
Teaching Anatomy

Lap Ki Chan • Wojciech Pawlina
Editors

Teaching Anatomy

A Practical Guide

 Springer

Editors

Lap Ki Chan
Institute of Medical and Health
Sciences Education
Department of Anatomy
Li Ka Shing Faculty of Medicine
The University of Hong Kong
Hong Kong SAR, China

Wojciech Pawlina
Department of Anatomy
Mayo Clinic College of Medicine
Mayo Clinic
Rochester, MN, USA

ISBN 978-3-319-08929-4 ISBN 978-3-319-08930-0 (eBook)
DOI 10.1007/978-3-319-08930-0
Springer Cham Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014956236

© Springer International Publishing Switzerland 2015

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

*“To my parents, Laura, and my teachers and students,
from whom I have learned much”*

Lap Ki Chan

*“To my anatomy teachers who guided me to the threshold of my
optimism: Kazimierz Pawlina, MD my father and first anatomy
teacher; Franciszek Jugowski MD, PhD from the Jagiellonian
University, Lynn H. Larkin, PhD from the University of
Florida; Stephen W. Carmichael, PhD from Mayo Clinic;
and to my past, present and future students.”*

Wojciech Pawlina

Preface

The title of this book, “Teaching Anatomy: A Practical Guide,” deserves some explanation. The word *teaching* has unfortunately become an unpopular word in educational writing. It is often associated with passive learning with the teacher playing the role of the “sage on the stage.” Knowledge is seen as packages transferrable from the teacher to the students, whose role is only to be receivers of the packages. But to us, teaching involves all activities that a teacher does to help students learn. It involves being both a “sage on the stage” and a “guide on the side.”

With the current trend toward a system-based approach to medical education, a book that focuses on the teaching of *anatomy* may seem old fashioned. After all, over the past few decades, anatomy has become increasingly integrated into the wider curriculum and is less of an isolated subject. However, this shift in the curriculum and educational philosophy has not destroyed anatomy’s long history as a distinct discipline. Anatomy, especially gross anatomy, still plays a unique role in many healthcare programs: it has frequently become the only practical course that students will experience in the early part of the medical curriculum. Students oftentimes learn gross anatomy from possibly one of the most mystical teaching aids: their first “patients,” the cadavers. Cadaveric dissection provides a unique opportunity for students to be introduced to issues of life, death, and suffering and to learn the “soft” skills of medicine. Through working together in the dissection laboratory, students learn skills like reflection, teamwork, communication, professionalism, and ethics, which are all important to their future healthcare careers.

This book aims to be a *practical guide* and not an exhaustive reference on educational theories as applied to anatomy teaching and learning. We understand that anatomy teachers work in diverse educational environments, including professional healthcare and undergraduate programs, teaching students with different kinds and levels of preparation. They may need to work within the confines of a set syllabus or designing their own course. They may have preferences for high or low tech materials and have few resources or many. Their backgrounds may be clinical or academic. They often need to convey a large body of knowledge to students in a short time and integrate it into the wider healthcare curriculum. They may need to take part in highly specialized pedagogies, such as problem-based learning, team-based learning, and e-learning. Moreover, since curriculum structures vary among schools, integrating anatomy into the curriculum must be flexibly done.

To help teachers to tackle these challenges, we edited this guide book, which gives practical advice to both novice and experienced anatomy teachers in the diverse educational situations that they commonly encounter. We are the first to admit that we do not know it all, so each chapter is written by an expert on its topic. The aim is to help teachers to give the best learning experiences to their students. We also understand that anatomy teachers, like most other teachers in tertiary institutions, need to divide their time between teaching, research, administrative duties and sometimes even clinical work. We have invited the expert authors of the chapters to write concisely and in simple language. Text boxes are provided to bring out the key points, to stimulate reflection on the reader's own situation, or to provide additional practical tips. Educational theories, though not the focus of this book, are selectively included in order to explain the theoretical foundation underlying practical suggestions, so that teachers can appropriately modify the strategies described in the book to fit their own educational environments.

As anatomy teachers, we often hope our students will gaze in awe at the inner universe of the human body, as we once did and, hopefully, still do. The induction of our students to this inner universe is a privilege for us. It deserves to be done well. We sincerely hope that this book can help you to help your students to learn. Learning should be fun. And so should teaching, especially anatomy.

Lap Ki Chan
Hong Kong SAR, China

Wojciech Pawlina
Rochester, MN, USA

Acknowledgments

The editors would like to thank the staff at Springer Science+Business Media, especially Mr. Richard Lansing, Editorial Director in Division of Clinical Medicine and the production team in India, for their advice, guidance, and professional work at the various stages of the production of this book. We would also like to thank Ms. Laura Chan for her help in the copy editing of the book.

Editor Biographies



Lap Ki Chan is an Associate Professor in the Institute of Medical and Health Sciences Education (IMHSE) and the Department of Anatomy at the Li Ka Shing Faculty of Medicine at The University of Hong Kong, where he is also the Deputy Director of IMHSE and the Assistant Dean (Pedagogy). After receiving his medical education at The University of Hong Kong, he completed his doctoral studies at the Department of Biological Anthropology and Anatomy at Duke University, on the comparative anatomy of the shoulder in primates. He then returned to Hong Kong where he completed his training in orthopedic surgery. Since 2007, he has been working exclusively in medical education. His research interests include innovative pedagogies in anatomy education, problem-based learning, and language issues in medical education. He is also involved in faculty development. He is the codirector of the Staff and Professional Development Program at his own school. He is also a Visiting Professor at Zhongshan School of Medicine and an educator for the Asia Pacific region for the *AO Foundation (Arbeitsgemeinschaft für Osteosynthesefragen)*, primarily offering services in faculty development. His teaching excellence has been recognized by such awards as the *Thomas Henry Huxley Instructorship* from Duke University, and most recently, an *Outstanding Teaching Award* from The University of Hong Kong. He serves as an associate editor for *Anatomical Sciences Education*.



Dr. Wojciech Pawlina is a Professor of Anatomy and Medical Education at Mayo Clinic College of Medicine in Rochester, Minnesota, USA. He earned his medical degree from the Jagiellonian University Faculty of Medicine, formerly Copernicus Medical School in Krakow, Poland, where he was appointed as instructor in the Department of Descriptive and Topographical Anatomy and completed his residency in Obstetrics and Gynecology. Since 1986 he worked as a Postdoctoral Associate at the

University of Florida College of Medicine before joining the faculty of the Department of Anatomy and Cell Biology as an Assistant Professor. In 1999 he relocated to Mayo Clinic in Rochester, Minnesota and currently serves as the Chair of the Department of Anatomy and Director of the Procedural Skills Laboratory. He has extensive experience in teaching gross anatomy, histology, and embryology to undergraduate, medical and dental students, as well as residents and fellows. From 2007 till 2013 he was appointed as an Assistant Dean for Curriculum Development and Innovation at Mayo Medical School. He received numerous teaching awards from both the University of Florida and Mayo Clinic and recently he was named 2014 Distinguish Mayo Educator. His research interest in medical education is directed toward strategies of implementing innovative teaching methodologies, teaching professionalism, leadership, and teamwork in early medical curriculum. He serves on several editorial boards of scientific journals and is also Co-Editor-in-Chief of the *Anatomical Sciences Education*, a journal of the American Association of Anatomists.

Contents

Part I Teaching and Learning Anatomy

1 Elements of Successful Adult Learning	3
Lap Ki Chan and Miriam Uhlmann	
2 Learners of a New Generation	11
Camille DiLullo	
3 Learning Styles in Anatomy Teaching and Learning	23
Barry S. Mitchell	
4 Constructive Alignment: An Outcomes-Based Approach to Teaching Anatomy	31
John Biggs and Catherine Tang	
5 Competencies for Teaching Anatomy Effectively and Efficiently	39
John F. Morris	
6 Using Teaching Assistants in Anatomy	45
Darrell J.R. Evans	
7 Engaging Residents and Clinical Faculty in Anatomy Education	55
Jennifer M. McBride and Richard L. Drake	

Part II Teaching in Large Group Settings

8 Giving a Lecture	61
Lap Ki Chan	
9 Preparing and Recording Lectures for Online Delivery	73
Thierry R.H. Bacro	
10 Evaluating Your Own Performance in a Lecture	81
John Dent	
11 Choosing Between Lecture and Briefing Sessions	89
Nirusha Lachman and Wojciech Pawlina	

Part III Teaching in Small Group Settings

- 12 Facilitating Small Group Discussion** 99
Boon Huat Bay and Samuel Sam Wah Tay
- 13 Applying Learning Styles to Engage a Diversity of Learners and Behavioral Problems in Anatomy Education** 107
Mark Terrell
- 14 Teaching and Learning Anatomy in a PBL Curriculum** 115
Esther M. Bergman
- 15 Learning and Teaching Anatomy Through Case-Based Learning (CBL)** 125
Jill E. Thistlethwaite
- 16 Team-Based Learning: An Effective Pedagogical Strategy to Teach Anatomy** 133
Cheryl Melovitz-Vasan, Grace Pinhal-Enfield, David O. DeFouw, and Nagaswami S. Vasan
- 17 Giving Feedback to Students** 143
Nirusha Lachman
- 18 Using Body Painting and Other Art-Based Approaches to Teach Anatomy** 155
Gabrielle M. Finn
- 19 Evaluating Your Own Performance in Leading a Small Group Discussion** 165
Jon Cornwall

Part IV In the Gross Anatomy Laboratory

- 20 Running a Body Donation Program**..... 175
Andrea Porzionato, Veronica Macchi, Carla Stecco, and Raffaele De Caro
- 21 Designing Gross Anatomy Laboratory to Meet the Needs of Today's Learner** 185
Quenton Wessels, Willie Vorster, and Christian Jacobson
- 22 Preparing Students Emotionally for the Human Dissection Experience** 195
Anja Böckers
- 23 Promoting Reflection in the Laboratory**..... 203
Lap Ki Chan

24 Teaching Anatomy: Prosections and Dissections	213
Nalini Pather	
25 Use of Unembalmed/Fresh Cadavers in Anatomy Teaching	223
Jennifer M. McBride and Richard L. Drake	
26 Facilities and Instruments for Learning in the Gross Anatomy Laboratory	227
Joy S. Reidenberg and Jeffrey T. Laitman	
Part V Teaching Tools	
27 Role of Image and Cognitive Load in Anatomical Multimedia	237
Timothy D. Wilson	
28 Essential E-Learning and M-Learning Methods for Teaching Anatomy	247
Robert B. Trelease	
29 The Use of Low-Tech Models to Enhance the Learning of Anatomy	259
Lap Ki Chan	
30 The Use of Medical School Museums in Teaching “Anatomy” Within an Integrated Medical Curriculum	267
Yehia M.A-H. Marreez and Luuk N.A. Willems	
Part VI Assessment	
31 Assessing Anatomy as a Basic Medical Science	279
Dujeepa D. Samarasekera, Ponnampalam Gopalakrishnakone, and Matthew C.E. Gwee	
32 Developing Multiple-Choice Questions for Anatomy Examinations	291
Thomas R. Gest and Webster Francois	
33 Peer and Faculty Assessment of Nontraditional Discipline-Independent Skills in Gross Anatomy	299
Nirusha Lachman and Wojciech Pawlina	
Part VII Curriculum Design	
34 Anatomy Education in an Innovative Medical School Curriculum	313
Jennifer M. McBride and Richard L. Drake	

35	The Role of the Anatomist in Teaching of Nontraditional Discipline-Independent Skills	319
	Darrell J.R. Evans and Wojciech Pawlina	
36	Role of Anatomists in Building an Integrated Medical Curriculum	331
	Douglas F. Paulsen, Brenda J. Klement, and Lawrence E. Wineski	
37	The Hidden Curriculum and Anatomy Education	339
	Frederic W. Hafferty and Gabrielle M. Finn	
Part VIII Teaching Anatomy to Students in Different Academic Programs		
38	Teaching Anatomical Sciences to Dental Students	353
	Stephen McHanwell	
39	Negotiation and Assessment as Tools for Tailoring Anatomy Courses to Allied Health Programs	363
	Lawrence J. Rizzolo, William B. Stewart, Alexandria Garino, and Linda H. Pellico	
40	Teaching Anatomy to Students in a Physical Therapy Education Program	373
	James W. Youdas, David A. Krause, and Nathan J. Hellyer	
Part IX Educational Research		
41	Research Methods in Anatomy Education	383
	Zubair Amin and Hamza Mohammad Abdulghani	
42	Scholarship of Teaching and Learning in Anatomy	391
	Valerie Dean O’Loughlin	
	Index	399

Contributors

Hamza Mohammad Abdulghani, MBBS, DPHC, ABFM, FRCGP, Diploma MedEd Department of Medical Education, Assessment and Evaluation Center, King Saud University, Riyadh, Saudi Arabia

Zubair Amin, MBBS, MHPE, FAAP Department of Pediatrics, Yong Loo Lin School of Medicine, National University of Singapore, National University Health System, Singapore

Department of Neonatology, Yong Loo Lin School of Medicine, National University of Singapore, National University Health System, Singapore

Thierry R.H. Bacro, PhD, PT Department of Regenerative Medicine and Cell Biology, Center for Anatomical Studies and Education, Medical University of South Carolina, Charleston, SC, USA

Boon Huat Bay, MBBS, PhD Department of Anatomy, Yong Loo Lin School of Medicine, National University of Singapore, National University Health System, Singapore

Esther M. Bergman, PhD Department of Educational Research and Development, Faculty of Health, Medicine and Life Sciences, Maastricht University, Maastricht, The Netherlands

Department of Anatomy, Radboud University Medical Center Nijmegen, Nijmegen, The Netherlands

John Biggs, PhD Tasmanian Institute of Learning and Teaching, University of Tasmania, Hobart, TAS, Australia

Anja Böckers, Dr Med, MME Institute of Anatomy and Cell Biology, Ulm University, Ulm, Germany

Lap Ki Chan, MBBS, PhD, FHKAM, FHKCOS, FRCS (Ed), MEd Institute of Medical and Health Sciences Education, Department of Anatomy, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong, SAR, China

Jon Cornwall, DipPhy, BSc, MSc, DMPHy, PGCertTertT, PhD Faculty of Law, University of Otago, Dunedin, New Zealand

Raffaele De Caro, MD Section of Human Anatomy, Department of Molecular Medicine, University of Padova, Padova, Italy

David O. DeFouw, PhD Department of Cell Biology and Molecular Medicine, New Jersey Medical School, Newark, NJ, USA

John Dent, MMed, MD, FHEA, FRCS(Ed) The Association for Medical Education in Europe (AMEE), Dundee, UK

Camille DiLullo, PhD Department of Bio-Medical Sciences, Philadelphia College of Osteopathic Medicine, Philadelphia, PA, USA

Richard L. Drake, PhD, FAAA Cleveland Clinic Lerner College of Medicine, Case Western Reserve University, Cleveland, OH, USA

Darrell J.R. Evans, BSc, PhD, FSB, FRMS, FHEA Office of Vice-Provost (Learning and Teaching), Monash University, Melbourne, Australia

Gabrielle M. Finn, BSc (Hons), PhD, PGCTLHE, FHEA Hull York Medical School, University of York, Heslington, York, UK

Webster Francois, MS School of Business, University of Michigan, Flint, MI, USA

Alexandria Garino, PA, MS Physician Associate Program, Department of Medicine, Yale University, New Haven, CT, USA

Thomas R. Gest, PhD Department of Medical Education, Texas Tech University Health Sciences Center, Paul L. Foster School of Medicine, El Paso, TX, USA

Ponnampalam Gopalakrishnakone, FAMS, DSc, PhD, MBBS Department of Anatomy, Yong Loo Lin School of Medicine, National University of Singapore, National University Health System, Singapore

Matthew C.E. Gwee, PhD, MHPEd, BPharm(Hons) Medical Education Unit, Dean's Office, Yong Loo Lin School of Medicine, National University of Singapore, National University Health System, Singapore

Frederic W. Hafferty, PhD Program in Professionalism and Ethics, Mayo Clinic, Rochester, MN, USA

Nathan J. Hellyer, PT, PhD Program in Physical Therapy, Mayo Clinic College of Medicine, Mayo Clinic, Rochester, MN, USA

Christian Jacobson, BSc, MSc, PhD Faculty of Health Sciences, Department of Biochemistry and Physiological Chemistry, University of Namibia, Windhoek, Namibia

Department of Biology, University of Waterloo, Waterloo, ON, Canada

Brenda J. Klement, PhD Department of Medical Education, Morehouse School of Medicine, Atlanta, GA, USA

David A. Krause, PT, MBA, DSc, OCS Program in Physical Therapy, Mayo Clinic College of Medicine, Mayo Clinic, Rochester, MN, USA

Nirusha Lachman, PhD Department of Anatomy, Mayo Clinic College of Medicine, Mayo Clinic, Rochester, MN, USA

Jeffrey T. Laitman, PhD Center for Anatomy and Functional Morphology, Icahn School of Medicine at Mount Sinai, New York, NY, USA

Veronica Macchi, MD, PhD Section of Human Anatomy, Department of Molecular Medicine, University of Padova, Padova, Italy

Yehia M.A-H. Marreez, MD, PhD Division of Anatomy and Pathology, Department of Basic Medical Sciences, Touro University Nevada, Henderson, NV, USA

Jennifer M. McBride, PhD Cleveland Clinic Lerner College of Medicine, Case Western Reserve University, Cleveland, OH, USA

Stephen McHanwell, BSc (Hons), PhD (Bristol), CBiol, FSB, FHEA, FLS School of Medical Sciences Education Development and School of Dental Sciences, Newcastle University, Newcastle upon Tyne, UK

Barry S. Mitchell, BSc, PhD, MSc, FSB Faculty of Health and Life Sciences, De Montfort University, Leicester, UK

John F. Morris, BSc, MB, ChB, MD, MA, FMedSci Department of Physiology, Anatomy and Genetics, University of Oxford, Oxford, UK

Valerie Dean O'Loughlin, PhD Anatomy and Cell Biology, Medical Sciences Program, Indiana University School of Medicine, Bloomington, IN, USA

Nalini Pather, PhD School of Medical Sciences, Medicine, University of New South Wales, Sydney, NSW, Australia

Douglas F. Paulsen, PhD, FAAA Department of Pathology and Anatomy, Morehouse School of Medicine, Atlanta, GA, USA

Wojciech Pawlina, MD, FAAA Department of Anatomy, Mayo Clinic College of Medicine, Mayo Clinic, Rochester, MN, USA

Linda H. Pellico, PhD, MSN, CNS-BC, RN School of Nursing, Yale University, New Haven, CT, USA

Grace Pinhal-Enfield, PhD Department of Cell Biology and Molecular Medicine, New Jersey Medical School, Newark, NJ, USA

Andrea Porzionato, MD, PhD Section of Human Anatomy, Department of Molecular Medicine, University of Padova, Padova, Italy

Joy S. Reidenberg, PhD Center for Anatomy and Functional Morphology, Icahn School of Medicine at Mount Sinai, New York, NY, USA

Lawrence J. Rizzolo, PhD Department of Surgery, Yale University, New Haven, CT, USA

Dujeepa D. Samarasekera, FAcadMed(UK), FAMS, MHPE, MBBS Medical Education Unit, Yong Loo Lin School of Medicine, National University of Singapore, National University Health System, Singapore

Carla Stecco, MD Section of Human Anatomy, Department of Molecular Medicine, University of Padova, Padova, Italy

William B. Stewart, PhD Department of Surgery, Yale University, New Haven, CT, USA

Catherine Tang, PhD Tasmanian Institute of Learning and Teaching, University of Tasmania, Hobart, TAS, Australia

Samuel Sam Wah Tay, BSc(Hons), MSc, PhD Department of Anatomy, Yong Loo Lin School of Medicine, National University of Singapore, National University Health System, Singapore

Mark Terrell, Ed.D Lake Erie College of Osteopathic Medicine, Erie, PA, USA

Jill E. Thistlethwaite, MBBS, PhD, MMed, FRCGP, FRAVGP School of Communication, University of Technology Sydney, Ultimo, Sydney, Australia

Robert B. Trelease, PhD Department of Pathology and Laboratory Medicine, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

Miriam Uhlmann, MSc Faculty Development, AO Foundation, AO Education Institute, Davos, Switzerland

Cheryl Melovitz-Vasan, PT, DPT, PhD Department of Biomedical Sciences, Cooper Medical School of Rowan University, Camden, NJ, USA

Nagaswami S. Vasan, DVM, MVSc, PhD Department of Biomedical Sciences, Cooper Medical School of Rowan University, Camden, NJ, USA

Willie Vorster, BSc (Hons), MSc, PhD, TDPE Department of Anatomy, School of Medicine, University of Namibia, Windhoek, Namibia

Quenton Wessels, BSc (Hons) (Cell Biol), BSc (Med Sci), MSc, PhD Lancaster Medical School, Faculty of Health and Medicine, Lancaster University, Lancaster, UK

Luuk N.A. Willems, MD, PhD Department of Respiratory Diseases, Leiden University Medical Center, Leiden, Netherlands

Timothy D. Wilson, PhD Department of Anatomy and Cell Biology, Schulich School of Medicine and Dentistry, CRIPT - Corps for Research of Instructional and Perceptual Technologies, Western University, London, ON, Canada

Lawrence E. Wineski, PhD Department of Pathology and Anatomy, Morehouse School of Medicine, Atlanta, GA, USA

James W. Youdas, PT, MS Program in Physical Therapy, Mayo Clinic College of Medicine, Mayo Clinic, Rochester, MN, USA