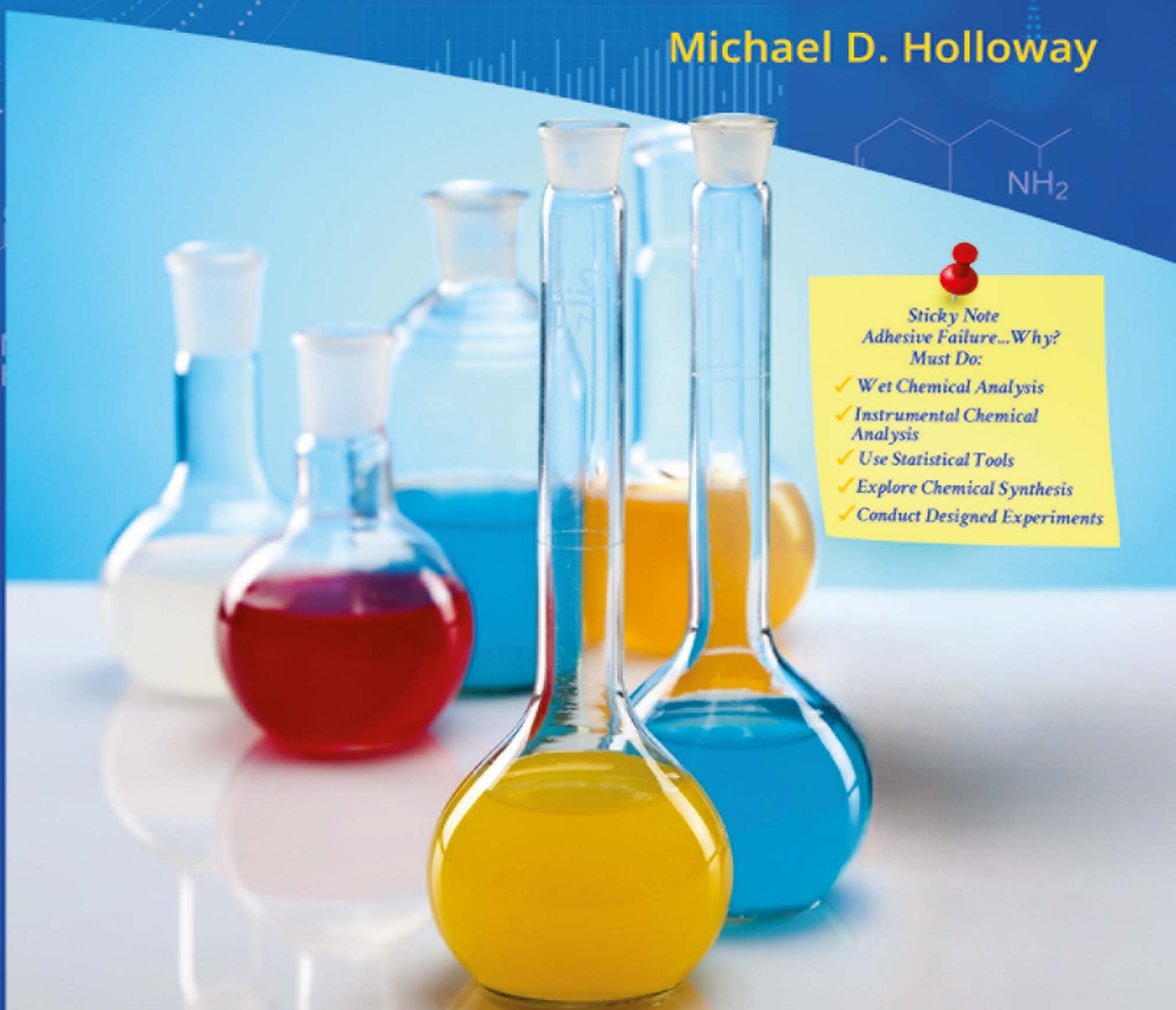
The Analytical Chemistry Laboratory Companion

Michael D. Holloway



Scrivener Publishing

WILEY

The Analytical Chemistry Laboratory Companion

Scrivener Publishing
100 Cummings Center, Suite 541J
Beverly, MA 01915-6106

Publishers at Scrivener
Martin Scrivener (martin@scrivenerpublishing.com)
Phillip Carmical (pcarmical@scrivenerpublishing.com)

The Analytical Chemistry Laboratory Companion

Michael D. Holloway

WILEY

This edition first published 2025 by John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA and Scrivener Publishing LLC, 100 Cummings Center, Suite 541J, Beverly, MA 01915, USA

For more information about Scrivener publications please visit www.scrivenerpublishing.com.

Wiley Global Headquarters
111 River Street, Hoboken, NJ 07030, USA

For details of our global editorial offices, customer services, and more information about Wiley products visit us at www.wiley.com.

Library of Congress Cataloging-in-Publication Data

ISBN 9781394355082

Front cover images supplied by the author
Cover design by the author

Set in size of 11pt and Minion Pro by Manila Typesetting Company, Makati, Philippines

Printed in the USA

10 9 8 7 6 5 4 3 2 1

This work is dedicated to Dr. Ascanio G. DiPippo, Dr. George Morris,
and Dr. James Nugent for their guidance and support during my formative chemical years
as an undergraduate student.

Contents

Preface

This work serves several functions. Foremost, it is the intent to serve as a reference guide that professional chemists, graduate students, and those interested in analytical chemistry can consult when they need quick explanations or refreshers on specific topics within a subject area as well as laboratory operational insight as well as the structures of designing experiments and the use of statistics to gain increased accuracy, precision, repeatability, and reproducibility of data. It introduces students of chemistry to chemical analysis as an educational tool designed to help grasp the fundamental concepts and principles of analytical chemistry. This work will also provide for more in-depth and advanced study and lay the groundwork and build the necessary background knowledge.

This companion provides a concise examination of the various analytical tools used for chemistry and defines the basic analytical instrument principles, techniques, and applications as well as exploring statistical tools useful in data interpretation, test result reporting, and common root cause for faulty data with suggested remedies. The introduction provides a concise guide on developing standard operating procedures, laboratory safety, how to decide on which instrumental analytical methods to use, establishing a designed experiment (DoX), establishing a budget, and common statistical tools useful for data interpretation.

This work covers both wet chemical and instrumental analysis. The wet chemistry section covers glassware, reagents, solvents, units of measures, pitfalls to avoid, remedies that can be implemented, report formats, and applications. The instrumental analysis section covers principles, techniques, components, applications, specific statistical tools, test reporting, common root cause for faulty data and suggested remedies, and abbreviations. The work commences with laboratory management, statistical tools, a review of chemical synthesis, chemistry designed experiment structures, and References along with literary reviews.

This work is built to provide quick and accurate information that serves to inform as well as encourage chemists. The format is designed for easy reading and comprehension. Consider this work the best notes from the professor of analytical chemist who also runs a professional laboratory. Happy experimenting!

Michael D. Holloway

Acknowledgements

We would like to express our sincere gratitude to the following individuals for their invaluable contributions to *The Analytical Chemistry Laboratory Companion*.

We extend our heartfelt thanks to **Emma Holloway** for her exceptional work in contributing to the statistics chapter. Her expertise and dedication were instrumental in shaping the content and ensuring its clarity.

Our deepest appreciation also goes to **Buhari Salahuddeen,** whose creativity and skill in developing the sketches for the layouts and instruments greatly enhanced the visual appeal and usability of this companion. His attention to detail has been vital in making complex concepts more accessible to readers.

We are truly grateful for their contributions and support throughout this project.