



## Laboratory work methods

Skilfulness and the correct equipment are necessary that chemical experiments can succeed and dangerous materials are handled safely. These knowledge and abilities as integral part of the lab course are important and highly appreciated and sometimes also defined as the “art of chemical synthesis”. The importance of practical experimentation technologies for a successful chemistry was first recognized by Justus von Liebig who equipped a first chemical instruction laboratory already in the year 1826. The working conditions and safety requests for chemical experiments changed completely since this time. However, the fact remained that skilfulness, attention, diligence and practice are indispensable also for successful and safe chemical experimentation – even with most modern equipment.



Pharmaceutical-chemical instruction laboratory from the year 1894.

Much has been written about the large number and wide-ranged laboratory appliance and experimental laboratory technologies. Many practical course books give good instructions for practical experiments, the construction of equipments or separation technologies, like for example the distillation or extraction. This should not be repeated here. A commented list of modern practical course books that can be found in most libraries is added here:



## Books in German language

### Organikum

Klaus Schwetlick, Wiley-VCH, 21. Auflage, 2001, ISBN 3-527-29985-8.

The undisputed real classic of the organic-chemical practical course books! In the first chapters is much worth knowing to find about experimental technologies. The main focus lies on the standard experiments using norm cut glass appliances, and rinsing procedures like distillation, extraction and crystallization

### Die Praxis des organischen Chemikers Gattermann Wieland

Th. Wieland, W. Sucrow; Walter de Gruyter, 43. Auflage, 1982, ISBN 3-11-006654-8.

The beginner finds a detailed introduction into the content with laboratory appliances of the organic-chemical practical course. Furthermore, useful information about the manufacturing of solutions of certain concentrations or about cleaning and drying of solvents is given.

### Reaktionen und Synthesen im organisch-chemischen Praktikum und Forschungslaboratorium

L. F. Tietze, Th. Eicher; Georg Thieme Verlag, 2. neubearbeitete Auflage, 1991, ISBN 3-13-612302-6.

The most current standard apparatus are portrayed and their use shortly described. The thorough preparation necessary for a successful work in the laboratory is expounded at each of the experiments

### Organisch-chemisches Grundpraktikum unter Berücksichtigung der Gefahrstoffverordnung

Th. Eicher, L. F. Tietze; Georg Thieme Verlag, 2. neubearbeitete Auflage, 1995, ISBN 3-13-109602-0.

The most current standard equipments are portrayed and their use shortly described. Big significance is drawn to the planning and preparation of a reaction. An operation scheme including also the waste disposal, is given to every experiment.

### Praxis der Organischen Chemie

A manual

J. Leonard, B. Lygo, G. Procter; G. Dyker (Hrsg.); Wiley & Sons, 1996, ISBN 3-527-29411-2

The book addresses all who are dealing with synthesis chemistry. It expounds also such experimental technologies that one cannot find in other practical course book: Special filtration techniques, production and application of staining reagents for the thin-layer chromatography, flash-chromatography or recrystallization of smallest volumes with the Craig tube.

### Integriertes Organisches Praktikum

S. Hünig, G. Märkl, J. Sauer; Verlag Chemie, 1979, ISBN 3-527-25473-0, **out of print**.



### **Arbeitsmethoden in der Organischen Chemie**

S. Hünig, P. Kreitmeier, G. Märkl, J. Sauer; Lehmanns Media, LOB.de, Berlin, 2006, ISBN 3-86541-148-7; available on-line at: <http://www.ioc-praktikum.de/>

The small booklet addresses all practical aspects of the basic organic teaching lab. Instructions and sketches illustrate all important techniques for the beginner and many practical hints help to get started.

## **Books in English language**

### **Vogel's Textbook of Practical Organic Chemistry**

Arthur Vogel; Longman Scientific & Technical copublished in the United States with John Wiley & Sons, Fifth edition, 1989, ISBN 0-470-21414-7.

Similar to the German-language classics "Organikum" and "Die Praxis des organischen Chemikers", the current laboratory technologies are introduced very descriptively.

### **Microscale Techniques for the Organic Laboratory**

Dana W. Mayo, Ronald M. Pike, Samuel S. Butcher, Peter K. Trumper; John Wiley & Sons, 1991, ISBN 0-471-62192-7.

This book doesn't contain any experiments; it deals virtually exclusively with the use of laboratory appliances (for example handling of a separation funnel) and the correct set up of standard equipments even including the attachment of clamps. Another main focus lies on the good preparation of the reaction and the safety in the laboratory.

### **Organic Chemistry Experiments Microscale & Semi-Microscale**

Bruce N. Campbell, Jr., Monica McCarthy Ali; Books/ Cole Publishing Company, 1994, ISBN 0-534-17611-9.

The main focus lies on the equipments specifically for small batch scales. Also the importance of a good planning of a reaction is underlined. Furthermore, a relatively detailed introduction in the thin-film-layer- and column chromatography is given.

### **Experimental Organic Chemistry Standard and Microscale**

L. M. Harwood, C. J. Moody, J. M. Percy; Blackwell Science, Second Edition, 1998, ISBN 0-632-04819-0.

The book introduces very descriptively the experimental techniques. Not only standard laboratory set ups, but also techniques like hot filtration or working under inert gas are explained in detail. Information about heating or cooling baths is included; and, last but not least, an introduction in thin-film and column chromatography is given.

### **The Organic Chem Lab Survival Manual**

James W. Zubrick; John Wiley & Sons, Fifth Edition, 2000, ISBN 0-471-38732-0.

The normal laboratory everyday life with all its dangers is portrayed descriptively. The current laboratory techniques are introduced with many useful indications of typical mistakes.