ORGANIC CHEMISTRY LABORATORY TECHNIQUES

Lisa Nichols, 2nd Edition

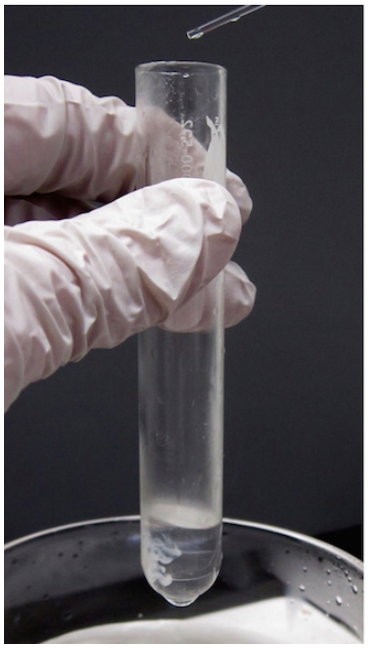

TABLE OF CONTENTS, IN BRIEF

Butte Community College

All photographs (unless otherwise indicated) were taken by Lisa Nichols.

The author has received written permission to use the photograph of all students appearing in this textbook.

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ABOUT THE AUTHOR LISA NICHOLS

This resource is the result of an academic sabbatical leave in the 2015-2016 academic year. The goal of the project was twofold: a) to create a free electronic laboratory resource for students, b) to show greater step-by-step detail for organic chemistry lab techniques than is usually shown in print textbooks, so that students could come to lab with greater confidence.

Lisa Nichols (Figure 1) obtained a Bachelor's of Science degree in chemistry from California State University, Chico in 2001 and a Master's degree in organic chemistry from Stanford University in 2003. At the time of the second edition (2017) she had taught chemistry full-time for 14 years at Butte Community College (in Oroville, northern California, near C.S.U. Chico), with an emphasis on teaching majors-level organic chemistry.

Figure 1: Author running a chromatography column for this project.

Lisa Nichols would like to express gratitude to the many people who made this project possible and/or enhanced the final product:

- The administration and LTPA committee at Butte College that selected her to receive the sabbatical.
- Special thanks to Dr. David Ball, Professor Emeritus at C.S.U. Chico, who was the primary editor for this textbook. Dr. Ball was always willing to discuss best practices and was also a source of occasional supplies.
- Special thanks to the secondary editors of this textbook: Dr. Carolynn Arpin, Dr. Christopher Nichols (faculty at C.S.U. Chico), Dr. Michael Lodewyk, and Dr. Kristin Milinkevich (faculty at Butte College).
- Dave Carr and Rusty Bogart (staff at Butte College) who were often asked to take pictures when both hands were needed in the photograph. Some of Mr. Carr's best work is shown in Figure 2.
- Occasional photography assistance: Dr. Elizabeth Wannenmacher, Martin Wallace (faculty at Butte College), Dr. Monica So, and Jana Burgess-Henry (faculty at C.S.U. Chico).
- Discussion of physics-related phenomena: Dr. Robert White (faculty at Butte College).
- Advice on publishing and multimedia: Jerry Garcia and Peter Dahl (staff at Butte College).
- Advice on online curricular materials: Matt Evans and Mark Blaser (faculty at Shasta College).
- For help on improving the accessibility of the textbook: Suzanne Wakim (faculty at Butte College).

Figure 2: Some excellent photographs taken by Dave Carr.

USING THIS RESOURCE

NOTE TO INSTRUCTORS

This resource is a PDF of an organic chemistry laboratory textbook designed for the undergraduate organic chemistry student who has never before taken a college-level organic chemistry course. It can also be used for students engaging in upper division courses or independent research who wish to have a refresher in basic laboratory techniques. This resource was not designed with graduate students in mind, and therefore may not be all inclusive in laboratory techniques experienced at that level.

One of the main goals of this project was to provide a free, yet quality resource for organic chemistry students. With that in mind, the author Lisa Nichols welcomes feedback on typos, errors, or differences in opinion that readers come across. Please send comments to: nicholsli@butte.edu.

It was not practical to show every conceivable iteration of every lab technique, and focus was placed on what was considered to be the most commonly encountered methods. Consideration was made to what materials are likely available in teaching labs. For example, a balloon technique was presented for inert atmospheric work as it was thought that gas manifolds are less common in academic labs.

COPYRIGHT ISSUES

Figure 3: Creative Commons logo.

NOTE TO STUDENTS

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All topics listed in the table of contents of each chapter are active links, and upon selection will take you to the beginning of each topic in the PDF. Some paragraphs in the text also contain links, and they will be underlined and a different color than the text (for example a link may look like this - this link takes you to the cover).

In many PDF readers, there is a method to return to a previous section after a link has sent you elsewhere in the document. In Adobe Reader, this can be accomplished by selecting **View < Page Navigation < Previous View**, while in Preview this can be accomplished by selecting **Go < Back**. This method will work even if you have scrolled rather far from where the link sent you.

There are several ways to find specific information in this text:

1. Use the **links in any Table of Contents** (In Brief, In Detail, or at the beginning of each chapter) to jump to chapter headings or the topic of interest.

   The chapter headings can also be accessed through the Bookmarks view in Adobe Reader (Figure 4a), or the Table of Contents view in Preview (Figure 4b).

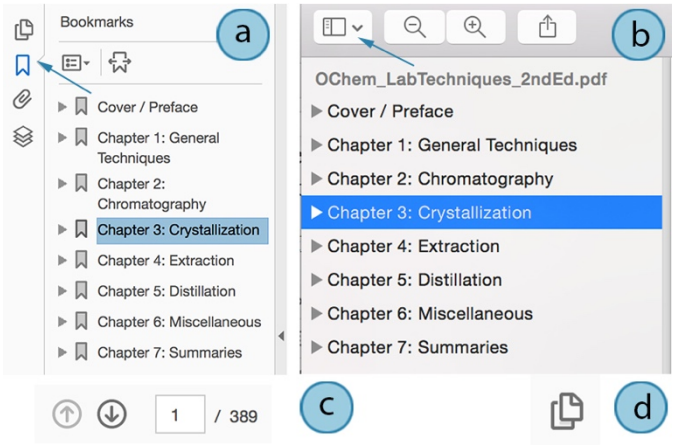

Figure 4: a) Bookmarks icon in Adobe Reader (indicated with an arrow), b) Table of contents icon in Preview (indicated with an arrow), c) Skipping to a page icon in Reader, d) Thumbnail icon in Reader.

2. Skip to the page number of interest (for example if a page has been assigned reading). In Adobe Reader, this can be accomplished by entering the page number in the toolbar that looks like Figure 4c. In Preview this is accomplished by using the **Go < Go to Page** option.

3. Use the **Search function** in the PDF reader to search for keywords. In Adobe Reader, this can be accomplished by using the **Edit < Find** option, and in Preview a search box is located in the top right toolbar with a magnifying glass icon. The keyword hits can be scrolled through to find the topic of interest. Note that in Preview searching for *water bath* will show separate hits for *water* and *bath*, while using quotation marks to enclose *"water bath"* will shows hits only when the two words are found together. In Adobe Reader, a search for *water bath* will only show hits when the two words are found together.

4. View the PDF as page thumbnails (in Adobe Reader select the icon in Figure 4d, and in Preview select **View < Thumbnails)** and scan through small images of each page to find the appropriate section.

   There are many ways to maximize your experience with a PDF. In many PDF readers, you may highlight text or add notes. Students are encouraged to learn about different options in their individual PDF reader.