

# OC Industrial Synthesis

Dr. Joshua P. Barham

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Room: 23.2.80 Phone: 4373

Course Schedule: 13 Lectures

**\*\*\*Lecture content and schedule may change and is subject to availability of external speakers\*\*\***

## November

### Lecture 1 Introduction, Types of Industry, Sustainable Chemistry

→Purposes, efficiencies and scales of different industries. Principles of Green Chemistry.

05.11.20

### Lecture 2 Dyes, Pigments, Fragrances, Flavors

→Biosynthesis. Extraction vs. Total Synthesis

12.11.20

### Lecture 3 Commodity Chemicals, Fuel & Energy

→Separation, Extraction, Synthesis

19.11.20

### Lecture 4 Crop Protection

→Herbicide discovery process. Basics of drug properties. Comparisons with Pharma.

26.11.20

## December

### Lecture 5 Functional Materials

→ Importance of Organic Synthesis to: Solar cells, Adhesives, Liquid Crystals.

03.12.20

### Lecture 6 Asymmetric Synthesis, Redox, Amidations and Cross Couplings on Scale

→Importance of chirality. Types of industry-relevant moieties.

10.12.20

**Lecture 7      Pharmaceuticals I - Drug Discovery, Opiates**

→Biosynthesis vs. Total Synthesis vs. Semi-Synthesis.

17.12.20

**January**

**Lecture 8      Pharmaceuticals II – Alkaloids, Prostaglandins**

→Biosynthesis vs. Semi-Synthesis.

07.01.21

**Lecture 9      *External Speaker 1: (Prof.) Dr. Robert Young.***

14.01.21

*Medicinal Chemist, GlaxoSmithKline (retired after 35 years).*

*Founder, Blue Burgandy Consulting.*

**Title: TBA**



*Dr. Robert Young joined Wellcome in 1990 (before its merger to Glaxo Wellcome and ultimately GlaxoSmithKline), following BA/DPhil degrees at the University of Oxford and postdoctoral research at the Ben May Institute, University of Chicago. In his 35 years in Drug Discovery at GlaxoSmithKline, he has contributed to a number of antiviral candidates (HIV/HBV/Herpes), assumed leadership roles in numerous hit-to-lead programs using diverse technologies including high-throughput screening, fragments, DNA-encoded libraries. His expertise in physical properties led to the development of the Property Forecast Index (PFI), setting new standards in drug discovery with chromatographic methods. His expertise also spans in silico predictive modelling, DMPK, Physical Chemistry, Stability and Safety. He is listed as author/inventor on >100 publications/patent applications (H-index 26) and is a honorary visiting Professor at the University of St. Andrews.*

**Lecture 10    Process Chemistry**

→How to *and how not to* scale up industrial synthesis. How industry optimizes chemical reactions. Route selection & commercial aspects.

21.01.21

**Lecture 11    Advanced Manufacturing Technologies I**

→Continuous Processing: advantages/limitations and case studies. Automation, Machine Learning in Industry.

28.01.21

**February**

**Lecture 12    Advanced Manufacturing Technologies II**

→Industrial Biocatalysis, Photocatalysis and Electrochemistry. Opportunities, problems and solutions.

04.02.21

**Lecture 13    External Speaker 2: TBA.** Process Chemist. Bayer AG

Title: **TBA**

11.02.21

**Closing Times**

24.12.20 (Christmas Eve)

**Consultation Hours**

Fridays 14:00 - 15:00 (**or** via appointment)

## Learning Objectives

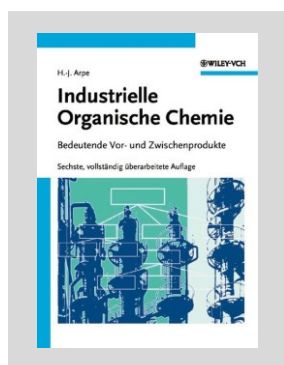
By the end of this course, you should possess the following competencies:

- Knowledge about important industries, industrial compound classes and scales
- Knowledge about particular organic reactions used in industry
- Knowledge about important industrial processes
- Basic knowledge on biosynthetic pathways and medicinal chemistry  
→You should be able to attend a medicinal chemistry lecture and understand what metrics are used to assess the efficacy and selectivity of a bioactive compound
- Basic knowledge on process chemistry and green chemistry  
→You should have an appreciation of the factors driving 'route selection' in industry, the kinds of techniques used/avoided and how reactions are optimized
- Appreciation of advanced manufacturing technologies  
→You will appreciate how advanced chemical and manufacturing technologies are changing the platforms used for industrial synthesis

By the end of this course, the following operational skills will be expected of you:

- Graphical reproduction of key compounds, intermediates and catalytic cycles
- Verbally and graphically rationalizing fundamental aspects of industrial (and bio) synthetic reaction schemes
- Independent recognition of analogies and differences between industrial and lab-scale synthesis
- Independent recognition of analogies and differences between different types of chemical industries

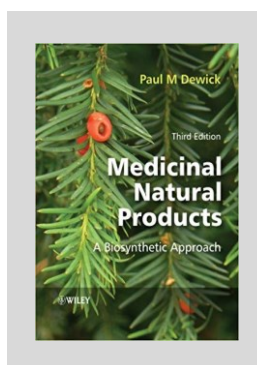
## Useful Reading



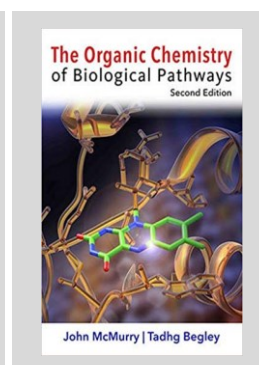
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*(1) Industrial Organic Chemistry: Important Raw Materials and Intermediates*

*H.-J. Arpe, Wiley-VCH 2007 (ISBN-10: 9783527315406) (Deut.)*

*K. Weissermehl, H.-J. Arpe, Wiley-VCH 1997 (ISBN-10: 3527288384) (Engl.)*

*(2) Naturstoffe der chemischen Industrie*

*B. Schäfer, Elsevier 2007 (ISBN-10: 3-8274-1614-0)*

*(3) Medicinal Natural Products – A Biosynthetic Approach*

*P. M. Dewick, John Wiley & Sons Ltd. 2009 (ISBN: 978-0-470-74167-2)*

*(4) The Organic Chemistry of Biological Pathways*

*J. McMurry, T. P. Begley, Roberts and Company 2016 (ISBN: 9781936221561)*

**Related (Free) Drug Discovery & Medicinal Chemistry Course**

<https://www.edx.org/course/med-001>