



# 6<sup>th</sup> Workshop on the Characterization of Heparin Products

Symposium Organized by The United States Pharmacopeial Convention (USP) and the  
National Institute for Biological Standards and Control UK (NIBSC)

August 6-7, 2015 • Sheraton WTC Hotel • São Paulo, Brazil

## ~ Preliminary Agenda ~

(As of July 30, 2015 / Subject to Change)

### Day One: Thursday, August 6, 2015

7:30–8:30 a.m. Registration and Networking Exhibition

**8:30–8:40 a.m. Welcome**

*Wesley Workman, Ph.D., Chair, USP Bovine Unfractionated Heparin Expert Panel*  
*Mr. Marcus Aurélio Miranda de Araújo, Advisor, Executive Office, ANVISA*

8:40–9:10 a.m.

**Keynote Address**

**Heparin Contamination Crisis & Lessons Learned**

*Robert Linhardt, Ph.D., Rensselaer Polytechnic Institute*

9:10–10:30 a.m.

**Session 1: UFH Pharmacopoeial Monograph Updates (20 min talks)**

*Session chairs: Wesley Workman, Ph.D., Chair, USP Bovine Unfractionated Heparin Expert Panel and Monica da Luz Carvalho Soares, Ph.D., ANVISA*

- **USP Heparin Monograph Revision Summary since 2008 and Future Monograph Development Strategy (9:10-9:30)**  
*Anita Szajek, Ph.D., Principal Scientific Liaison, USP*
- **Brazilian Pharmacopoeia: Challenges to Manage the Co-existence of Porcine and Bovine Heparins in Brazil (9:30-9:50)**  
*Prof. Paulo Mourão, Ph.D. Federal University of Rio de Janeiro*
- **Argentine Pharmacopoeia: Heparins in the Argentine Pharmacopoeia (9:50-10:10)**  
*Dr. Héctor Giuliani, Argentine Pharmacopoeia, ANMAT*

Questions and Answers (20 min, 10:10-10:30)

10:30–11:00 a.m. Morning Break and Networking Exhibition

11:00 a.m.–12:30 p.m. **Session 2: Bovine Unfractionated Heparin—API Sourcing, Production**

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*Session Chair: Kristian Johansen, Ph.D., Member, USP Low Molecular Weight Heparins Expert Panel and Bovine Unfractionated Heparin Expert Panel*

- **Reintroduction of Bovine Heparin in U.S. Market (11:00-11:20)**  
*Ali Al-Hakim, Ph.D., Acting Director of Division of New Drugs API, U.S. Food and Drug Administration (FDA), Center for Drug Evaluation and Research (CDER); U.S. Government Liaison to USP Low Molecular Weight Heparins Expert Panel and Bovine Unfractionated Heparin Expert Panel*
- **Heparin Supply Situation in Latin America and Bovine Heparin Manufacturing Process (11:20-11:40)**  
*Fabian Magalhaes, B.S., MBA., Extrasul*
- **Bovine Heparin Production and Characterization (11:40-12:00)**  
*C.S. Venkatesan, Ph.D., Gland Pharma*

Questions and Answers (30 min, 12:00-12:30)

**12:30–1:30 p.m.** Independent Lunch

**1:30–3:00 p.m.** **Session 3: Bovine Unfractionated Heparin—Safety Considerations**  
*Session chair: David Keire, Ph.D., Acting Laboratory Chief, Branch I, Division of Pharmaceutical Analysis, OTR/OPQ/CDER, U.S. FDA; U.S. Government Liaison to the USP Bovine Unfractionated Heparin Expert Panel*

- **BSE Mitigation Strategies (1:30-1:50)**  
*Luisa Gregori, Ph.D., U.S. FDA, Center for Biologics Evaluation and Research (CBER)*
- **Laboratory Approaches to Evaluate the Propensity of Bovine Heparins for Heparin Induced Thrombocytopenia (1:50-2:10)**  
*Raj S. Kasthuri, Ph.D., University of North Carolina*
- **Protamine sulfate neutralization of porcine and bovine heparins (2:10-2:30)**  
*John Hogwood, NIBSC*

Questions and Answers (30 min, 2:30-3:00)

**3:00–3:30 p.m.** Afternoon Break & Networking Exhibition

**3:30–5:30 p.m.** **Session 4: Bovine Unfractionated Heparin—Analytical Considerations, Part I**  
*Session chairs: Barbara Mulloy, Ph.D., Institute of Pharmaceutical Science, Kings College London; Member, Member, USP Low Molecular Weight Heparins Expert Panel and Bovine Unfractionated Heparin Expert Panel and John Hogwood, NIBSC*

- **Characterization of NIBSC bovine lung, bovine mucosal and whale API heparin sodium standards (3:30-3:50)**  
*David Keire, Ph.D., FDA*
- **Comparative NMR Spectroscopy Study of Porcine and Bovine Heparins (3:50-4:00)**  
*Barbara Mulloy, Ph.D., Institute of Pharmaceutical Science King's College London*
- **NMR and Multivariate Analysis for Structural Characterization of Crude Heparins (4:00-4:20)**  
*Marco Guerrini, Ph.D., Ronzoni*

- **Structural Comparison of Bovine Lung, Bovine Intestinal Mucosa and Porcine Intestinal Mucosa Heparins (4:20-4:40)**

*Pierre Mourier, Ph.D., Sanofi*

- **Differences between Bovine and Porcine Unfractionated Heparins: Structure and Activity (4:40-5:00)**

*Maria Leticia Bertot, Ph.D., Syntex*

Questions and Answers (30 min, 5:00-5:30)

**5:30–6:30 p.m.**

Networking Reception & Exhibition

## Day Two: Friday, August 7, 2015

**8:00–8:30 a.m.**

Registration and Networking Exhibition

**8:30–10:15 a.m.**

**Session 5: Bovine Heparin—Analytical & Potency Considerations, Part II**

*Session chairs: Elaine Gray, Ph.D., Principal Scientist, NIBSC; Co-Chair, USP Low Molecular Weight Heparins Expert Panel and Bovine Unfractionated Heparin Expert Panel and Prof. Paulo Mourão, Ph.D., Federal University of Rio de Janeiro*

- **Structural peculiarity and antithrombin binding region profile of mucosal bovine and porcine heparins (8:30-8:50)**  
*Annamaria Naggi, Ph.D., Ronzoni*
- **Comparative study on biological activities and molecular weight profiles of Porcine and Bovine Heparins (8:50-9:10)**  
*Elaine Gray, Ph.D. NIBSC*
- **Updating the Comparison between Bovine Lung and Porcine Mucosal Heparins (9:10-9:30)**  
*Carlos Aláez, Ph.D., Bioiberica*
- **Impact of Molecular Size and Disaccharide Composition on the Anticoagulant Activity of Unfractionated Heparin (9:30-9:50)**  
*Ana M.F. Tovar, Ph.D., Universidade Federal do Rio de Janeiro*

Questions and Answers (30 min, 9:50-10:20)

**10:20–10:50 a.m.**

Morning Break & Networking Exhibition

**10:50 a.m.–12:20 p.m. Session 6: LMWHs and Synthetic Analogs**

*Session chair: Zachary Shriver, Ph.D., Professor of Bioengineering, Massachusetts Institute of Technology (MIT); Member, USP Low Molecular Weight Heparins Expert Panel and Bovine Unfractionated Heparin Expert Panel*

- **Scientific Considerations in the Approval of Generic LMWHs in the United States (10:50-11:10)**  
*Andre Raw, Ph.D., Acting Senior Scientific and Policy Advisor, U.S. Food and Drug Administration (FDA), Center for Drug Evaluation and Research (CDER); Government Liaison to USP Bovine Unfractionated Heparin Expert Panel*
- **Structural and functional analyses of biosimilar enoxaparins available in**

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**Brazil (11:10-11:30)**

*Bianca F. Glauser, Ph.D., Federal University of Rio de Janeiro*

- **Novel Structural Characterization Methods for Dalteparin Sodium and Other Low Molecular Weight Heparins (11:30-11:50)**

*Lianli Chi, Ph.D., Shangdong University*

Questions and Answers (30 min, 11:50-12:20)

**12:20–1:30 p.m.**

Independent Lunch

**1:30–3:20 p.m.**

**Session 7: Regulatory and Dossier Requirements for UFH and LMWHs**

*Session chairs: Ali Al-Hakim, Ph.D., Acting Director of Division of New Drugs API, U.S. FDA, CDER; U.S. Government Liaison to USP Low Molecular Weight Heparins Expert Panel and Bovine Unfractionated Heparin Expert Panel and Anita Szajek, Ph.D., USP*

- **ANMAT: New Regulatory Requirements for the Registration of Heparin and LMWH in Argentina (1:30-1:55)**

*Lic. Liliana Oliva, Biological Products Department, INAME-ANMAT*

- **Regulatory Overview of Unfractionated Heparin and LMWH in Brazil (1:55-2:20)**

*Bernardo Luis Moraes Moreira, Ph.D., ANVISA*

- **U.S. FDA CMC Perspectives for Heparin Applications: Drug Substance and Drug Product (2:20-2:50)**

*Ali Al-Hakim, Ph.D., FDA*

Questions and Answers (30 min, 2:50-3:20)

**3:20 p.m.**

**Rapporteur Round-up & Closing Remarks**

*Wesley Workman, Ph.D., Chair, USP Bovine Unfractionated Heparin Expert Panel*

**3:40 p.m.**

**Meeting Adjourns**