UNIVERSITÉ CÔTE D'AZUR

univ-cotedazur.fr

POST-DOCTORAL RESEARCHER (M/W)
Full time 100 %
Project FIRE/BronchoClogDrain/VirtualChest

Employer description

Université Côte d'Azur is a major public scientific, cultural, and professional institution whose core missions are education and training of students and professionals, excellence in research, and innovation for the benefit of all. Since January 1, 2020, this experimental public institution has aimed to develop a 21st-century model for French universities, based on new interactions between disciplines (multidisciplinarity and transdisciplinarity), a commitment to collective dynamics linking education, research, and innovation, as well as strong partnerships at the local, national, and international levels with both the public and private sectors.

Awarded the Initiative of Excellence (IDEX) with 'UCA Jedi' in 2016, the 3IA project (Interdisciplinary Institute for Artificial Intelligence) in 2019, and a graduate school project (EUR), Université Côte d'Azur is engaged in a trajectory of transformation and excellence. Its ambition is to reach the rank of a major research-intensive university, both rooted in its territory and oriented toward the international scene. Université Côte d'Azur directly employs more than 3,000 staff and welcomes more than 30,000 students each year.

Université Côte d'Azur is spread across several sites mainly located in Nice, Sophia Antipolis, and Cannes, but also extending between La Seyne-sur-Mer and Menton. Its privileged geographical location between the sea and the mountains offers an exceptional quality of life for staff and students. Its central European location, combined with the proximity of Nice Côte d'Azur International Airport, makes it a gateway to the global academic and scientific community.

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Job description

Drawing on the scientific literature and ongoing work at the LJAD, the postdoctoral researcher will be tasked with developing research on the mathematical and numerical modelling of the respiratory system and its biomechanics, in order to study airflow within it and its interactions with bronchial mucus. The project aims to study both healthy and diseased lungs, particularly in the context of coughing, with the goal of better understanding the consequences of pulmonary fibrosis, which stiffens part of the lung tissue.

This position will be integrated into an interdisciplinary research team involved in the FIRE, BronchoClogDrain and VirtualChest projects. These projects aim to establish links between the biomechanical properties of the pulmonary system, airflow, and mucus displacement in the bronchial tree as a function of the rheological properties of that mucus. FIRE, BronchoClogDrain and VirtualChest bring together biologists, physicians, physiotherapists, biophysicists and applied mathematicians.

The postdoctoral researcher will also contribute to the development of the respiratory system modelling research group at the LJAD (currently comprising two permanent researchers). He/she will likewise be part of the Interfaces of Mathematics and Complex Systems administrative team, which brings together researchers in applied mathematics, biology, mechanics, physics and chemistry.

Main activities

The project will focus on the consequences of changes in the biomechanical properties of human lungs on airflow and its interaction with mucus, particularly during coughing (high Reynolds number flow conditions). The postdoctoral researcher will study the distribution of airflow in the bronchi of a patient-dependent lung model already developed at the LJAD, as well as the dynamics of air–mucus interfaces in the branches of this model. In particular, we will focus on the impact of the mechanical properties of the lung, the geometry of the airways, and the key rheological characteristics of mucus, such as yield stress, viscosity and elasticity. Simplified models of mucus will be used to explore the influence of its key characteristics, typically representing it as an elastic Bingham fluid or a Herschel–Bulkley fluid.

The numerical study will be carried out using FreeFem++ (lung biomechanics) and OpenFOAM (high-flow regime, coughing). FreeFem++ is free software enabling the development of finite element numerical studies. OpenFOAM is free finite volume numerical computation software, fluid-oriented (CFD), capable of simulating turbulence, two-fluid systems and non-Newtonian fluids. Other equivalent software familiar to the candidate may also be used where appropriate.

Regarding lung biomechanics, the postdoctoral researcher will seek to estimate, using the FreeFem++ numerical code developed at the LJAD, the distribution of airflow in the lung for a set of tissue-stiffening scenarios mimicking the effects of pulmonary fibrosis. These computations will form a basis to feed more detailed simulations of air–mucus interactions in the bronchi. Building on preliminary simulations developed at the LJAD with OpenFOAM, the postdoctoral researcher will carry out dimensional analyses of the nonlinear equations of the system in order to identify the relevant physical parameters. New series of numerical simulations will then be set up to identify the relevant dimensionless parameters and characterise air–mucus interactions in various airway geometries (e.g. cylinders, bronchial bifurcations, etc.).

Candidate profile

A young researcher in applied mathematics, physics, mechanics, or engineering sciences with an interest in interdisciplinary research applied to biology and health.

Required Skills and Qualities

We are looking for a team-oriented individual with skills in mathematical and numerical modelling of continuous media, particularly in mechanics, fluid mechanics and/or non-Newtonian fluids. A knowledge of standard numerical methods and experience in scientific computing are expected.

In particular, skills in mathematical modelling and scientific computing in one or more of the following areas will be valued:

- Biomechanics
- Two-fluid flows
- Compressible and incompressible fluids
- Turbulence
- Partial differential equation solvers: FreeFem++ and OpenFOAM.

Experience or a strong interest in applications in biology or physiology will be particularly valued.

Skills in writing scientific articles in English, as well as preparing and delivering presentations in English at workshops, scientific congresses or conferences are essential.

An interest in scientific outreach and popularisation will be appreciated.

Job Location

University campus Valrose in Nice, France, within the Laboratoire Jean Alexandre Dieudonné.

Valrose Campus and potential training in Sophia Antipolis.

Teleworking : this position may be eligible for teleworking arrangements.

Application conditions

Type of contract: 18-month fixed-term contract starting September 1st, 2026.

Position level: Post-doctoral researcher

RIFSEEP:

· Associated profession:

· Job group:

Informations complémentaires :

Application files, including a curriculum vitae and a cover letter, should be sent to the following address: benjamin.mauroy@univ-cotedazur.fr before 30/10/2025.

All our positions are open to applicants with disabilities.

Find all our job offers on the Université Côte d'Azur recruitment portal.