Begin: Now
(February 2023)

Institute of Aerodynamics and Chair of Fluid Mechanics

RWTH AACHEN UNIVERSITY

Projekt-/ Bachelorarbeit

Development of a realistic three-dimensional human respiratory tract model for experimental aerosol deposition measurements

Topics: Experimental fluid dynamics, optical measurement techniques, PIV, generic lung model, particle deposition, COVID-19, interdisciplinary research

Pulmonary infectious diseases are a growing challenge of human health. Therefore, investigations of alternative curative therapies and new strategies are essential. As the literature indicates, allicin (diallyl thiosulfinate) has antifungal, antibacterial activity, even against multiple drug resistance (MDR) strains of human lung bacteria as well as antiviral properties. To better understand the deposition mechanism of aerosols, experimental investigations are mandatory. Hence, a detailed analysis of the drug-loaded and infectious aerosol particle deposition in the respiratory system is necessary. A combined approach of biology, medicine and experimental fluid dynamics allows realistic in vitro measurements of the human airways.

Two realistic three-dimensional generic models of the human respiratory system have been created for the experimental investigation of the flow field and the aerosol deposition. The geometry extends from the nasal/oral cavity until the 6th bifurcation generation (as seen in figure 1) depicting a large part of the respiratory system, even the smaller bronchi. In an adjoining measurement, the aerosol deposition is quantified. By investigating the flow field in areas of interest a deeper understanding of the deposition behaviour can be obtained.

Now its your turn:

You will start with a brief literature survey on flow mechanisms - with a focus on aerosol deposition - in three dimensional airways, which is followed by the further development of the existing model used for the deposition measurements, see figure 2. Afterwards, the model is manufactured by a high-precision 3D printer. Your model will directly be used for the experimental investigations. The results are then compared with previous measurements and existing data from literature. The findings of your work will be summarized in your final thesis.

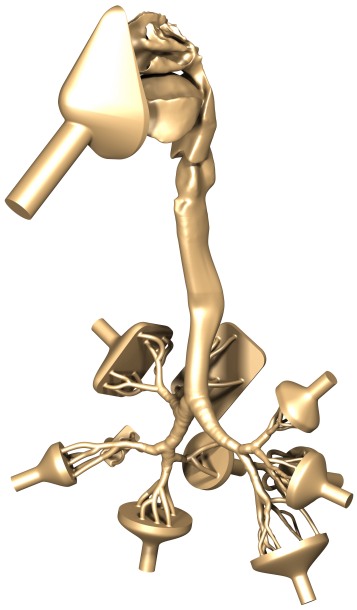

Figure 1: Model of the respiratory system used for the PIV measurements.

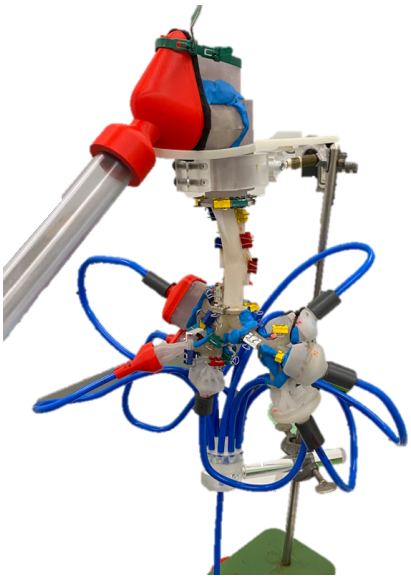

Figure 2: Experimental Setup for the deposition measurements.

Requirements

- Enthusiasm for fluid dynamics in a medical context.
- Good knowledge in the field of fluid mechanics.
- Knowledge of CATIA or a similar CAD software is recommended.
- Affinity to perform experimental work.

What we offer

- Interesting insights into the interdisciplinary work of fluid dynamics, biology and medicine.
- Active participation in a current research project and measurement campaign.
- Further development of the existing measurement setup.
- Analysis and post-processing of the generated measurement data.

If you are interested in the presented work or would like to learn more about, feel free to send me an email with your CV or pass by our office.

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