DR. ENG. ROBERTO BRUTTINI, Ph.D.

CURRICULUM STUDIORUM
AFTER Ph.D. DISSERTATION OF MAY, 1994

After the Ph.D. in Chemical Engineering Dr. Bruttini continue his research work in Criofarma, Freeze-Drying Equipment, as Director of R&D Department. At the beginning, he improve the control design of the Equipment as well as he designs equipment able to be sterilized with pressure steam at 121 °C according to European regulation and to ASME Boiler and Pressure Vessel Code.
He has been invited to give Lectures at Politecnico of Turin in an advanced graduate course of Principles of Chemical Engineering in 1995.

In January 1996 he did Consulting work for Autonome Provinz Bozen-Sudtirol on the possibility of a new conservation technique of the Archaeological find named "The Iceman" or "The Man of Similaun" able to allow the exposure of the mummy to the people of the Museum.

In June 1996 he became member of the international scientific committee for the study of the new conservation techniques of the Iceman with Dr. Platzer and Dr.Gaber (Vorstand des Institutes fur Anatomie der Universitat Innsbruk, Austria), Dr. Eduard Vigl Egarter and Dr. Capasso (Anatomie Institute of Bozen, Italy), Dr. N:Oswald (Sektion Forschung und Entwicklung des Schweizerischen Landesmuseums Zurich, Switzerland) until January 16, 1998 when the Iceman has been successfully espoused in the Museum.

In 1997 he has been invited by Marcel Dekker to be Editor of the **Handbook of Pharmaceutical Drying Technology** and he also write the chapter **Freeze-Drying, Pharmaceuticals** for the Encyclopedia of Bioprocess and Biotechnology, John Wiley and Sons.

In September 1998 he has been accepted as a new Member of the Advisory Panel of the International Drying Symposia (IDS) and he became permanent member of the International scientific committee for the study of the Iceman.

He is Member of the American Society of Mechanical Engineer (ASME) since 1999.

In 2000, he won the BEST DISTINGUISHED YOUNG ALUMNUS AWARD of University Missouri Rolla, USA.

From 1994 till now he presented scientific paper at international meeting and he publish scientific paper as indicated in the enclosed list.

His continuous R&D work in Criofarma till now allow his company to gain the benefit to double the worldwide sales at the end the last two consecutive years.

DR. BRUTTINI RESEARCH AND DEVELOPMENT
INTERNATIONAL WORK

Scientific Publications:

R. Bruttini and A. I. Liapis
"Fundamentals of modeling and analysis of spray freeze drying: the drying of frozen pharmaceutical and food particles in packed beds", "IDS 2010", pp 71-80, Magdeburg, Germany.

R. Bruttini and A. I. Lapis, 2009 - **"A mathematical model for the Spray Freeze Drying Process: The Drying of Spray – Frozen Particles in Trays and in Vials on Trays"**, International Journal of Heat and Mass Transfer, Elsevier Ed., pp 100-111

R. Bruttini and A. I. Lapis, 2008 - **"Exergy Analysis of freeze drying of pharmaceuticals in vials on trays"**, International Journal of Heat and Mass Transfer, Elsevier Ed., pp 3854-3868

R. Bruttini and A. I. Lapis, 2007 - **"Freeze drying"**, in A. S. Mujundar (Ed). "Handbook of Industrial Drying" - Third. Ed. CRC Press., New York and Basel, pp. 257-283.

R. Bruttini , G. N. Panagopoulos, and A. I. Liapis
"A molecular dynamics modeling and simulation study on determining the molecular mechanism by which formulations based on trehalose could stabilize biomolecules during freeze drying", "IDS 2006", Budapest, Hungary.

Bruttini R., A.I.Liapis, O. K. Crosser, K.H. Gan, 2005 - "**Lyophilization in vials on trays: effects of trays side**" - Drying Technology, Vol. 23, No. 7, pp 341-363

Bruttini R., A.I.Liapis, O. K. Crosser, K.H. Gan, 2005 - "**Freeze Drying of Pharmaceuticals in vials on trays: effects of drying chamber wall temperature and tray side on lyophilization performance**" – International Journal of Heat and Mass Transfer, pp 1675-1687

Bruttini R., A.I.Liapis, O. K. Crosser, K.H. Gan, 2004 - "**Heating Policies during the primary and secondary drying stages of the lyophilization process in vials: effects of the arrangement of vials in clusters of square and hexagonal arrays on trays**" – Drying Technology, Vol. 22, No. 7, pp 1539-1575

Bruttini R. and Samadelli M., 2004 - "**The effects of energy sources on the Iceman's low temperature storage conditions in the South Tyrol Museum of Archaeology**" – V WORLD CONGRESS ON MUMMY STUDIES, 2004, Turin, Italy

Bruttini R. and Samadelli M., 2004 - "**Conservation condition of the mummy of Similaun in the museum: influence and limitation of the energy sources at low temperature storage condition able to avoid long term atmospheric freeze drying process of the iceman**" – IDS 2004, San Paulo, Brazil

Bruttini R., A.I.Liapis, O. K. Crosser, K.H. Gan, 2004 - "**The effects of tray side and drying chamber wall temperature on the performance of freeze drying in vials arranged in clusters of square and hexagonal arrays on trays for different heat input control policies**" – International Meeting on Pharmaceuticals, Biopharmaceutics and Pharmaceutical Technology 2004 and EFCE Working Party on Drying, Nuremberg, Germany

Bruttini R. and A.I. Liapis, "**Lyophilization of Skim Milk in a Container of Cylindrical Geometry"**, - IDS 2002 Beijing, P.R. China.

Bruttini R., A.I.Liapis, O. K. Crosser, 2001 - "**Exergy Analysis for the freezing stage of the freeze drying process**" - Drying Technology, pp 2303-2313

Bruttini R. and A.I. Lapis, 2000 "**Optimal Control Of The Primary And Secondary Drying Stages Of The Freeze Drying Of Pharmaceuticals In Vials"** - Drying 2000

Bruttini R. and H. Sadikoglu, A.I.Liapis, O. K. Crosser, 1999 - "**Estimation of the Effect of Product Shrinkage on the Drying Times, Heat Input and Condenser Load of the Primary and Secondary Drying Stages of the Lyophilization Process in Vials**" - Drying Technology, pp 2013-2035

Bruttini R. , 1999 - "**Freeze-Drying Pharmaceuticals**" - Encyclopedia of Bioprocess Technology: Fermentation, Biocatalysis and Bioseparation, Ed. John Wiley & Sons Inc. New York, pp 1276-1289

Bruttini R. , 1998 - "**Dinamic Multi-Dimensional Models of the Atmospheric Freeze-Drying Process that can occur during the low Temperature Archaeological find storage in the Museum: a Study on the Conservation Conditions of the Man of Similaun**", Drying 1998, vol. C pp. C1849 - C1857

Liapis A.I. and Bruttini R. , 1997 - "**Mathematical models for the primary and secondary drying stages of the freeze-drying of pharmaceuticals on trays and in vials**" in the Book "Mathematical Modelling in the drying processes" - A.S. Mujumdar and A. Turner Ed., Marcel Dekker, Inc., New York

Liapis A.I. Pikal M. J. and Bruttini R. , 1996 **- "Research and Development needs and Opportunities in Freeze-Drying**,"- Drying Technology, Vol 14, Issue N. 6.

Liapis A.I. and Bruttini R. , 1995 - "**Freeze-Drying**", in A. S. Mujundar (Ed). "Handbook of Industrial Drying" - Sec. Ed., Marcel Dekker Inc., New York and Basel, pp. 309-343.

Liapis A.I. and Bruttini R. , 1995 - "**Freeze-Drying of Pharmaceutical Crystalline and Amorphous Solutes in Vials: Dynamic multidimensional models of the Primary and Secondary Drying Stages and Qualitative Features of the moving Interfase**." - Drying Technology, 13, pp. 43-72

Liapis A.I. and Bruttini R. , 1994 - "**A Theory for the Primary and Secondary Drying Stages of the Freeze-Drying of Pharmaceutical Crystalline and Amorphous Solutes: Comparison between Experimental Data and Theory**" - Separation Technology, 4, pp.144-155.

Bruttini R. , 1994 - "**Analytical Modelling and Experimental Studies of the Primary and Secondary Drying Stages of the Freeze-Drying of Pharmaceutical**

Crystalline and Amorphous Solutes" - Ph. D. Dissertation, University of Missouri-Rolla, U.S.A.

Bruttini R., 1991 - "**Experimentation and modelling of pharmaceutical lyophilization using a pilot plant**." - The Chem. Eng. J. 45, B67 - B77.

INTERNATIONAL MEETING PRESENTATIONS:

"IDS 2010" - Bruttini R. , Session Chairman of Drying of pharmaceuticals and biomaterials, - Magdeburg, Germany.

"IDS 2010" – R. Bruttini and A. I. Liapis
"Fundamentals of modeling and analysis of spray freeze drying: the drying of frozen pharmaceutical and food particles in packed beds", "IDS 2010", Magdeburg, Germany.

"Liofilizzazione: Principi, Tecnologia e Applicazione", 2009, course organized by Pharma Education Center, Milan, Italy

"IDS 2006" – R. Bruttini , G. N. Panagopoulos, and A. I. Liapis
"A molecular dynamics modeling and simulation study on determining the molecular mechanism by which formulations based on trehalose could stabilize biomolecules during freeze drying", Budapest, Hungary.

"V WORLD CONGRESS ON MUMMY STUDIES", 2004 - Bruttini R. and Samadelli M., 2004 - "The effects of energy sources on the Iceman's low temperature storage conditions in the South Tyrol Museum of Archaeology", Turin, Italy.

"IDS 2004" - Bruttini R. and Samadelli M., - "Conservation condition of the mummy of Similaun in the museum: influence and limitation of the energy sources at low temperature storage condition able to avoid long term atmospheric freeze drying process of the iceman" , San Paulo, Brazil.

"IDS 2004" - Bruttini R. – Session Chairman on "Industrial Processes and Equipment", San Paulo, Brazil.

"International Meeting on Pharmaceuticals, Biopharmaceutics and Pharmaceutical Technology 2004 and EFCE Working Party on Drying", - Bruttini R., A.I.Liapis, O. K. Crosser, K.H. Gan, - **"**The effects of tray side and drying chamber wall temperature on the performance of freeze drying in vials arranged in clusters of square and hexagonal arrays on trays for different heat input control policies**",** Nuremberg, Germany

"Course on Freeze Drying and GMP for the Pharmaceutical Industry", 2004, AFI (Associazione Farmaceutica Industrie), Milan, Italy

"IDS 2002" 2002 - Bruttini R. , Session Chairman on Freeze Drying, - Beijing, P.R. China.

"IDS 2002" 2002 - Bruttini R. and A.I. Liapis, "Lyophilization of Skim Milk in a Container of Cylindrical Geometry", - Beijing, P.R. China.

"IDS 2000" 2000 - Bruttini R. and A.I. Liapis, "Optimal Control Of The Primary And Secondary Drying Stages Of The Freeze Drying Of Pharmaceuticals In Vials", - Noordwijkerhout, The Netherlands.

"IDS '2000" 2000 - Bruttini R. Session Chairman, "Industrial Processes & Equipment", Noordwijkerhout, The Netherlands.

"**Best Distinguished Young Alumnus Award"** 2000 - MSM-URM ALUMNI Association University of Missouri Rolla, USA

"Freeze-Drying of Pharmaceuticals and Biologicals", 1998 - A.I. Liapis and Bruttini R. "Scale-up Considerations: Manometric Temperature Measurement and Design of a Scaleable Laboratory Dryer", Vermont, U.S.A.

"IDS '98" 1998 - Bruttini R. , "Dynamic Multi-Dimensional Models of the Atmospheric Freeze-Drying Process that can occur during the low temperature Archaeological find storage in the Museum: a Study on the Conservation Conditions of the man of Similaun", Thessaloniki - Halkidiki, Greece

"IDS '96" 1998 - Bruttini R. Session Co-Chairman , "Miscellaneous Drying Process", Thessaloniki - Halkidiki, Greece 1998

"IDS '96" 1996 - Bruttini R. Session Chairman, "Drying of Pharmaceuticals and Biomaterial", Kracow, Poland.

"IDS '96" 1996 - Bruttini R. , "Development of Validation Protocol for Freeze-Drying Process and Equipments from advanced theoretical model, Kracow, Poland.

"Pharmaceutical Science and Technology" 1995 - Bruttini R. "Analytical, Modelling, and Experimental Studies of the Primary and Secondary Drying Stages of the Freeze-Drying of Pharmaceutical and Foods", Chicago, Illinois, U.S.A.

"Food Science and Technology" 1995 - Bruttini R. , "Analytical, Modelling, and Experimental Studies of the Primary and Secondary Drying Stages of the Freeze-Drying of Pharmaceutical and Foods", Chicago, Illinois, U.S.A.

"IDS '92" 1992 - Bruttini R. "The Modelling of the Primary and secondary drying stages of pharmaceutical lyophilization: theoretical calculations and comparisons with experimental data" - Montreal, CANADA

"C.I.E.C. 3" 1991 - Bruttini R. "Lyophilization experiences on sol and gel alumina-zirconia-yttria suspensions", Lion, FRANCE