The BioUpdate Foundation was established in the Netherlands in 1992 for the promotion of post-experience education and training in aspects of life sciences including biotechnology. The Foundation has achieved a reputation throughout Europe for consistently high standards, mainly by engaging tutors with extensive experience.

**Protein Drugs: Stability and Aggregation**

This course will be held on 16th and 17th November 2015 in Amersfoort, Netherlands.

**Introduction**

Proteins are important biotechnology commodities, whether as drugs, diagnostics, biosensors or food and detergent additives. All of these applications require proteins to be stable and to retain their inherent activities. These requirements are more stringent for the proteins used as drugs because they must retain activity and also generate no side effects after administration. For all these reasons it is essential to maximise stability and to minimise aggregation of protein drugs, during production and storage, as well as after injection. This course will aim to provide an understanding of protein stability and aggregation, and to describe current methods which may be used to monitor these properties. Case studies will be described in order to illustrate problems which may be encountered with protein drugs, and how they have been resolved. The relevance of lessons from protein evolution and from the adaptive strategies adopted in extremophiles will be presented. Recent progress to ensure the correct formulation of proteins is dramatically improving the success rate of taking proteins to market. Regulatory aspects and concerns will be covered.

**Who should attend?**

The course is designed primarily for industrial and academic scientists engaged in the use of proteins as therapeutics, particularly those issues concerning stability and aggregation which arise during production, purification, characterisation, development (including pharmacokinetic optimisation), storage and quality control. The course is also relevant for professionals involved in the licensing and regulation of protein drugs.
Programme

Proteins as drugs - challenges of instability and aggregation. Complexities of protein structure and chemistry pose substantial challenges for their use as drugs. Examples from the pharma industry will be used to illustrate problems of instability and aggregation. The importance of formulation is an underlying theme.

Understanding protein stability and aggregation. Proteins are dynamic and exist in a broad range of conformations of varying flexibility. Greater flexibility is associated with greater instability. The chemical and physical properties of proteins are fundamental to their stability and tendency to form inactive aggregates.

Methods to monitor protein conformation and aggregation. Recent advances in light-scattering, spectroscopic and microscopic technologies have enhanced the range of convenient methods to monitor proteins in solution.

Examples of problems encountered with protein drugs. Protein drugs such as human calcitonin, antibodies, Xolair and Herceptin will be used to illustrate difficulties associated with protein aggregation.

Formulation strategies to prevent protein aggregation. High-throughput formulation and analysis are used to analyse and develop new formulations to prevent protein aggregation. Examples include human calcitonin, Hirudin, monoclonal antibodies and growth factors.

Strategies to reduce flexibility of commercially relevant proteins. The flexibility of protein pharmaceuticals and other commercial proteins may be reduced to enhance stability and minimise aggregation. Two main types of strategy are used: those that change the proteins themselves and those that change the environment of the proteins.

Aggregation of biopharmaceuticals in human plasma. Intravenous administration of protein drugs such as hormones or monoclonal antibodies may lead to their aggregation in the plasma environment. Case studies will be presented to demonstrate how these problems may be avoided by suitable formulation.

Lessons from extremophiles and directed evolution. Detailed study of enzymes and other proteins from organisms that thrive under extreme conditions have suggested ways in which proteins have evolved to possess enhanced stability. The combination of the ‘rules’ learned from extremozymes with directed evolution may prove to be a rewarding approach for the production of enzymes and other proteins for particular commercial applications.

Regulatory aspects and concerns. The licensing of new protein drugs has stalled, due in no small part to problems of stability and aggregation. Case studies will be used to illustrate the ways in which correct formulation may resolve these problems.

The course tutors are Linda Fothergill-Gilmore (ISMB, University of Edinburgh, UK) and Tudor Arvinte (CEO Therapeomic Inc, Basel, and University of Geneva, Switzerland).
The course will be held at the Regardz Berghotel in Amersfoort, the Netherlands which is 45 minutes by train from Schiphol airport.

The course will be limited to 25 participants. The all-inclusive course fee is 1250 Euros, and includes course manual, hotel room, breakfast, lunches, and course dinner.

Registration: You can register and pay on-line at http://www.bioup.com/courses.php. Alternatively please complete the form below and return it to the BioUpdate Foundation by email (schram@bioup.com) or by post to BioUpdate Foundation, Brinklaan 76A3, 404 GL Bussum, Netherlands.

For details and registration: www.bioup.com
or contact André W. Schram at: schram@bioup.com

REGISTRATION CLOSES 3rd NOVEMBER, 2015

Please Note: The course fee includes accommodation for the night of November 16th only. Reservations for additional nights before or after the course should be made with the hotel directly (see http://berghotel-amersfoort.h-rez.com/contact.htm).
# Registration Form

**Protein Drugs: Stability and Aggregation**  
Amersfoort, Netherlands  
November 16th and 17th, 2015

**Course Fee €1250**

## BIOUPDATE FOUNDATION COURSE REGISTRATION

### DELEGATE DETAILS

<table>
<thead>
<tr>
<th>Family name</th>
<th>Forename</th>
<th>Title</th>
<th>E-mail</th>
<th>Telephone</th>
<th>Job Title</th>
</tr>
</thead>
</table>

### COMPANY DETAILS

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address line 1</th>
<th>Address line 2</th>
<th>City</th>
<th>Postcode</th>
<th>Country</th>
</tr>
</thead>
</table>

**BOOKING CONTACT DETAILS if different to delegate details**

<table>
<thead>
<tr>
<th>Family name</th>
<th>Forename</th>
<th>Title</th>
<th>E-mail</th>
<th>Telephone</th>
</tr>
</thead>
</table>

---

**Terms & Conditions**

Course fees must be paid in advance to secure your place. The fee includes lunch and dinner on November 16th, lunch on November 17th, and hotel room and breakfast November 16th, 2015.

Cancellations Notice of cancellation must be given in writing. Cancellations within 30 days of the course start date will be refunded at 50% of the fee. No refunds for cancellation within 10 days of the start date.

Confirmation You will receive confirmation of your booking. If you do not, please contact schram@bioup.com.

---

**Payment Information:** Payment to be made by cheque or direct bank transfer.

<table>
<thead>
<tr>
<th>Payment by cheque</th>
<th>Payment by bank transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payable to: The BioUpdate Foundation</td>
<td>Bank: ABN-AMRO</td>
</tr>
<tr>
<td>Address: Brinklaan 76A3, 1404 GL Bussum, Netherlands.</td>
<td>Account: The BioUpdate Foundation</td>
</tr>
<tr>
<td>Please quote delegate name/PD2015</td>
<td>Acc Number: 554079968</td>
</tr>
</tbody>
</table>

**Invoice required? Yes/No**

---

Data Protection. The personal information given on this form will be held on a database. The BioUpdate Foundation will not share this information with any third party other than to book hotel rooms and as required to do so by law.