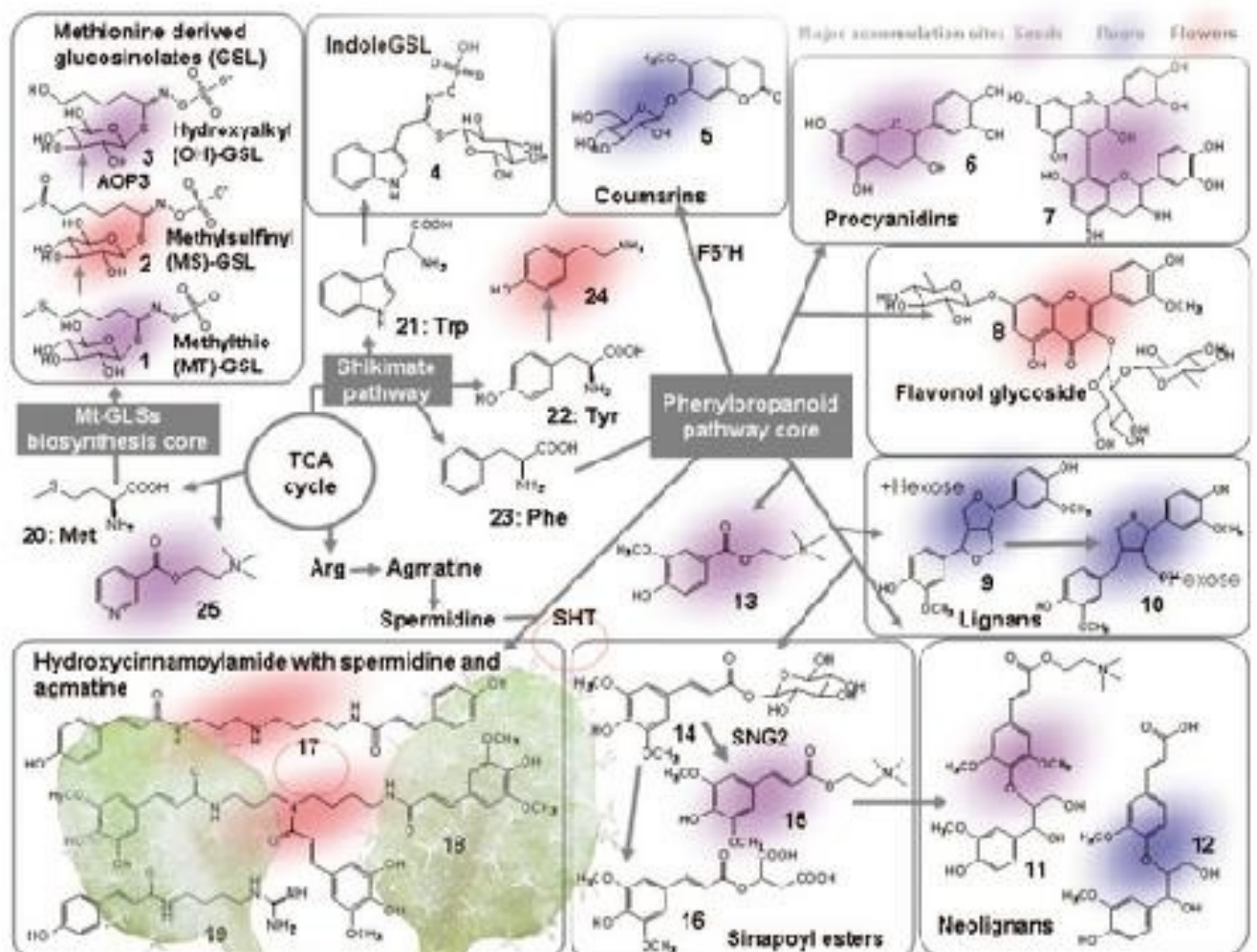


# The Handbook of Plant Metabolomics

Edited by Wolfram Weckwerth  
and Günter Kahl



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*Dedicated to*

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*Ulrich and Hannelore Weckwerth  
for their endless sympathy, patience and guidance*

# Preface

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Whereas the most modern topics of plant research, grouped into the term “omics,” such as genomics, transcriptomics, and proteomics, are comparatively new, the strategies to isolate, purify, identify, and quantify a multitude of low molecular weight cellular compounds (called metabolites) look back on a long history. While initially only metabolites present in comparatively high concentrations could be isolated and quantified (sometimes only semiquantified), the advent of enzymatic detection techniques in the 1970s brought a breakthrough in precise metabolite analysis. Unfortunately, these techniques required the coupling of a metabolite's detection to the reduction/oxidation of  $\text{NAD}^+$  to  $\text{NADP}^+$ , and therefore excluded the majority of metabolites, especially secondary metabolites. More recent developments in mass spectrometry (MS), matrix-assisted laser desorption/ionization (MALDI)–MS for metabolite imaging, gas chromatography coupled to mass spectrometry (GC–MS), liquid chromatography coupled to mass spectrometry (LC–MS), and NMR technology for medium- to high-throughput identification and quantification of low molecular weight compounds pushed metabolite analysis to today's advanced level, where various physico-chemical separation techniques are combined to analyze metabolite profiles in considerable detail and accuracy. The present state of technology for metabolite analysis has been denoted “metabolomics.”

Metabolomics reflects the physiological state of an organism or its organs, tissues, or cells, and therefore allows a hitherto not possible comprehensive understanding of the biology of an organism and its response to intrinsic or environmental changes or influences. The various techniques of metabolomics allow the comprehensive profiling of cellular metabolites at the systems level, thereby providing a direct readout of biochemical activity that can be correlated with phenotype and used to identify therapeutic targets. This omics discipline then bridges the gap between genotype and phenotype. The present *Handbook of Plant Metabolomics* not only witnesses the present state-of-the-art metabolomics and its widespread applications, but also portrays up-to-date technical advances in metabolite fingerprinting and the *in silico* analysis of the resulting, mostly very complex, metabolite patterns.

*The Handbook of Plant Metabolomics (Metabolite Profiling and Networking)* is the fourth volume of the successful Wiley-VCH series of *Handbooks of Plant Genome Analysis*, and follows the warmly welcomed *The Handbook of Plant Genome Mapping (Genetic and Physical Mapping)*, *The Handbook of Plant Functional Genomics (Concepts and Protocols)*, and *The Handbook of Plant Mutation Screening (Mining of Natural and Induced Alleles)*. It provides informative introductions to each chapter, detailed descriptions of techniques for metabolite profiling, and robust and ready-to-go laboratory protocols, in addition to some applications, all written by internationally renowned experts in their research fields. Although this volume focuses on *plant* metabolomics, the techniques presented are broadly applicable to other biological systems exemplifying the pioneering and original character of metabolomics in plant biology. This rapid development of metabolomics to a mature technology is catalyzing the application of metabolomics in other fields of research also, such as biomedicine.

The Editors very much appreciate the excellent chapters contributed by all the authors, and expect that *The Handbook of Plant Metabolomics* will reproduce the worldwide success of its three progenitors.

Vienna (Austria)  
Frankfurt am Main (Germany)  
August 2012

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# List of Contributors

***Martin F. Almstetter***

University of Regensburg  
Institute of Functional Genomics  
Josef-Engert-Strasse 9  
93053 Regensburg  
Germany

***Susanna Atwell***

University of California, Davis  
Department of Plant Sciences  
One Shields Avenue  
Davis, CA 95616  
USA

***Sebastian Böcker***

Friedrich-Schiller-University Jena  
Institute for Informatics  
Ernst-Abbe-Platz 2  
07743 Jena  
Germany

***Christian Bölling***

Charité Universitätsmedizin Berlin  
Computational Systems Biochemistry Group  
Seestrasse 73  
13347 Berlin  
Germany

***Shih-Chang Chien***

National Chung Hsing University  
Experimental Forest Management Office  
No. 250, Kuo Kuang Road Taichung 402  
Taiwan

***Young Hae Choi***

Leiden University  
Institute of Biology  
Natural Products Laboratory  
Sylviusweg 72, 2333 BE Leiden  
The Netherlands

***Katja Dettmer***

University of Regensburg

Institute of Functional Genomics

---

Josef-Engert-Strasse 9

93053 Regensburg

Germany

***Wolfgang Eisenreich***

Technische Universität München

Lehrstuhl für Biochemie

Lichtenbergstrasse 4

85435 Garching

Germany

***Ivo Feussner***

Georg-August-Universität Göttingen

Albrecht-von-Haller-Institute for Plant Sciences

Department of Plant Biochemistry

Justus-von-Liebig-Weg 11

37077 Göttingen

Germany

***Kirstin Feussner***

Georg-August-Universität Göttingen

Institute of Microbiology and Genetics

Department of Molecular Microbiology and Genetics

Grisebachstrasse 8

37077 Göttingen

Germany

and

Georg-August-Universität Göttingen

Albrecht-von-Haller-Institute for Plant Sciences

Department of Plant Biochemistry

Justus-von-Liebig-Weg 11

37077 Göttingen

Germany

***Astrid Forneck***

University of Natural Resources and Life Sciences, Vienna

Department of Crop Sciences

Division of Viticulture and Pomology

Konrad-Lorenz-Strasse 24

3430 Tulln

Austria

***Lena Fragner***

University of Vienna  
Department of Molecular Systems Biology  
Althanstrasse 14  
1090 Vienna  
Austria

***Takeshi Furuhashi***

University of Vienna  
Department of Molecular Systems Biology (MOSYS)  
Althanstrasse 14  
1090 Vienna  
Austria

***Alexander Herrmann***

Metabolomic Discoveries GmbH  
Am Mühlenberg 11  
14476 Potsdam-Golm  
Germany

***Camilla B. Hill***

The University of Melbourne  
School of Botany, Building 122  
Australian Centre for Plant Functional Genomics (ACPGF)  
Professors Walk  
Parkville, VIC 3052  
Australia

***Claudia Huber***

Technische Universität München  
Lehrstuhl für Biochemie  
Lichtenbergstrasse 4  
85435 Garching  
Germany

***Jan Hummel***

Max Planck Institute of Molecular Plant Physiology (MPIMP)  
Bioinformatics Group  
Am Muehlenberg 1  
14476 Potsdam-Golm  
Germany

***Masao Ishimoto***

National Institute of Agrobiological Sciences  
2-1-2 Kannondai  
Tsukuba



Ibaraki 305-8602

Japan

---

***Piotr Kachlicki***

Institute of Plant Genetics PAS  
Strzeszyńska 34  
60-479 Poznań  
Poland

***Alexander Kaefer***

Georg-August-Universität Göttingen  
Institute of Microbiology and Genetics  
Department of Bioinformatics  
Goldschmidtstrasse 1  
37077 Göttingen  
Germany

***Hye Kyong Kim***

Leiden University  
Institute of Biology  
Natural Products Laboratory  
Sylviusweg 72, 2333 BE Leiden  
The Netherlands

***Daniel J. Kliebenstein***

University of California, Davis  
Department of Plant Sciences  
One Shields Avenue  
Davis, CA 95616  
USA

***Nihat Knispel***

Technische Universität München  
Lehrstuhl für Biochemie  
Lichtenbergstrasse 4  
85435 Garching  
Germany

***Joachim Kopka***

Max Planck Institute of Molecular Plant Physiology  
Applied Metabolome Analysis  
Department 1  
Prof. Lothar Willmitzer  
Am Muehlenberg 1  
D-14476 Potsdam-Golm  
Germany

**Rudolf Krska**

University of Natural Resources and Life Sciences, Vienna

---

Center for Analytical Chemistry

Department IFA-Tulln

Konrad-Lorenz-Strasse 20

3430 Tulln

Austria

**Erika Kutzner**

Technische Universität München

Lehrstuhl für Biochemie

Lichtenbergstrasse 4

85435 Garching

Germany

**Manuel Landesfeind**

Georg-August-Universität Göttingen

Institute of Microbiology and Genetics

Department of Bioinformatics

Goldschmidtstrasse 1

37077 Göttingen

Germany

**Nora C. Lawo**

University of Natural Resources and Life Sciences, Vienna

Division of Viticulture and Pomology

Department of Crop Sciences

Konrad-Lorenz-Strasse 24

3430 Tulln

Austria

and

Syngenta Crop Protection Research Stein

Schaffhauserstrasse 101

4332 Stein

Switzerland

**Chiu-Ping Liu**

National Taiwan University

Institute of Biotechnology

No. 1, Sec. 4, Roosevelt Road

Taipei 10617

Taiwan

**Fumio Matsuda**

RIKEN Plant Science Center

Metabolomic Function Research Group

---

Suehiro-cho 1-7-22

Tsurumi-ku

Yokohama 230-0045

Japan

and

Osaka University

Graduate School of Information Science and Technology

Department of Bioinformatic Engineering

1-5, Yamada-oka Suita

Osaka 565-0871

Japan

***Vlora Mehmeti***

University of Vienna

Department of Molecular Systems Biology

Althanstrasse 14

1090 Vienna

Austria

***Peter Meinicke***

Georg-August-Universität Göttingen

Institute of Microbiology and Genetics

Department of Bioinformatics

Goldschmidtstrasse 1

37077 Göttingen

Germany

***Axel Meissner***

Leiden University Medical Center

Department of Parasitology

P.O. Box 9600

Eindhovenweg 20, 2333 ZC Leiden

The Netherlands

***Hans-Peter Mock***

Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)

Corrensstrasse 3

06466 Gatersleben

Germany

***Toshiya Muranaka***

Yokohama City University

Kihara Institute for Biological Research

---

641-12 Maioka-cho

Totsuka-ku

Yokohama

Kanagawa 244-0813

Japan

and

Osaka University

Department of Biotechnology

2-1 Yamadaoka

Suita-shi

Osaka 565-0871

Japan

***Steffen Neumann***

Leibniz Institute of Plant Biochemistry, IPB Halle

Department of Stress and Developmental Biology

Weinberg 3

06120 Halle (Saale)

Germany

***Peter J. Oefner***

University of Regensburg

Institute of Functional Genomics

Josef-Engert-Strasse 9

93053 Regensburg

Germany

***Kiyoshi Ohyama***

Tokyo Institute of Technology

Graduate School of Engineering

2-12-1 Ohokayama

Meguro-ku

Tokyo 152-8551

Japan

and

RIKEN Plant Science Center

1-7-22 Suehiro-cho

Tsurumi-ku

Yokohama

Kanagawa 230-0045

Japan

**Florian Rasche**

Friedrich-Schiller-University Jena

Institute for Informatics

Ernst-Abbe-Platz 2

07743 Jena

Germany

**Ute Roessner**

The University of Melbourne

School of Botany, Building 122

Australian Centre for Plant Functional Genomics (ACPFPG) and Metabolomics Australia

Professors Walk

Parkville, VIC 3052

Australia

**Kazuki Saito**

RIKEN Plant Science Center

Metabolomic Function Research Group

Suehiro-cho 1-7-22

Tsurumi-ku

Yokohama 230-0045

Japan

and

Graduate School of Pharmaceutical Sciences

Department of Molecular Biology and Biotechnology

Chiba University

Inohana 1-8-1

Chuo-ku

Chiba 260-8675

Japan

**Nozomu Sakurai**

Kazusa DNA Research Institute

2-6-7 Kazusa-Kamatari

Kisarazu

Chiba 292-0818

Japan

**Satoru Sawai**

Chiba University

Graduate School of Pharmaceutical Sciences

1-33 Yayoi-cho

Inage-ku

Chiba 263-8522

Japan

---

and

Tokiwa Phytochemical Co., Ltd.

58 Kinoko

Sakura

Chiba 285-0801

Japan

and

RIKEN Plant Science Center

1-7-22 Suehiro-cho

Tsurumi-ku

Yokohama

Kanagawa 230-0045

Japan

***Nicolas Schauer***

Metabolomic Discoveries GmbH

Am Mühlenberg 11

14476 Potsdam-Golm

Germany

***Stefanie Schmidt***

Max Planck Institute of Molecular Plant Physiology

Applied Metabolome Analysis

Department 1

Prof. Lothar Willmitzer

Am Muehlenberg 1

D-14476

Potsdam-Golm

Germany

***Nicholas Schramek***

Technische Universität München

Lehrstuhl für Biochemie

Lichtenbergstrasse 4

85435 Garching

Germany

and

Bavarian Health and Food Safety Authority

Veterinärstrasse 2

85764 Oberschleissheim

Germany

***Rainer Schuhmacher***

University of Natural Resources and Life Sciences, Vienna

---

Center for Analytical Chemistry

Department IFA-Tulln

Konrad-Lorenz-Strasse 20

3430 Tulln

Austria

***Hikaru Seki***

Yokohama City University

Kihara Institute for Biological Research

641-12 Maioka-cho

Totsuka-ku

Yokohama

Kanagawa 244-0813

Japan

and

Osaka University

Department of Biotechnology

2-1 Yamadaoka

Suita-shi

Osaka 565-0871

Japan

***Daisuke Shibata***

Kazusa DNA Research Institute

2-6-7 Kazusa-Kamatari

Kisarazu

Chiba 292-0818

Japan

***Lie-Fen Shyur***

Agricultural Biotechnology Research Center

Academia Sinica

No. 128, Sec. 2, Academia Road

Nankang

Taipei 115

Taiwan

***Maciej Stobiecki***

Institute of Bioorganic Chemistry PAS

Noskowskiego 12/14

Laboratory of Natural Products Biochemistry

61-704 Poznań

Poland

---

***Nadine Strehmel***

Leibniz Institute of Plant Biochemistry, IPB Halle  
Department of Stress and Developmental Biology  
Weinberg 3  
06120 Halle (Saale)  
Germany

***Hiroshi Sudo***

Chiba University  
Graduate School of Pharmaceutical Sciences  
1-33 Yayoi-cho  
Inage-ku  
Chiba 263-8522  
Japan

and

Tokiwa Phytochemical Co., Ltd.  
58 Kinoko  
Sakura  
Chiba 285-0801  
Japan

and

Hoshi University  
School of Pharmacy and Pharmaceutical Sciences  
2-4-41 Ebara  
Shinagawa-ku  
Tokyo 142-8501  
Japan

***Xiaoliang Sun***

University of Vienna  
Department of Molecular Systems Biology  
Althanstrasse 14  
1090 Vienna  
Austria

***Hideyuki Suzuki***

Kazusa DNA Research Institute  
2-6-7 Kazusa-Kamatari  
Kisarazu  
Chiba 292-0818  
Japan



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