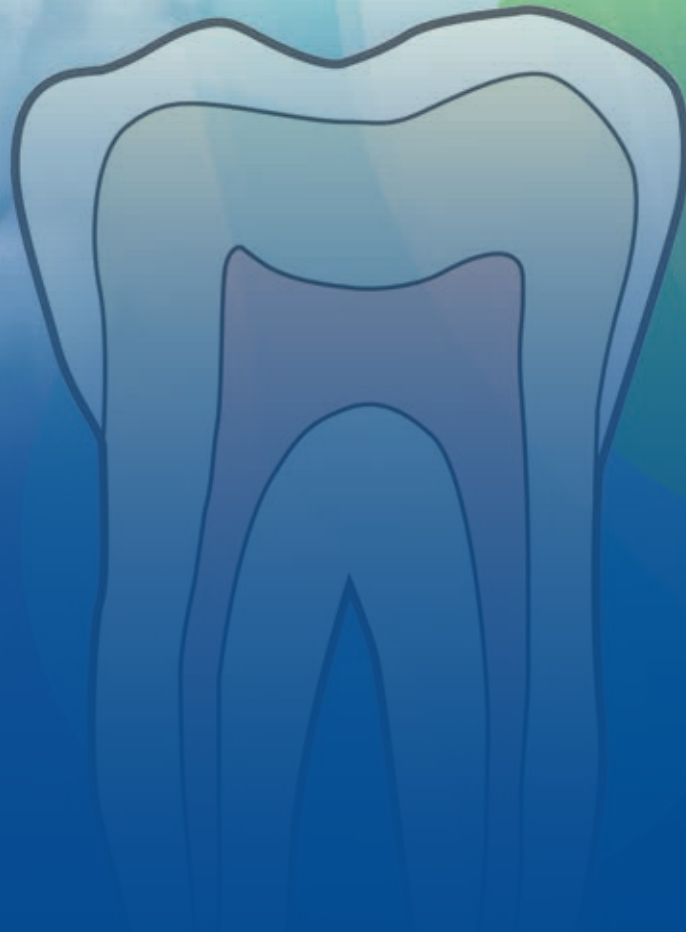


ENHANCED NINTH EDITION

WOELFEL'S

# Dental Anatomy





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Dr. Rickne Scheid received his DDS in 1972 at The Ohio State University and was inducted into the dental honorary fraternity, Omicron Kappa Upsilon. After serving in the U.S. Navy Dental Corps, he practiced part-time practice and taught at his alma mater from 1974 until 2006 when he retired with Emeriti status. His appointments at the

College of Dentistry were in the Division of Dental Hygiene, the Section of Restorative and Prosthetic Dentistry, and the Section of Primary Care. While teaching, he earned his Masters in Education with honors in 1980. Throughout his teaching career, he authored or coauthored nearly 50 scientific papers and abstracts and developed and directed 12 courses, including the Dental Anatomy course. He directed this course for 10 years, lecturing to both dental and dental hygiene students. Further, he helped develop and annually co-direct numerous continuing education courses including a review course for dental hygienists returning to practice, a dental anatomy review course for dentists and dental auxiliaries, and an expanded functions course for dental auxiliaries. He was inducted into the dental hygiene honorary, Sigma Phi Alpha, in 1989 and has received numerous dental and dental hygiene student teaching awards as well as the peer-evaluated Postle Teaching Award in 1996. In retirement, he has presented continuing education courses at the university and has served as an evaluator for the Commission on Dental Testing for Expanded Functions Dental Auxiliaries in Ohio.

## GABRIELA WEISS, DDS



Dr. Gabriela Weiss received her DDS in 1986 from the National University of Tucuman, Argentina, where she graduated as Valedictorian. After graduation, she completed a clinical fellowship in Occlusion and Oral Rehabilitation in Argentina. The following year she was awarded the F.A.M.U., an honor given to the Outstanding Professional Female. In 1988, she moved to California in the

United States where she worked in a private practice. Then, in 1994, she moved to Michigan to pursue her passion for teaching at the University of Michigan Dental School where she taught Operative and Prosthetic Dentistry courses and became director of Dental Anatomy and Occlusion. She continued teaching these courses and directing dental anatomy at two other dental schools, first at University of Pittsburgh and later at The Ohio State University College of Dentistry where she is currently an Associate Professor. She recently developed a course designed to improve the hand skills of prospective dental students. Students have recognized her passion and talent for teaching by presenting her with 14 Student Government Teaching Awards over the years.

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# Preface to the Enhanced Ninth Edition

Woelfel's Dental Anatomy is primarily intended as a study guide for dental students, dental hygiene students, dental assistants, and dental laboratory technicians as they master the details of tooth morphology and their usefulness in the dental office. The book provides dental and dental hygiene students with basic knowledge required when answering dental anatomy questions on the national board examinations, but it goes well beyond by discussing the application of tooth morphology and terminology as it relates to the practice of dentistry. Five chapters provide an introductory overview to periodontics, endodontics, occlusion, restorative dentistry, and forensic dentistry. The book with its Power Point lecture slides and test items for teachers and its many learning exercises was designed for instructors of dental anatomy courses as a teaching manual during lectures, discussion periods, and laboratory sessions, as well as during early clinical experiences. It is also useful as a reference in the dental office.

## NEW IN THIS EDITION

Over 120 new color illustrations were added in this edition, especially in the first six chapters where unique traits of each type of each tooth are best learned by visualizing multiple examples of teeth from different views. Further, to facilitate learning, many existing illustrations were reorganized and improved by adding new labels, arrows, color highlights, and tooth numbers.

Chapters that provide the introduction to the specialty areas of dentistry were updated to include the most current terminology and new topics including the description of healthy tissues surrounding dental implants. The chapter on forensic dentistry was expanded to include more current examples of the relevance of forensic dentistry. Further, several new examples of anomalies were added, as well as several new anatomical structures of the head including the location and clinical relevance of paranasal sinuses.

Finally, the authors developed numerous critical thinking exercises that require the learner to search the Internet for specific images and answer questions that serve to expand the learner's appreciation of topics covered within the book.

## BOOK FEATURES

The book is organized into three parts. Part I, **Comparative Tooth Anatomy**, includes six chapters. The first chapter begins with an introduction to terminology and concepts related to tooth morphology that provides the foundation for the next four chapters on adult tooth traits. In these chapters, the authors present similarities and differences using drawings, photographs, and many summary tables. Primary teeth and their eruption patterns are discussed in Chapter 6.

Part II, **Application of Tooth Anatomy in Dental Practice**, has seven chapters. The first two chapters include a discussion of roots of the adult teeth related to the external surfaces and supporting tissues involved in periodontal therapy and the internal anatomy of the roots involved in endodontic therapy. Other chapters include a contemporary overview of ideal occlusion, operative and restorative dentistry, and forensic dentistry. Finally, there is an extensive discussion about many commonly encountered dental anomalies as well as a chapter designed to help students draw, carve, and sketch teeth.

Part III, **Anatomical Structures of the Oral Cavity**, includes two chapters. One chapter presents the relationship of the teeth to landmarks of the skull, the temporomandibular joints, and the muscles, nerves, blood supply, and lymph drainage associated with the oral cavity. The other chapter includes a description of normal oral structures observed during a head and neck cancer screening examination and shows sites for injections for local anesthetic relative to the underlying nerve locations.

Each chapter includes methods designed to help you, the reader, master the content, and put it to practice immediately.

- **Topic list:** Each chapter begins with a list of topics presented in the same order as the sections within that chapter.
- **Learning objectives:** In each chapter, learning objectives are presented to help you appreciate what you can expect to learn as you read and that you can reference after you study to ensure that you have mastered the specified knowledge and skills.
- **New terms:** As each new term is encountered for the first time, it is highlighted in **bold print** and is defined within the text at that time, often with references to figures, diagrams, and tables to improve understanding. The bold print is helpful when searching for important terms that are listed alphabetically in the index at the end of the book.
- **Glossary:** New in this edition is an extensive glossary providing brief definitions of all important terms presented in this edition. However, many terms in dentistry are best appreciated by referring to illustrations or photographs for a complete understanding. Terms in the index include the page where you can find the term (in bold) along with its definition, and often, a reference to an associated illustration for the best learning.
- **Pronunciations:** New terms that may be difficult to pronounce have phonetic suggestions placed within brackets [like this] immediately after the word is first encountered.
- **Review questions with answers:** Many chapters or sections end with a series of review questions to test the learner's mastery of the objectives. These questions, in

many cases, cover concepts similar to those included on past dental and dental hygiene national examinations. For the convenience of quick and convenient feedback, the answers are presented immediately following the questions.

- **Learning exercises:** Most chapters include a number of learning exercises. These exercises are presented at intervals where the authors feel an active learning experience would be helpful for you to understand and/or apply the topic. These exercises may suggest that you examine extracted teeth or tooth models, or skulls (or skull models), or perform specific self- or partner examinations. New in this edition are many guided searches on the Internet designed to expose the learner to many examples of concepts discussed in that chapter. More advanced exercises (as in Chapter 13) provide methods for drawing and sketching teeth, and carving teeth from wax, thus helping you to become intimately familiar with tooth shape and terminology.
- **Summary tables:** Throughout the text, the authors have included numerous tables to summarize the many facts presented within the text. These tables are helpful when reviewing the highlights of content found within each section.
- **Original illustrations and drawings:** For complete understanding and clinical application of each topic, the authors have included a variety of photographs, illustrations, and original colorized drawings selected and designed to illustrate key points and improve learning. Over 120 new color illustrations have been added to this edition. Also, qualified instructors will have access to an image bank which contains all of the illustrations and drawings in the text that can be used when lecturing.
- **Appendix of comparative dental anatomy:** This text's unique Appendix is designed to help the learner visualize the many tooth similarities and differences that are often difficult to understand with words alone. Each adult tooth class is referenced on two separate appendix pages. The first page includes traits (each trait is identified with a different letter) that are common to all teeth within that class. The second page is devoted to the differences (each identified with a letter) between the types of teeth within each class and differences between teeth in each arch. In addition, two appendix pages illustrate the unique characteristics of anterior and posterior primary teeth. The layout on these pages makes it easy to compare the differences between teeth because views of each tooth type are lined up on the same page next to other teeth in that class. As each tooth characteristic is described within the chapters on tooth morphology (Chapters 1 to 6), reference is frequently made to the illustrated representation of that characteristic on an appendix page as follows: The word "Appendix" is followed by the page number and letter denoting items being discussed (e.g., "Appendix 1a" refers you to the Appendix, page 1, item "a"). The authors recommend that you copy each

Appendix page (front and back sides) or print out these pages from the online Navigate 2 Advantage Access site provided for this book, and place them in a separate loose-leaf notebook to facilitate study and minimize page turns as you read chapters two through six. When used in this fashion, these pages provide you with increased convenience (since fewer page turns are required when referencing all of the tooth characteristics within each chapter), easier learning (since the complex terminology used to describe each characteristic is best learned by visualizing that characteristic and comparing it to other similar teeth), and a separate study guide (since all lettered traits for each type of tooth are described on the back of each appendix page).

- **Research data:** This text is unique since it includes both original and reviewed research findings based on the study of thousands of teeth, casts, and mouths. Information on crown and root dimensions was obtained from measurements of a convenient sample of 4572 teeth extracted by Ohio dentists and studied by Dr. Julian Woelfel and his dental hygiene students at The Ohio State University between 1974 and 1979. The data from these studies are presented throughout the text by using superscript letters like this (data<sup>A</sup>) that refer to the data listed by letters at the end of the chapters. For example, the text states that a mesial marginal groove is a distinguishing characteristic of the maxillary first premolar,<sup>A</sup> and at the end of the chapter under A, you are told that this occurred in 97% of the 600 premolars studied, which means that, on the average, 3% may not have this groove, whereas only 37% of maxillary second premolars are likely to have this groove.

## SUGGESTIONS FOR STUDYING TEETH

Spend time thinking about and comprehending each new concept as you read. After all, you are learning the "foreign" language of dental anatomy that you will be using for the rest of your professional lives. Have fun looking at teeth as though you were a tooth detective. Take notes, sketch different views of each tooth, and take advantage of all learning exercises, references to figures, and the appendix. Ask questions until your curiosity is satisfied. The authors hope this book will stimulate your interest and involvement in the wonderful and fascinating field of dentistry and that you will consider this book to be a worthwhile addition to your library even after your formal education is complete.

As you begin learning the characteristics that differentiate each type of tooth as described in Part I, you need to be aware of the considerable variation in tooth morphology that can occur from one person to the next. Keep in mind that tooth sizes and characteristics cited within the text do *not* apply to *all* patients' teeth but are based on average sizes or particular morphology occurring with the greatest frequency. Observe the similarities and differences between each type of tooth by comparing the many photos of teeth included in this book.

Since a picture is worth a thousand words, it is very important that you refer to all figures whenever they are referenced in order to maximize learning. In most cases, important traits are emphasized or clarified in the illustration legends, so read the legends as you study each figure. Also, try covering the labels on each illustration in order to test yourself on the terms you are learning. Be sure to test your knowledge by participating in all learning exercises, and answer all test items included in each chapter to make sure you do not need to review the material before proceeding. When studying each table, try to list as many traits as you can for each tooth and see how many traits you have not remembered. Finally, it is imperative that you refer to the Appendix items as they are discussed to make sure that you can visualize each trait that is being discussed, and later, review the traits listed on the back of each appendix page to assure that you understand each concept. If a description of a trait is not clear, turn the page over in order to visualize the trait. After studying each chapter, refer back to the objectives presented at the beginning of the chapter and ask yourself if you have mastered each one. As you become familiar with the many similarities and differences of tooth morphology, you can later apply your knowledge during patient treatment, evaluation, and education.

As you read the description of tooth morphology, it would be ideal to use a dental explorer on an actual tooth or model to “feel” the contours being described since you will eventually be required to evaluate, reproduce, and/or clean the surfaces of these tooth contours with specific dental instruments. The best resource for learning about teeth is a collection of as many intact extracted teeth as you are able to acquire. A dentist, if presented with a quart jar of bleach, will remember his or her own student days and will probably be glad to put extracted teeth in the jar. Do not expect these teeth to be clean or sorted out; sorting is your job. While handling these teeth, it is critical to follow the *guidelines for infection control* presented here:

## GUIDELINES FOR STERILIZING AND STUDYING EXTRACTED TEETH

Using protective gloves and a mask, tooth specimens should be scraped clean with a knife. Soaking for several hours in

hydrogen peroxide before scraping is helpful. After scraping to remove hard deposits and soft tissue, tooth specimens should be further cleansed by soaking for 20 minutes in 4 ounces of household bleach containing 2 tablespoons of Calgon (a water softener). Teeth can then be placed in water (in a beaker covered with tin foil) to be autoclaved for 40 minutes at 121°C and 15 psi (Pantera E, Schuster G. *J Dent Ed* 1990;54(5):284). Once prepared, teeth should be kept moist, either by soaking in water or, as suggested by Dr. Kim Loos, DDS, by soaking in 25% glycerin and 75% water (parentsplace.com, February 28, 2001).

## ADDITIONAL RESOURCES

*Woelfel's Dental Anatomy* includes additional resources for both instructors and students that are available through the book's Navigate 2 Advantage Access site.

### Instructor Resources

Approved adopting instructors will be given access to the following additional resources:

- PowerPoint Presentations
- Image bank in PowerPoint format
- Test Bank
- Answers to end-of-chapter Critical Thinking Questions

### Student Resources

Students who have purchased *Woelfel's Dental Anatomy* have access to the following additional resources:

- Image Bank
- PowerPoint Presentations

In addition, purchasers of the text can access the searchable eBook through the Navigate 2 Advantage Access site. See the inside front cover of this text for more details.

# Acknowledgments

During my first year teaching at The Ohio State University College of Dentistry in 1974, I was fortunate to be assigned to teach in a laboratory for dental anatomy where I worked with and was mentored by, Dr. Julian Woelfel. He asked me to contribute the chapter on Operative Dentistry in the third edition in 1984. Little did I realize that in 1994, he would select me to coauthor the fifth edition of a text on the very topic I began teaching in 1974: dental anatomy. During the preparation for the fifth and sixth editions, Julian permitted me great latitude in reorganizing the text to reflect my teaching style since I used this text as I taught over 135 dental and dental hygiene students each year. During this major reorganization, I was careful to maintain the unique aspects that he had incorporated into previous editions. This includes the results of his personal, science-based research, which formed the basis for many of the conclusions presented within this text: on everything from the average mandibular hinge opening to the frequency of Carabelli cusp formation and the comparative sizes of primary and permanent teeth. In the seventh edition, Dr. Woelfel entrusted me to take over the text.

I would like to express my appreciation to all of the contributors to this and previous editions of this book. My thanks goes to Dr. Woelfel for selecting me to take over the book and teaching me to be meticulous, and for his many contributions to this text; to his wife, Marcile, who helped tremendously in typing and editing previous editions; and to the following colleagues who updated chapters in this edition: Dr. Binnaz Leblebicioglu and Dr. Lewis Claman (Periodontal anatomy), Dr. D. Stanley Sharples, II (Restorative dentistry), and Dr. Shereen Azer (Occlusion), Dr. John Nusstein (Endodontics), and Dr. Daniel Jolly (Forensic Dentistry) and Dr. Burak Yilmaz (who helped with the photography for this edition). I would also like to recognize Ms. Dorothy Permar, who conceived and wrote the first edition in 1974, and Dr. Robert Rashid, Dr. Theodore Berg, Jr., Dr. Al Reader, and Ms. Connie Sylvester, who contributed to previous editions. Finally, a special thanks goes to my co-author, Dr. Gabriela Weiss, who collaborated with me to incorporate the many improvements and additional teaching exercises and test items, and in the daunting task of editing and proofing each chapter.

*Rickne C. Scheid, DDS, MED*

## ABOUT DR. JULIAN WOELFEL



Professor Emeritus Julian Woelfel, known primarily for his expertise in complete dentures, research, and occlusion, has taught clinical dentistry for 40 years in the College of Dentistry at The Ohio State University, Columbus, Ohio. He served as an Army prosthodontist in Texas for 2 years, conducted clinical research for

the American Dental Association at the National Bureau of Standards in Washington, District of Columbia, for 3 years, and was a visiting professor in Japan, Taiwan, England, and Brazil. Dr. Woelfel has lectured in 18 foreign countries. He has published 85 scientific articles, 8 editions of this Dental Anatomy textbook, and chapters in 5 other dental books. Dr. Woelfel also has published scientific dental articles in Japan, Bulgaria, and Brazil. He holds patents on two inventions that are used in Europe and the United States for accurately recording jaw relation. In addition to Dr. Woelfel's love for students and teaching, he had a part-time dental practice limited to partial and complete dentures for 33 years. One of his proudest accomplishments has been this textbook. In 1967, he was the first recipient of the International Association of Dental Research Award for Research in Prosthodontics and was awarded a Life Membership in the Japanese Nihon University Dental Alumni Association. In 1972, the New York Prosthodontic Society selected him for the Jerome and Dorothy Schweitzer Award for Outstanding and Continuing Research in Prosthodontics. In 1992, the Ohio Dental Association chose Dr. Woelfel for the prestigious Callahan Award, and in 2004, he was the recipient of the Distinguished Alumnus Award from the Ohio Dental Alumni Association. He is a Life Member of Sigma Xi, the International Association for Dental Research, the American Prosthodontic Society, Sigma Phi Alpha Dental Hygiene Honor Society, and the ADA, AES, FDI, FICD, and FACD.

*Comments or suggestions may be submitted to Dr. Scheid on e-mail (scheid.2@osu.edu).*

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