Application seminars

Health and multiphase systems

28-29-30 January, 2026

Centre SPIN
Mines Saint-Etienne

MULTIPHASE MASTER
Erasmus Mundus

Wednesday 28.01.2026	10:00 am G1.04	Jean-Marie Lenoir VirexpR	Bioaerosols in confined spaces
Wednesday 28.01.2026	1:30 pm G4.05	Régis Andreux Sanofi	Health & Multiphase – Modelling pharma processes (Media & Solution, Vaccines, Injectables, Synthetics)
Thursday 29.01.2026	2:00 pm G1.05	Cendrine Gatumel Mines Albi	Are mathematics and physics hidden in your pills?
Friday 30.01.2026	10:00 am G1.05	Georg Dietze Laboratoire FAST	Mucus films in the pulmonary airways. A hydrodynamic modelling approach
Friday 30.01.2026	1:30 pm Teams	Anne-Virginie Salsac Laoratoire BMBI, UTC	Biological Fluid Structure Interactions

Bioaerosols in confined spaces

About the presentation

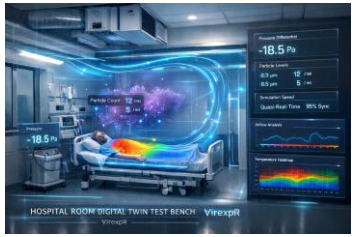
A presentation of the activities of VirexpR, a company specializing in the control of microbiological contamination in confined environments, will be given.

The use of CFD simulation tools on a case study will be demonstrated.

Finally, an outlook on the development of a digital twin will conclude the presentation.

About the speaker

Dr. J.-M. Lenoir
VirexpR



Jean-Michel Lenoir is a PhD in fluid mechanics and heads the fluid mechanics department at VirexpR https://virexpr.fr/

After completing his PhD thesis on homogeneous and isotropic turbulence, he conducted postdoctoral research under an ANR contract with a company in the transportation sector. He then worked for engineering consulting firms. These academic and industrial professional experiences in the field of fluid mechanics enabled him to develop protocols and test benches dedicated to evaluating air treatment and respiratory protection technologies at VirexpR.

Health & Multiphase – Modelling pharma processes (Media & Solution, Vaccines, Injectables, Synthetics)

About the presentation

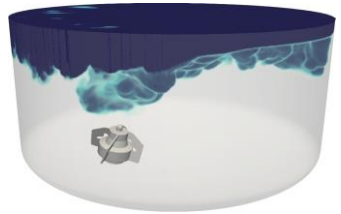
Pharmaceutical processes cover a wide range of applications, whether in terms of the diversity of products manufactured (liquids, solids), their category (synthetic molecules, biological products), their mode of administration (injection, oral), or their position in the manufacturing chain (substrate preparation, cell culture, viral infection, separation and purification, formulation, and filling).

Historically subject to strict safety constraints, a highly regulated environment (requiring complete traceability of process changes and continuous product quality control), and intense competition, the pharmaceutical industry has adopted advanced process modeling to overcome the technical, industrial, and financial barriers that delay or prevent patient access to innovative medicines.

In this presentation, we will describe the industrial and regulatory context, present Sanofi's activities, identify the main industrial and scientific challenges, and present the approaches implemented to address them. We will conclude with perspectives on the future of process modeling in the pharmaceutical sector.

About the speaker

Dr. R. Andreux
Sanofi



Régis Andreux, 50, Polytech-Nancy engineer (formerly ESSTIN), PhD in fluid mechanics and energy from INP Toulouse, Habilité à Diriger la Recherche, with 20 years of industrial experience in the energy (IFPEN) and pharmaceutical (Sanofi) industries, 8 years of entrepreneurship in the field of finance and wealth management consulting, 3 years in DeepTech innovation (SATT Pulsalys).

Co-author of half a dozen patents, around 15 journal articles, and around 20 conference presentations.Currently Head of the MSAT-DSD Modeling Unit team at Sanofi Marcy l'Etoile, dedicated to the mechanistic modeling of upstream and downstream processes for technical assistance and technology transfer missions.

Are mathematics and physics hidden in your pills?

About the presentation

Many pharmaceutical forms are manufactured from several powdered ingredients. If you cut a tablet in half, will the active ingredient be evenly distributed in both parts? For manufacturers, is it possible to measure the characteristics of a powder in the laboratory and predict the energy required to stir it? If the flow properties of the ingredients are known, can the flow properties of their mixture be predicted?

During this seminar, we will address the issues of powder mixing and flow through research findings. The first area of interest is the study of powder mixing. We will present how to evaluate the homogeneity of the mixture, what the mixing and segregation mechanisms are, how to scale up the processes, and how to simulate homogenisation operations. The second area of interest concerns the agitation and rheology of powders. Characterising, controlling and modelling powder flow are essential prerequisites for designing operations and processes..

About the speaker

Dr. C. Gatumel
Mines Albi

Associate Professor

IMT Mines Albi, RAPSODEE Research Center

Engineering degree in Chemical Engineering - ENSIACET, Toulouse, 1994

PhD thesis on Precipitation assisted by ultrasounds : effects on micro-mixing and nucleation - University of Toulouse, 1997

HDR, Mixing and process engineering of particulate solids, multi-scale studies - National Polytechnic Institute of Toulouse, 2020

Mucus films in the pulmonary airways
A hydrodynamic modelling approach

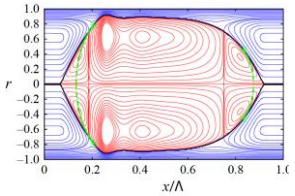
About the presentation

The tracheobronchial tree comprises the first 16 airway generations of the human respiratory system. Here, the inner surface of the airways is coated by an annular film of mucus, which captures alien particles contained in the inspired air, thus protecting the respiratory portion of the lungs. This configuration is associated with two hydrodynamical phenomena: (1) mucociliary clearance, i.e. the evacuation of mucus toward the trachea via the coordinated beating of cilia, and (2) airway occlusion due to the formation of liquid plugs via the Plateau-Rayleigh instability.

In this seminar, we will present two approaches to model these phenomena, the long term goal being to enable predictions at the scale of the entire tracheobronchial tree. In particular, the talk will focus on the role of viscoelasticity in mucociliary clearance and on predicting the formation of liquid plugs.

About the speaker

Dr. G. Dietze
FAST Laboratory



Georg Dietze is a CNRS research associate at Laboratoire FAST in Orsay, a mixed research unit at Université Paris-Saclay. He obtained his Ph.D. in mechanical engineering from RWTH-Aachen University in 2010. After that, he obtained a postdoctoral fellowship from DAAD to work with Christian Ruyer-Quil (Université Pierre et Marie Curie), and he joined CNRS in 2012.

His research interests focus on thin film flows and interfacial instabilities, which he investigates based on theoretical and numerical approaches, in close collaboration with experimentalists.

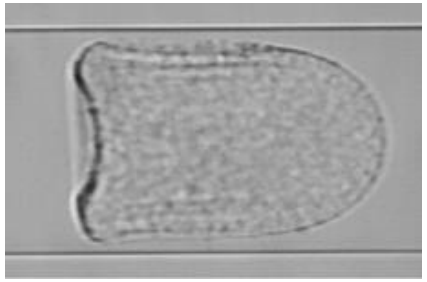
Biological Fluid Structure Interactions

About the presentation

Temporary abstract:

In most applications, bioartifical capsules are suspended in a carrying fluid. When the suspension is flowing, the particles deform in a complex manner under the hydrodynamic stresses.

Modeling the motion and deformation of a capsule in flow is a difficult non-linear problem, as non-conventional fluid-structure interactions intervene: the fluid motion is governed by viscous effects, the structure is undergoing large deformation and inertial effects are negligible



Teams link

About the speaker

Dr. A.V. Salsac
Director of Research at the CNRS
UTC Compiègne

- 2013 Habilitation à Diriger des Recherches, Université de Technologie de Compiègne (France)
- 2007 PGCHE (Post-Graduate Certificate in Higher Education), University College London (UK)
- 2005 Ph.D., University of California, San Diego (USA). Joint degree with École Polytechnique (France)
- 2001 Master of Science, University of California, San Diego (USA)
- 2000 Engineering degree from ENSHMG – Ecole Nationale d'Hydraulique et Mécanique de Grenoble (France)