

Scientific Update | Training Courses 2010



# Chemical Development & Scale-Up in the Fine Chemical & Pharmaceutical Industries

Principles and Practice



10 - 12 May 2010  
The Avenue Hotel  
Chicago, IL, USA

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# Chemical Development & Scale-Up in the Fine Chemical & Pharmaceutical Industries Principles and Practice

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## Course Objectives

To train R&D chemists and engineers in the most efficient methods for developing cheap, robust processes for the manufacture of fine organic chemicals in the minimum amount of time.

To educate chemists in the principles of scale-up and development, in basic engineering concepts and in techniques for the optimisation of processes.

To teach chemists to learn from the experience (and mistakes) of others by examining case studies from industry.

## Fee

£1225.00 including lunch & refreshments, course dinner and course manual.

## Course Introduction

Chemical process development is generally not taught as part of degree courses in higher education; the conversion of a synthetic route used for making milligram or gram quantities of a chemical into a process for manufacturing multi-kilogram and tonne quantities is typically learnt "on the job" by chemists in industry. For many years, little chemical development work was published in the literature, until the establishment of the Organic Process R & D journal by Dr Trevor Laird (Founder of Scientific Update). Even now, "tricks of the trade" are handed down within individual company organisations, and it can be difficult to gain an awareness of what is involved in chemical development, and of the skills and techniques required to efficiently scale-up chemical processes.

This three-day course, written and presented by highly experienced process chemists from the pharmaceutical and fine chemical industries, provides a comprehensive overview of this fascinating and important element of the chemical industry. A logical investigative approach to all aspects of chemical development is described, with an abundance of case studies from literature, conferences and private communications. The multi-disciplinary nature of chemical development is emphasised, from the initial interaction with laboratory research scientists to the vital partnership with chemical engineers in the pilot plant and in the production environment. The lectures are interspersed with interactive problem sessions, enabling participants to share in the problem solving and troubleshooting typically experienced during chemical development.

## Course Outline

### Introduction

- The purpose of chemical development

### Synthetic Route Discovery

- Route design
- Selecting the best route for scale-up
- Choice of raw materials, reagents etc

### Costing of Chemical Processes

- Raw materials
- Overheads
- Context

### The Investigative Approach to Chemical Development

- Optimising Chemical Reactions
- Making processes robust
- Minimising scale-up difficulties

### Solvent Effects

- Often overlooked
- Key to making a modest process a great process

### Statistical Methods of Optimisation

- Vital, but under-utilised
- Design of Experiments
- Simplex
- Factorial design

### Analytical Issues

- In Process Control
- Quality Control and Specification Setting
- Regulatory Guidelines
- GMP, Validation
- Use of analysis to aid process optimisation

### Work Up

- Product isolation

### Planning for Scale-Up

- Key points to consider

### Appreciation of Chemical Engineering Principles

- Mass Transfer
- Mixing
- Heat Transfer
- Kinetics

### Crystallisation and Polymorphism

- Particle size control
- Polymorph control
- Methods of analysis

### Chemical Development of Enantiomerically Pure Compounds

- Resolution
- Chemocatalysis
- Biocatalysis
- Crystallisation-induced asymmetric transformations

### Thermal Hazard Testing and Runaway Reactions

- Essential process safety considerations
- Equipment and screening approaches

### Effluent Minimisation and Control

- Environmental considerations
- Cost considerations
- Green chemistry

“*Very good and large selection of examples - excellent!*”  
DSM

## Tutors



**Will Watson** gained his PhD in Organic Chemistry from the University of Leeds in 1980. He joined the BP Research Centre at Sunbury-on-Thames and spent five and a half years working as a research chemist on a variety of topics including catalytic dewaxing, residue upgrading, synthesis of novel oxygenates for use as gasoline supplements, surfactants for use as gasoline detergent additives and non-linear optical compounds. In 1986 he joined Lancaster Synthesis and during the next 7 years he was responsible for laboratory scale production and process research and development to support Lancaster's catalogue, semi-bulk and custom synthesis businesses. In 1993 he was appointed to the position of Technical Director, responsible for all Production (Laboratory and Pilot Plant scale), Process Research and Development, Engineering and Quality Control. He helped set up and run the Lancaster Laboratories near Chennai, India and had technical responsibility for the former PCR laboratories at Gainesville, Florida. He joined Scientific Update as Technical Director in May 2000. He is also involved in an advisory capacity in setting up conferences and in the running of the events. He is active in the consultancy side of the business and sits on the Scientific Advisory Boards of various companies. He can be contacted by email at: [will@scientificupdate.co.uk](mailto:will@scientificupdate.co.uk)



**Derek Robinson** gained his PhD in Physical Organic Chemistry from the University of St. Andrews in 1981. After completing two years post doctoral research at the University of Strathclyde, he joined the Pharmaceutical Research and Development group at Parke-Davis/Warner Lambert. During the next eleven years he was responsible for the development and optimisation of synthetic routes to novel drug candidates, organising the scale-up to pilot plant and transfer to production facilities. He was manager of synthetic chemistry laboratories at Pontypool, Wales and Freiburg, Germany. Since 1995 he has been an associate lecturer at Scientific Update. Derek has developed courses on Good Manufacturing Practices (GMP), Basic Organic Chemistry for Chemical Engineers and Statistical Experimental Design for Chemists. He also tutors the Chemical Development in the Fine Chemical and Pharmaceutical Industries course. He has also worked with fine chemical companies to help develop documentation procedures and GMP training courses. He can be contacted by email on [derek@kolvox.net](mailto:derek@kolvox.net)

## Venue



**The Avenue Hotel**  
160 East Huron Street, Chicago, Illinois 60611, USA  
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[www.avenuehotelchicago.com](http://www.avenuehotelchicago.com)

The Avenue Hotel is located in the heart of Chicago and approximately 17 miles from O'Hare International Airport. A limited number of rooms have been reserved at the hotel for the special rate of \$149 per night for a single/double occupancy room – plus local taxes. Please note there is a cut-off date of Friday April 9 2010 for these rates. These rates are room only.

Reservations are to be made by yourself, directly with the hotel. Full details of how to book a hotel room will be sent when you register.

## General Information

The course begins with registration at 8.30 am on Monday 10 May and finishes at approximately 3pm on Wednesday 12 May. There is a course dinner for all attendees on Monday 10 May.

The organisers reserve the right to change the published programme of events and course content as circumstances dictate.

## Who Should Attend?

**Young Chemists** who have just started work in industry as development chemists.

**Organic Chemists/Medicinal Chemists** in Research and Development who would like to gain an appreciation of development and scale-up and who are perhaps contemplating moving into chemical development.

**Development and Production Chemists** in industry who would like to improve their efficiency and gain an insight into alternative approaches to chemical development.

**Chemical Engineers** who wish to understand a chemist's approach to chemical development of batch processes. (Engineers would, however, need a good grounding in organic chemistry.)

**Students** who are about to enter the industry and can obtain company sponsorship.

**Experienced Chemists** looking to refresh and/or augment their knowledge of chemical development.

**Analytical Chemists** who wish to gain a broader appreciation of process chemistry.

**Managers** who might benefit from a comprehensive and up to date overview of chemical development.

## At the end of the Course, participants will have gained

A logical investigative approach to chemical development and optimisation

An insight into the factors involved in scale-up

An appreciation of chemical engineering concepts, particularly mixing, heat transfer and process control

A preliminary knowledge of statistical methods of optimisation

Improved ability to decide which parts of the chemical process to examine in detail

Ideas for efficient resource allocation

Improved troubleshooting and problem solving ability

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