ornate nail care implements were made of tempered steel and decorated with coveted materials, such as ivory, ebony, or gemstones.

Edward Steichen/gettyimages.com

▲ **FIGURE 1–1** The moon manicure—with sharp, pointed tips—was a popular fashion-forward style in the 1930s.

1920s

The moon manicure, which left the **lunula** (LOON-yah-la) and tip bare—gained in popularity after silent movie stars wore this nail fashion on-screen. Cutex introduced the first acetone-based nail polish remover. Manicurists repaired nail breaks using shredded strips of tea bags.

1930s

Inspired by new advances in automobile paint, makeup artist Michelle Menard partnered with Charles Revson (a founder of Revlon) to develop the first modern nail polish using pigments rather than dyes. The moon manicure—now with sharp, pointed tips—was popular among fashion-forward women (**Figure 1–1**). With the advent of the Great Depression, nail polish became desirable as an affordable luxury.

1940s

The weekly manicure—using the same basic techniques that are practiced today—was a popular and affordable beauty service. Blockbuster movies were often filmed in color, with actresses' nail colors sparking new nail trends, including the half-moon manicure (only the lunula is left bare) and fully painted, longer nails with oval- or almond-shaped tips. Wearing matching nail polish and lipstick shades became a strong fashion statement (**Figure 1–2**).

©Pexels

▲ **FIGURE 1–2** In the 1940s, wearing matching nail polish and lipstick colors made a bold statement.

1950s

In 1953, Rita Hayworth made long red nails the most enduring color of the decade (**Figure 1–3**). The weekly manicure appointment continued in popularity for the first half of the decade and then declined in favor of at-home care. Juliette Marglens introduced the Juliette wrap, a natural nail-enhancement service that wrapped the top third of the nail with a fiber-like paper for strength and durability. Dr. Fred Slack tore his thumbnail while working in his dental lab and created an impromptu fix with foil and acrylic material. It looked so realistic that Slack, along with his brother Tom, founded the first acrylic nail company, Patti Nails. The Slack family's business is now known as NSI Nails.

Bergamont/istockphoto.com

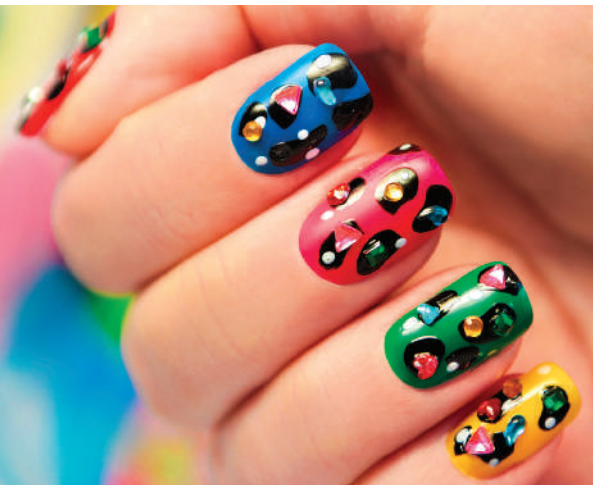
▲ **FIGURE 1–3** In the 1950s, celebrities like Rita Hayworth helped make long red nails the most enduring style.

1960s

The color television set became a household staple, making musicians—with their nails on full display as they gripped the microphone—the new nail trendsetters. Detached nail tips were reaffixed with model airplane glue and reinforced with thin strands of cotton and permanent wave papers. Frosted pastel polish colors were extremely popular. The second half of the decade introduced flower child nail art using oil or acrylic paints.

1970s

Nail technicians offered the first monomer liquid and polymer powder nail services, commonly called acrylic nails. Jeff Pink introduced the French manicure (a clear nail bed with a white tip) and Ridgefiller (a product that makes ridged nails appear smooth). Singers such as Cher and Diana Ross fueled the trend for long, sculptured nails.



MangoZ0/istockphoto.com

▲ **FIGURE 1–4** In the 1980s, decals and jewels were popular additions to nail art.

1980s

Nail art—decals, jewels, metallic strips, and hand-drawn images—were popular (**Figure 1–4**). Monomer liquid and polymer powder nail formulations continued to improve in terms of ease of application and longevity for wearers. Silk nail wraps came into vogue, followed by linen and fiberglass nail wraps. Popular nail polish colors ranged from natural to dark and neon colors. Long nails with square tips ruled the decade.

1990s

The day spa business took hold, ushering in a resurgence in natural manicure and pedicure services. Airbrush (spray) guns were commonly used to apply nail designs, especially the white tip of a French manicure. In 1998, Creative Nail Design (now CND) introduced the first spa pedicure system for the professional beauty industry. UV gel systems grew in popularity. The square-oval nail tip came into vogue.

CHECK IN

4. Describe the moon manicure. When was it popular?
5. When did the first modern nail polish become available to nail technicians?
6. Name the first nail wrap. When was it introduced?
7. When were the first monomer liquid and polymer powder nail formulations introduced to nail technicians?

Describe the Advancements in Nail Technology in the Twenty-First Century

The twenty-first century is a time of change and advancements that are continuously redefining the nail industry. While passing the state board examination is essential to launching your career, advanced education will always be crucial to your ongoing career success.

2000–2009

Nail grooming reached a new zenith in terms of client demand and service choices, creating a critical shortage of nail technicians. Because of the adhesion of UV gel enhancements, natural leveling capabilities, permanent shine properties, and no-odor formulations,

their demand grew by leaps and bounds. Nail polish formulations evolved to embody chip-resistant and fade-resistant characteristics, and unsafe ingredients were eliminated from many professional brands. Pedicures became the second-most-requested nail service; closely following manicures (**Figure 1–5**).

2010–Present

The UV gel manicure sweeps the nation. Acrylic dip powders re-enter the professional nail industry, with improved results. Hand-painted and nail-stamping nail art are the most popular add-on services. Social media plays a key role in putting nail services and nail art in the spotlight. There are approximately 400,000 licensed nail technicians in the U.S. alone.

PeopleImages/istockphoto.com

▲ **FIGURE 1–5** **In the early 2000s, pedicures became the second most requested service in a nail salon.**

CHECK IN

8. Describe why there was a shortage of nail technicians in the early twenty-first century.
9. Identify the two most popular services performed by nail technicians.
10. Identify the newest services offered by nail technicians in 2010 to the present.
11. Which services are the most popular add-ons?
12. Which service is once again gaining in popularity?

Compare the Career Opportunities Available to Licensed Nail Technicians

Once you have completed your schooling and are licensed, there are numerous specialties that you can pursue. Because rules and regulations vary from state to state, it is important to know which services are allowed in your state of licensure.

Beyond defining your area of expertise, you must also decide whether you want to work in one or more of the following environments:

- Nail salon
- Full-service salon (hair, skin, and nail services)
- Day spa (skin, body, nail, and hair services that emphasize beauty and wellness)
- Medical spa or medical (podiatry) office

- Salon management
- Sales consultant or educator for distributors
- Education for salons, trade shows and special nail company symposiums
- Beauty school instructor
- Online education, either in real-time or recorded
- Onsite fashion shows, photo shoots, and movie/television productions

Foremniakowski/istockphoto.com

▲ **FIGURE 1–6** Natural nail services account for many services offered in a traditional nail salon or spa.

Nail Technician in a Traditional Salon or Spa

Today, clients request a variety of nail services that require a combination of skills. The following are just some examples of what you could be required to do:

- Natural nail services including; manicures, gel polish manicures, pedicures, and nail-strengthening treatments (**Figure 1–6**)
- Artificial enhancements; including liquid and powder enhancements and odorless soft or hard gel enhancements

Ocskaymark/istockphoto.com

▲ **FIGURE 1–7** You need to obtain additional training before working on at-risk clients.

Medical Nail Technician/Advanced Nail Technician

Many physicians now recognize the benefits of using the services of an advanced nail technician (ANT) and/or medical nail technicians (MNT) to perform safe cosmetic manicures and pedicures on at-risk patients (**Figure 1–7**).

- An ANT must successfully complete an advanced training course that focuses on providing the ultimate protection from the transfer of infection for at-risk clients in a salon or spa setting.
- To become an MNT, you are required to take specialty courses and complete an internship under the direction of a podiatrist or other physicians. Once you are certified, you have the choice of providing cosmetic manicures and pedicures in a variety of medical settings, including a medical spa or podiatry office.

CAUTION!

An ANT or MNT does not permit nail technicians to work outside the scope of practice as defined by your state and the licensing regulations. Failure to comply can result in legal action, including losing your license. You also risk injuring your client.

Salon Management

If business is your calling, you will find diverse management opportunities in the salon and spa environment. They include, but are not limited to, inventory manager, retail sales manager, department head, assistant manager, and general manager. With experience, you can also add salon owner to your list of career possibilities. To ensure your success in salon management, it is wise to enroll in business classes to learn more about managing products, departments, and, above all, people.

Salon Educator

Many large independent salons or salon chains hire experienced nail technicians and train them to educate others. This kind of education can take many forms, ranging from technical to management and interpersonal relationship training.

Independent Educator

Independent beauty education—classes and workshops held by individual beauty professionals—has become extremely popular in recent years. For nail technicians, this entails creating a compelling class or workshop, publicizing and selling it, and collecting class fees. Having a strong specialty is recommended for this type of endeavor.

Manufacturer Educator

Most manufacturers hire their own educators to train salon professionals on how to use their products and even to provide advanced education at salons, professional beauty supply stores, and trade shows. Mastery of the company's product lines is a must. An accomplished educator, who is also a good public speaker can advance to field educator, regional educator, or even director of education for nail-centric companies.

Beauty School Instructor

Have you ever wondered how your instructor decided to start teaching? Many instructors had fantastic careers in salons before dedicating themselves to teaching new professionals the tricks of the trade. If this career path interests you, spend some time with your school's instructors and ask them why they went into education (**Figure 1–8**).

DID YOU KNOW?

Some MNTs choose to follow a career path to become a clinical podiatric medical assistant (CCPMA) through the American College of Foot & Ankle Orthopedics & Medicine (ACFAOM).

▲ **FIGURE 1–8** **Beauty School Instructors guide the next generation from their first day of school to their state board exams.**

Distributor Sales Consultant

The salon industry depends heavily on its relationships with product distributors in order to stay abreast of changes in the marketplace. In addition to selling products, distributor sales consultants (DSCs) provide information about new products, trends, and techniques. This specialty provides an excellent opportunity for highly skilled and trained nail professionals.

Film/Editorial Nail Technician

Those who work behind the scenes at magazine and Internet photo shoots, or backstage on movie and TV sets, often started out by interning. Even if you are right out of school, you can start the interning process by networking with photographers, editorial stylists, or nail technicians who are already involved in these activities. Once you are officially assisting a seasoned nail technician at photo shoots, ask photographers for one or two images that highlight your work for your portfolio. Eventually, as you gain the trust of those who have allowed you to assist, you will be invited to do shoots as a paid nail technician. The qualities required to get to this level include technical expertise, persistence, networking skills, reliability, team spirit, speed, and attention to detail (**Figure 1–9**).

"Beauty begins the moment you decided to be yourself."

—Coco Chanel

Augustino/shutterstock.com

▲ **FIGURE 1–9** Film and editorial nails are often more dramatic and styled than you would see with everyday wear.

CHECK IN

13. List the different services performed by full-service nail technicians in a traditional salon or spa.
14. Name at least three educator opportunities for nail technicians.
15. Identify and describe management opportunities offered by many salons.
16. List the qualities you will need in order to succeed as a film/editorial nail technician.

COMPETENCY PROGRESS

How are you doing with history and career opportunities? **Check the Chapter 1 Learning Objectives below that you feel you have mastered; leave unchecked those objectives you will need to return to:**

- ☐ Explain why an understanding of the history of nail technology is important to future career success.
- ☐ Summarize the cultural influences of nail technology in ancient history.
- ☐ Outline the key milestones of the history of nail technology in the twentieth century.
- ☐ Describe the advancements in nail technology in the twenty-first century.
- ☐ Compare the career opportunities available to licensed nail technicians.

CHAPTER GLOSSARY

cosmetology cawz-meh-TALL-oh-jee	p. 5	The art and science of beautifying and improving the skin, nails, and hair; the study of cosmetics and their application.
nail technology nayl tek-NAWL-oh-jee	p. 5	The art and science of beautifying and improving the nails and skin of the hands and feet.
lunula LOON-yah-la	p. 8	The whitish half-moon shape at the base of the nail plate.

CHAPTER 2
General Anatomy and Physiology

"Impossible is not a scientific term."

–Vanna Bonta

Learning Objectives

After completing this chapter, you will be able to:

1. Explain how anatomy and physiology relate to nail technology.
2. Describe the basic structure and function of a cell.
3. Describe the four types of tissue in the human body.
4. Define the functions of the body's organs in the body systems.
5. Identify the five functions of the skeletal system.
6. Recognize the voluntary muscles involved in the nail service.
7. Name the parts of the nervous system.
8. Recognize how the circulatory system affects the skin of the hands and feet.
9. Describe the primary functions of the lymphatic/immune system.
10. Identify the glands that make up the endocrine system.
11. Outline the organs in digestion.
12. List the five organs that make up the excretory system.
13. Describe what occurs during inhalation and exhalation.
14. Define the integumentary system.
15. Define the reproductive system.

Explain How Anatomy and Physiology Relate to Nail Technology

Whether applying a new set of tips or performing a manicure or foot massage, licensed nail technicians are permitted to touch people as part of their profession. This is true of very few other occupations, and it is an honor to be able to aid others in achieving a greater sense of well-being.

Olesya22/istockphoto.com

Nail technicians should have a thorough understanding of anatomy and physiology because:

- Understanding how the human body functions as an integrated whole is a key component to understanding how a client's skin and nails may react to various treatments and services.
- You must be able to recognize the difference between what is considered normal and abnormal for the body in order to determine whether specific treatments and services are appropriate.
- This knowledge will help determine a scientific basis for the proper application of services and products.
- You will be responsible for performing safe and effective manicure and pedicure services aided by your knowledge of hand and foot nerves, bones, and muscle structure.
- You will be able to perform manipulations involving the hands, forearms, feet, and lower legs safely and effectively as a result of your understanding of bones, muscles, nerves, and circulation.

Define Anatomy, Physiology, and Histology

As a nail professional, an overview of human anatomy and physiology will enable you to perform your services knowledgeably, effectively, and safely on a consistent basis.

- **Anatomy** (ah-NAT-ah-mee) is the study of the structures of the human body and the substances these structures are made of. It is the science of the interconnected detail of organisms, or of their parts.
- **Physiology** (fiz-ee-ALL-ah-jee) is the study of the functions and activities performed by the body's structures.
- **Histology** (hiss-TAHL-uh-jee), also known as *microscopic anatomy*, is the study of the structure and composition of tissue.

CHECK IN

1. Why is the study of anatomy, physiology, and histology important to the nail technician?
2. Define anatomy, physiology, and histology.

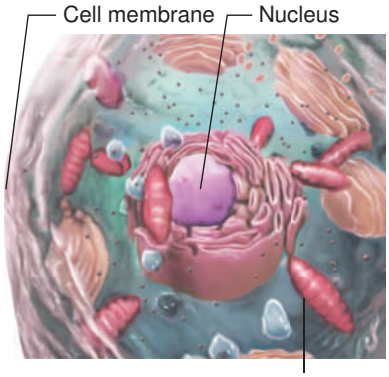
Describe the Basic Structure and Function of a Cell

Cells (SELLZ) are the basic units of all living things—from bacteria to plants to animals to human beings. Without cells, life does not exist. As a basic functional unit, the cell is responsible for carrying on all life

processes. There are trillions of cells in the human body, and they vary widely in size, shape, and purpose.

Basic Structure of the Cell

The cells of all living things are composed of a substance called **protoplasm** (PRO-toh-plaz-um), a colorless, jellylike substance found inside cells in which food elements such as proteins, fats, carbohydrates, mineral salts, and water are present. You can visualize the protoplasm of a cell as being similar to the white of a raw egg. In addition to protoplasm, most cells also include a nucleus, **organelles** (or-guh-NELZ) (small organs), and the cell membrane (**Figure 2–1**).



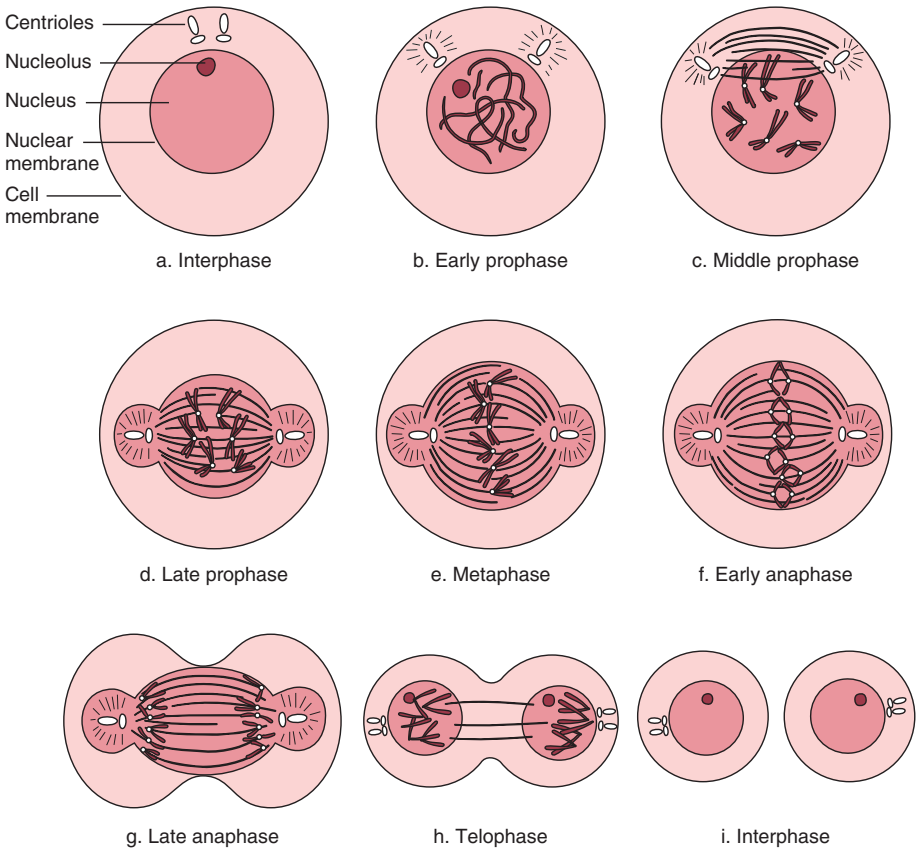
▲ **FIGURE 2–1** **The cell is responsible for carrying on all life processes.**

- The **nucleus** (NOO-klee-us) is the dense, active protoplasm found in the center of the cell. It plays an important part in cell reproduction and metabolism. You can visualize the nucleus as the yolk of a raw egg. Within the nucleus of the cell is the **nucleoplasm** (NOO-klee-oh-plasm), which is a fluid that contains proteins and a very important acid known as **deoxyribonucleic acid (DNA)** (dee-OX-ee-rye-boh-noo-KLAY-ik AS-ud). DNA is what determines our genetic makeup, including the color of our eyes, skin, and hair.
- The **cytoplasm** (SY-toh-plaz-um) is the part of the protoplasm that exists outside of the nucleus and inside the cell wall. The protoplasm surrounds the nucleus and is needed for growth, reproduction, and self-repair.
- **Mitochondria** (my-toh-KON-dree-uh) take in nutrients, break them down, and create energy for the cell. Mitochondria work to keep the cell full of energy. This chemical energy used within cells for metabolism is called **adenosine triphosphate (ATP)** (uh-DEN-uh-seen try-FAWS-fayt). Mitochondria are small organelles floating freely throughout the cell. Some cells have several thousand mitochondria, such as muscle cells, while others have none, like red blood cells. Muscle cells need a lot of energy, so they have many mitochondria. **Neurons** (NOOR-onz) or nerve cells (cells that transmit nerve impulses) don't need as many.
- The **cell membrane** (SELL MEM-brayn) is the part of the cell that encloses the protoplasm and permits *soluble* (SAHL-yuh-bul) substances to enter and leave. It is selectively permeable, controlling the introduction of beneficial substances into the cell and the removal of waste and other substances that do not benefit the life of the cell. The cell membrane protects the cell from its surroundings. It also communicates with other cells, linking like cells together to form tissues.

Cell Reproduction and Division

Cells have the ability to reproduce, thus providing new cells for the growth and replacement of worn or damaged cells. The usual process of cell reproduction of human tissues occurs when the cell divides into

two identical cells, called *daughter cells*, through a process known as **mitosis** (my-TOE-sis) (**Figure 2–2**). As long as conditions are favorable, the cell will grow and reproduce. This is true of human cells, plant cells, and single-cell creatures, such as bacteria. Favorable conditions include an adequate supply of food, oxygen, and water; suitable temperatures; and the ability to eliminate waste by-products. If conditions become unfavorable, the cell will become impaired or may die. For instance, when blood flow is restricted to part of the body, such an unfavorable condition could lead to an unusual buildup in the levels of toxins within the cells, which in turn may cause the cell to die.



▲ **FIGURE 2–2** The phases of mitosis.

Cell Metabolism

Metabolism (mah-TAH-buh-liz-um) is a chemical process that takes place in living organisms, through which the cells are nourished and carry out their activities. Metabolism occurs in two distinctly different phases.

Anabolism (ah-NAH-buh-liz-um) is called *constructive metabolism* because it is the process of combining smaller molecules to build larger and more complex molecules. During this process, the body focuses on storing water, food, and oxygen for a later time when these substances will be needed for cell growth, reproduction, or repair.

Catabolism (kuh-TAH-buh-liz-um) is the phase of metabolism in which larger, more complex molecules are broken down within the cells to create smaller, simpler molecules. As a result of this breakdown, energy is released so that it may be used or stored for later use.

Anabolism and catabolism are carried out simultaneously and continually, 24 hours a day, within the cells as part of their normal processes.

> **Cell Metabolism: How Is this Important?** Aging influences the cell's metabolism and the cell begins to function less efficiently. As a nail technician, cell metabolism is something you will consider when working on your client's arm, hands, legs, and feet. A client's response to different services and response to the active ingredients in the skin care products you use will be influenced by the efficiency and speed of their metabolism.

CHECK IN

3. List and describe the parts of the cell.
4. Define metabolism and list the two phases of cell metabolism and their purpose.

DID YOU KNOW?

A toxin is a poisonous substance produced by *microorganisms* (bacteria and viruses). You know that a bee sting injects a toxin into the skin that causes a painful burning sensation, but did you know that your skin is constantly creating toxins? As our skin cells metabolize nutrients, the process creates toxins that must be removed before they cause damage by becoming too concentrated inside the cell. Fortunately, our bodies have highly efficient ways of dealing with these toxins. Tiny blood and lymph capillaries in the skin collect toxins and transport them away to be later removed from the body. So, remember, the normal flow of blood moving through the skin helps ensure that the concentration of toxins in the skin cells are kept at safe levels and that the skin remains healthy.

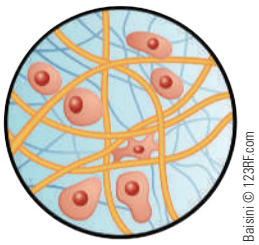
Describe the Four Types of Tissue in the Human Body

Tissue (TISH-ew) is a collection of similar cells that performs a specialized function. Each type of tissue has a specific function and can be recognized by its characteristic appearance. Body tissues are composed of large amounts of water, along with various other substances. The human body is about 60 percent water.

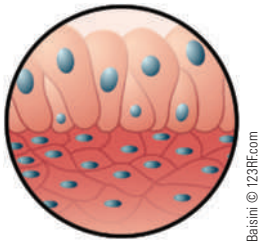
There are four types of tissue in the body.

1. **Connective tissue** (cah-NEK-tiv TISH-ew) is fibrous tissue that binds together, protects, and supports the various parts of the body. Examples include bone; cartilage; ligaments; tendons; fascia, which separates muscles; liquid tissue, such as blood and lymph; and fat, which is also called **adipose tissue** (AH-di-pohs TISH-ew). Adipose tissue gives smoothness and contour to the body while protecting internal organs and insulating the body (**Figure 2–3**).

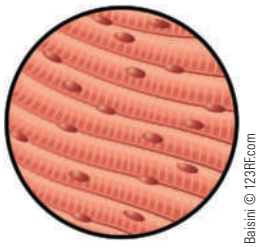
2. **Epithelial tissue** (eh-pih-THEE-lee-ul TISH-ew) is a protective covering on body surfaces. Skin, mucous membranes, the tissue inside the mouth, the lining of the heart, digestive and respiratory organs, and glands are all examples of epithelial tissue (**Figure 2–4**).
3. **Muscle tissue** (MUH-sel TISH-ew) contracts and moves various parts of the body (**Figure 2–5**).
4. **Nerve tissue** (NURV TISH-ew) carries messages through the central nervous system to control and coordinate all bodily functions. Nerve tissue is composed of specialized cells known as neurons, which make up the nerves, brain, and spinal cord (**Figure 2–6**).



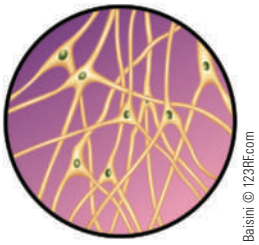
▲ **FIGURE 2–3**
Connective tissue.



▲ **FIGURE 2–4**
Epithelial tissue.



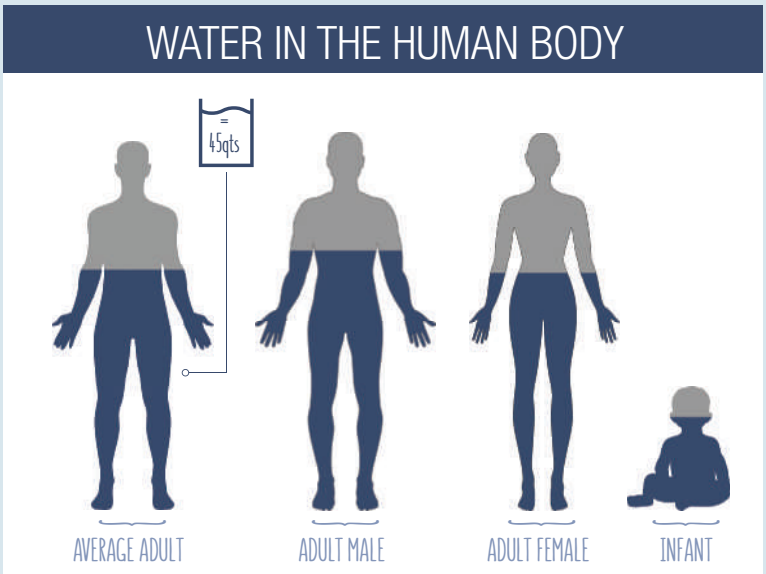
▲ **FIGURE 2–5**
Muscle tissue.



▲ **FIGURE 2–6**
Nerve tissue.

According to Jeffrey Utz, MD, from the Department of Neuroscience at Allegheny University:

- Men's bodies contain more water than women's bodies do.
- Water content differs throughout various tissues in the body
- Blood is made up of 83 percent water, and muscle is 75 percent water.
- The human brain is 73 percent water.
- Even bones are about 31 percent water.



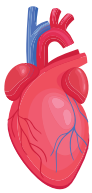
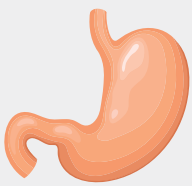
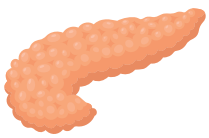
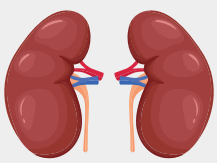
CHECK IN

5. List and describe the functions of the four types of tissue found in the human body.

Define the Functions of the Body's Organs in the Body Systems

An **organ** (OR-gan) is a structure composed of specialized tissues that allow it to perform specific functions. A **body system** (BAH-dee SIS-tum) consists of a group of body organs acting together to perform one or more functions (Table 2–1).

▼ TABLE 2–1 Eleven Main Body Systems, their Functions, and Organs

System	Organs	Function
Circulatory (SIR-kew-lah-toh-ree)  Macrovector/Shutterstock.com	Heart with blood vessels	Controls the steady circulation of the blood through the body; works with the lymphatic channels
Digestive (dy-JES-tiv)  Macrovector/Shutterstock.com	Esophagus, stomach, gall bladder, liver, small and large intestines	Breaks down food into smaller and smaller particles to absorb nutrients or for excretion
Endocrine (EN-doh-krin)  Macrovector/Shutterstock.com	Adrenal gland, pituitary gland, pancreas	Affects the growth, development, sexual activities, and normal regulatory processes of the body; consists of specialized glands
Excretory (EKS-creh-toh-ree)  Macrovector/Shutterstock.com	Kidneys, bladder	Purifies the body by eliminating waste matter

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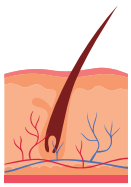
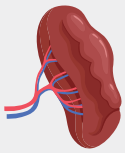
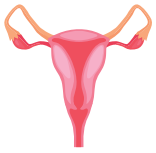
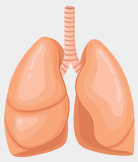
Integumentary (in-teg-yuh-MEN-tuh-ree)  Macrovector/Shutterstock.com	Skin and accessory organs, such as oil and sweat glands, sensory receptors, hair, and nails	Largest organ of the body, first line of defense against infection and water loss; regulates temperature, perceives sensation, produces vitamin D; and has absorption capabilities
Lymphatic (lim-FAT-ick)/**immune** (im-YOON)  Macrovector/Shutterstock.com	Spleen, lymph	Protects the body from disease by developing resistances and destroying disease-causing toxins, foreign material, and bacteria
Muscular (MUSS-kew-ler)  Macrovector/Shutterstock.com	Muscles	Covers, shapes, and supports the skeletal tissue; contracts and moves various parts of the body
Nervous (NUR-vus)  Macrovector/Shutterstock.com	Brain, spinal cord, nerves	Controls and coordinates all other body systems inside of the body and makes them work harmoniously and efficiently; carries messages through the central nervous system
Reproductive (ree-proh-DUK-tiv)  Macrovector/Shutterstock.com	Uterus, ovaries, penis, testes	Produces offspring and passes on the genetic code from one generation to another; differentiates between the sexes
Respiratory (RES-puh-rah-tor-ee)  Macrovector/Shutterstock.com	Lungs, trachea, bronchi	Enables breathing, supplying the body with oxygen, and eliminating carbon dioxide and other gases as waste products
Skeletal (SKEH-lah-tul)  Macrovector/Shutterstock.com	Bones	Forms the physical foundation of the body; 206 bones that are connected by movable and immovable joints

CHECK IN

6. What is an organ?
7. Name the 11 body systems and their main functions.

Identify the Five Functions of the Skeletal System

The **skeletal system** (SKEH-lah-tul SIS-tum) is the physical foundation of the body. Humans are born with 300 bones. However, some fuse together over time, so eventually the body ends up with 206 bones that vary in size and shape and are connected by movable and immovable joints. **Osteology** (ahs-tee-AHL-oh-jee) is the study of anatomy, structure, and function of the bones. *Os* (AHS) means bone and is used as a prefix in many medical terms, such as **osteoarthritis** (os-tee-oh-ar-THRI-tis) a joint disease.

Except for the tissue that forms the major part of the teeth, bone is the hardest tissue in the body. It is composed of connective tissue consisting of about one-third organic matter, such as cells and blood, and two-thirds minerals, mainly calcium carbonate and calcium phosphate.

DID YOU KNOW?

People often complain of joint pain, which is usually caused by inflammation of the tissue surrounding the joint.

> **Skeletal System: How Is this Important?** For a nail technician to be successful, it is important to understand the body's skeletal structure and mechanics: More than half of the bones in your entire body are found in your hands and feet, which are the support system for the entire body.

The five primary functions of the skeletal system include:

1. Giving shape and support to the body
2. Protecting various internal structures and organs
3. Serving as attachments for muscles and act as levers to produce body movement
4. Helping produce both white and red blood cells (one of the functions of bone marrow)
5. Storing most of the body's calcium supply as well as phosphorus, magnesium, and sodium

A **joint** (JOYNT) is the connection between two or more bones of the skeleton. There are two types of joints: movable, such as elbows,

DID YOU KNOW?

The purpose of fingernails is to provide protection for the delicate tips of the phalanges in the hand. If a phalange is accidentally broken, the finger loses much of its fine dexterity and has a more difficult time picking up very small objects, such as sewing needles and coins.

knees, and hips; and immovable, such as the pelvis or skull, which allows little or no movement.

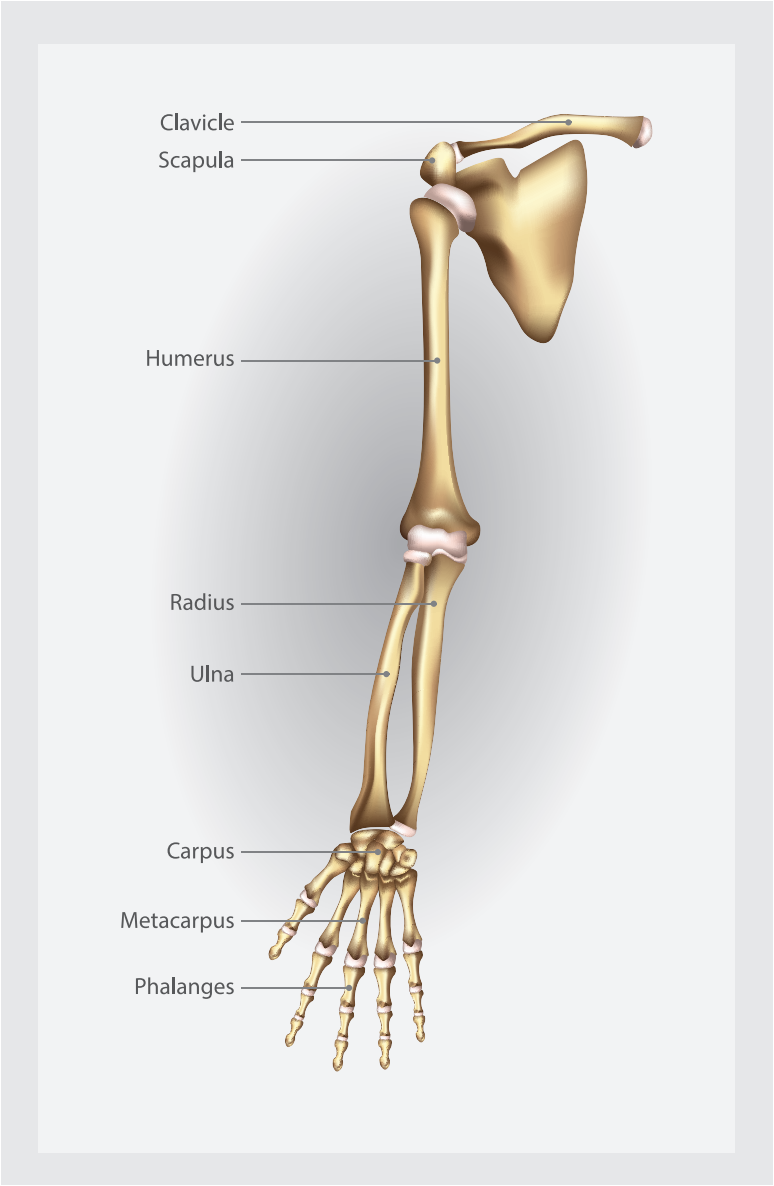
Bones of the Arms and Hands

Important bones of the arms and hands include the following (**Figures 2–7** and **Figure 2–8**):

- **Humerus** (HYOO-muh-rus). The uppermost and largest bone of the arm, extending from the elbow to the shoulder.
- **Ulna** (UL-nuh). The longer bone of the forearm. It is larger at the elbow than at the wrist and is located on the little finger side of the hand.

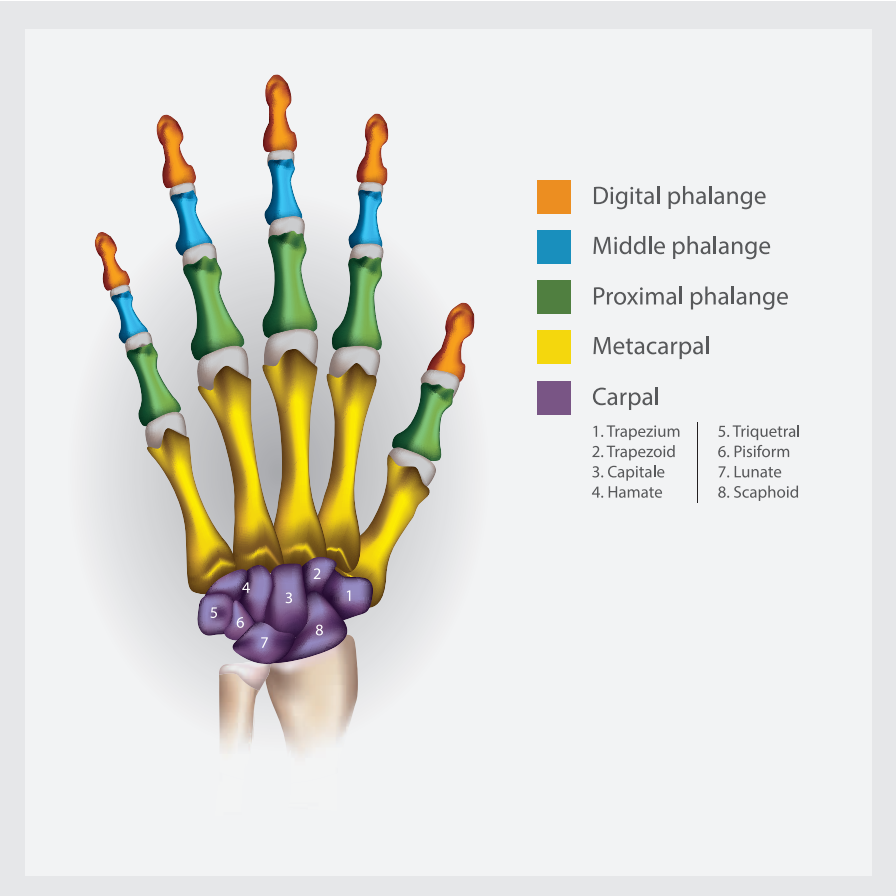
DID YOU KNOW?

Painful inflammation involving the carpus area can be caused by repetitive motions, such as flexing your wrist excessively or locking it in a bent position while using a nail file. Keeping the wrist straight—without flexing—while filing can help prevent these injuries.



Natee Jitthammachai/shutterstock.com

▲ **FIGURE 2–7** The bones of the arm and hand.



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▲ **FIGURE 2–8** **Bones of the hand.**

- **Radius** (RAY-dee-us). The shorter of the two bones of the forearm. It is largest at the wrist and located on the thumb side of the hand.
- **Carpus** (KAR-pus). The wrist: a flexible joint composed of a group of eight small, irregular bones held together by ligaments.
- **Metacarpus** (met-uh-KAR-pus). Bones of the palm of the hand; parts of the hand containing five bones between the carpus and phalanges.
- **Phalanges** (fuh-LAN-jeez). Bones of the fingers or toes, or *digits*.

Bones of the Leg, Ankle, and Foot

The four bones of the leg are:

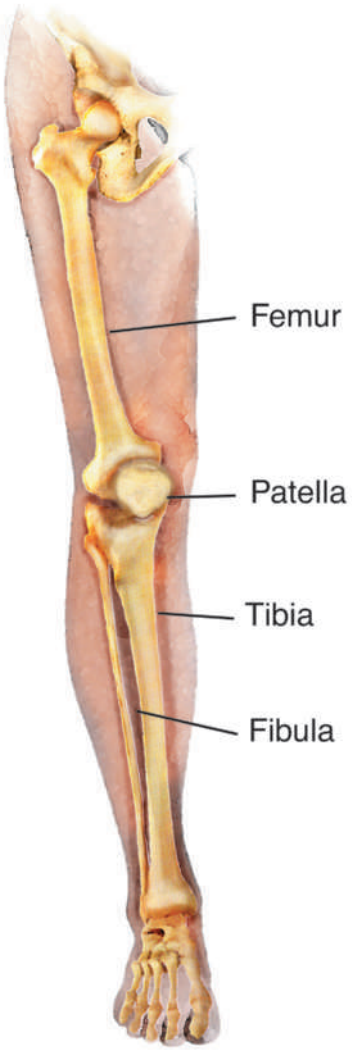
- The **femur** (FEE-mur) is a heavy, long bone that forms the leg above the knee.
- The **tibia** (TIB-ee-ah) is the larger of the two bones that form the leg below the knee. The tibia may be visualized as a bump on the big-toe side of the ankle.
- The **fibula** (FIB-yoo-lah) is the smaller of the two bones that form the leg below the knee. The fibula may be visualized as a bump on the little-toe side of the ankle.

- The **patella** (pah-TEL-lah), also called the accessory bone, forms the cap of the knee joint (**Figure 2–9**).

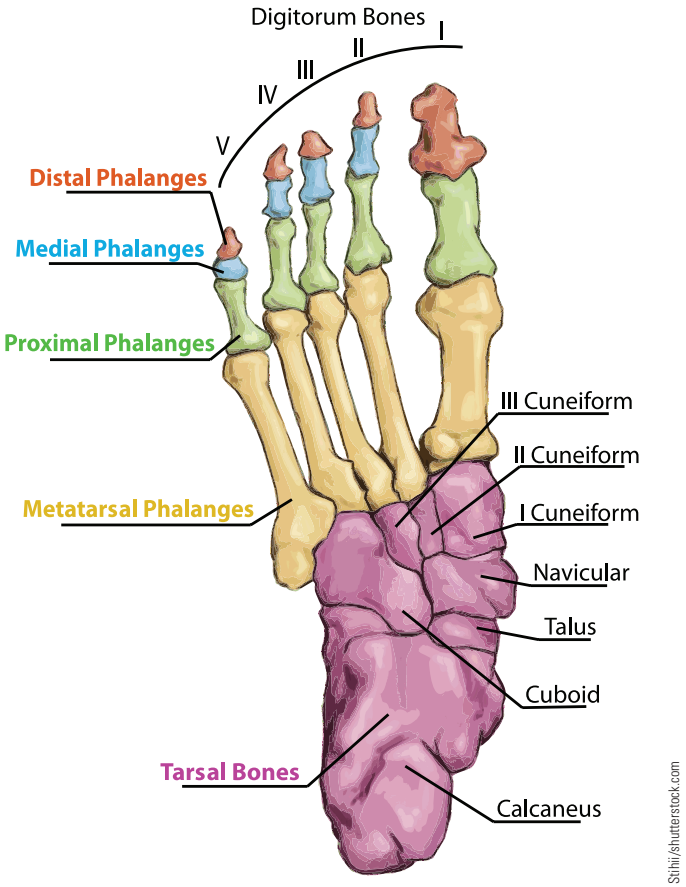
The ankle joint is made up of three bones:

- The tibia, which comes down from the leg.
- The fibula, which comes down from the leg.
- The **talus** (TA-lus), or ankle bone, of the foot.

The foot is made up of 26 bones. These can be subdivided into three general categories: seven **tarsal** (TAHR-sul) bones (talus, calcaneous, navicular, three cuneiform bones, and the cuboid); five **metatarsal** (meh-tah-TAHR-sul) bones, which are long and slender, like the metacarpal bones of the hand; and 14 bones called *phalanges*, which compose the toes. The phalanges of the feet are similar to the hand's phalanges, which are commonly called finger bones. There are three phalanges in each toe, except for the big toe, which has only two (**Figure 2–10**).



▲ **FIGURE 2–9** Bones of the leg.



▲ **FIGURE 2–10** Bones of the foot.

CHECK IN

8. List the primary functions of the skeletal system.

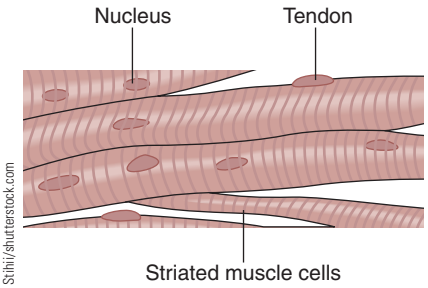
Recognize the Voluntary Muscles Involved in the Nail Service

The **muscular system** (MUSS-kew-ler SIS-tum) is the body system that covers, shapes, and supports the skeletal tissue. It contracts and moves various parts of the body.

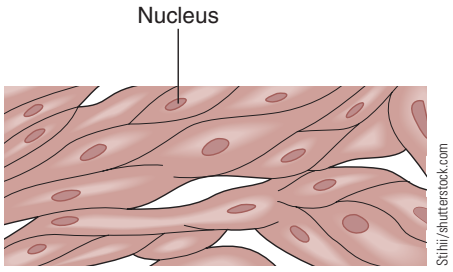
> **Muscular System: How Is this Important?** The nail technician must be concerned with the voluntary muscles that control movements of the arms, hands, lower legs, and feet. It is important to know where these muscles are located and what they control. These muscles become fatigued from excessive work or injury and can benefit greatly from the massaging techniques you can incorporate into your services. Proper massage not only helps to relax and de-stress your clients but can be therapeutic as well.

Myology (my-ALL-uh-jee) is the study of the structure, function, and diseases of the muscles. The human body has over 600 muscles, which are responsible for approximately 40 percent of the body's weight. Muscles are fibrous tissues that have the ability to stretch and contract according to the demands of the body's movements. There are three types of muscular tissue:

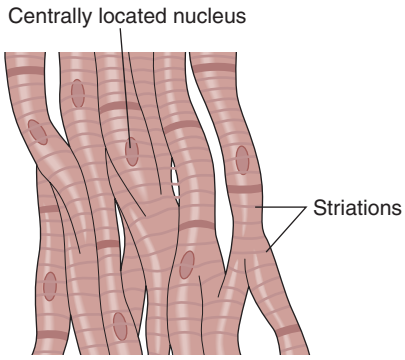
- **Striated muscles** (STRY-ayt-ed MUH-sels), also called *skeletal muscles* (SKEH-lah-tul MUH-sels), are attached to the bones and are voluntary or consciously controlled. *Striated* (skeletal) muscles assist in maintaining the body's posture and protect some internal organs (Figure 2–11).
- **Nonstriated muscles** (non-STRY-ay-ted MUH-sels), or *smooth muscles (SMOOTH MUH-sels)*, are involuntary and function automatically, without conscious will. These muscles are found in the internal organs of the body, such as the digestive or respiratory systems (Figure 2–12).



▲ **FIGURE 2–11** Striated muscle cells.



▲ **FIGURE 2–12** Nonstriated muscle cells.



Stihii/shutterstock.com

▲ **FIGURE 2–13** **Cardiac muscle cells.**

- **Cardiac muscle** (CAR-dee-ak MUH-sel) is the involuntary muscle that is the heart. This type of muscle is not found in any other part of the body (**Figure 2–13**).

A muscle has three parts:

- The **origin** (OR-ah-jin) is the part that does not move; it is attached to the skeleton and is usually part of a skeletal muscle.
- The **insertion** (in-SER-shun) is the point of attachment in a muscle where more movement occurs.
- The **belly** (BELL-ee) is the middle part of the muscle. Pressure in massage is usually directed from the insertion to the origin and moving toward the belly of the muscle.

Muscular tissue can be stimulated by:

- Massage (pressure and friction created by hand, electric vibrator, or water jets)
- Electrical current (high frequency or faradic—alternating or interrupted—current)
- Infrared light (heating lamps and a normal component of natural sunlight)
- Dry heat (heating caps)
- Moist heat (steamers or warm steam towels)
- Nerve impulses (through the neurons of the nervous system)

Muscles that Attach the Arms to the Body

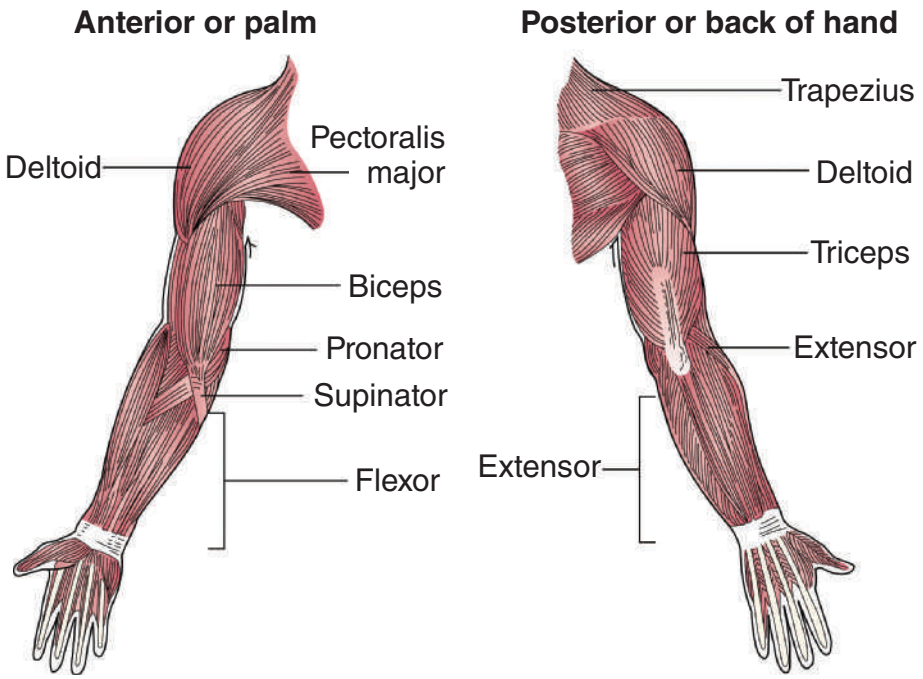
The muscles that attach the arms to the body are briefly summarized below.

- **Latissimus dorsi** (lah-TIS-ih-mus DOR-see). A large, flat triangular muscle covering the lower back.
- **Pectoralis major** (pek-tor-AL-is MAY-jor) and **pectoralis minor** (pek-tor-AL-is MY-ner). Muscles of the chest that assist the swinging movements of the arm.
- **Serratus anterior** (seh-RAT-us an-TEER-ee-or). Muscle of the chest that assists in breathing and in raising the arm.
- **Trapezius** (trah-PEE-zee-us). Muscle that covers the back of the neck and upper and middle region of the back; rotates and controls swinging movements of the arm.

Muscles of the Shoulder and Arm

There are three principal muscles of the shoulders and upper arms (**Figure 2–14**):

- **Bicep** (BY-sep). Muscle producing the contour of the front and inner side of the upper arm; they lift the forearm and flex the elbow.
- **Deltoid** (DEL-toyd). Large, triangular muscle covering the shoulder joint that allows the arm to extend outward and to the side of the body.



▲ **FIGURE 2–14** **Anterior and posterior muscles of the shoulder and arm.**

- **Tricep** (TRY-sep). Large muscle that covers the entire back of the upper arm and extends the forearm.

The forearm is made up of a series of muscles and strong tendons.

As a nail technician, you will be concerned with:

- **Extensors** (eks-STEN-sors). Muscles that straighten the wrist, hand, and fingers to form a straight line.
- **Flexors** (FLEK-sors). Extensor muscles of the wrist are involved in bending the wrist.
- **Pronators** (PRO-nay-tors). Muscles that turn the hand inward so that the palm faces downward.
- **Supinator** (SOO-puh-nayt-er). Muscle of the forearm that rotates the radius (forearm) outward and the palm upward.

Muscles of the Hand

The hand is one of the most complex parts of the body, with many small muscles that overlap from joint to joint, providing flexibility and strength to open and close the hand and fingers (**Figure 2–15**).

- **Abductors** (ab-DUK-turz). Muscles that separate the fingers.
- **Adductors** (ah-DUK-turz). Muscles at the base of each finger that draw the fingers together.