iLADDER-OA

**In-silico LADDER: Lung Aerosol Dosimetry for Drug and Environmental Research**

This GitHub repository contains human oral airway geometries developed and used by the in-silico LADDER team of investigators. You are welcome to download and use these geometries, but please cite the references associated with the downloaded models.

The repository includes the oral airway of 7 healthy male subjects and 4 male subjects with COPD. Details are as follows:

**Imaging**: multi-slice CT imaging of the head and torso (0.5 x 0.7 x 0.7 mm resolution, FOV 36 × 36 × 48 cm, i.e., image volume size of 512 × 512 × 960).

**Segmentation**: based on intensity thresholding followed by visual validation and repair.

**Model**: Mouth, oropharynx, larynx, vocal cord, and upper tracheal region. Subregional regions (mouth, oropharynx, larynx, trachea) are identified.

**Mesh**: Hybrid prism/polyhedral volume meshes generated in ICEM-CFD 21.0 (~12 millions elements per model)

**Simulation types:** airflow and aerosol transport

**Simulation parameters:** flow rate: 18 and 45 L/min, tidal volume: 1 L, particle size: 1-30 µm

**Funding:** NIEHS U01 ES028669

**Related publications**: Borojeni et al., 2023 (<https://doi.org/10.3390/pharmaceutics15010160>)

**This project is also available on** [**SimTK**](https://simtk.org/projects/insilico_ladder)**.**

**Available oral airway models**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject ID and STL** | **Sex** | **Age, Yr** | **Height, cm** | **BMI** | **Health Status** | **FEV1, %pred** | **FEV1/FVC** | **Mesh** | **Model** |
| OA-H1 | Male | 35 | 170 | 23.5 | Healthy | 113 | 0.88 | Yes |  |
| OA-H2 | Male | 52 | 165 | 35.5 | Healthy | 117 | 0.79 | Yes |  |
| OA-H3 | Male | 47 | 183 | 26.5 | Healthy | 85 | 0.74 | Yes |  |
| OA-H4 | Male | 26 | 183 | 27.5 | Healthy | 94 | 0.80 | Yes |  |
| OA-H5 | Male | 34 | 193 | 26.8 | Healthy | 104 | 0.84 | Yes |  |
| OA-H6 | Male | 21 | 168 | 19.2 | Healthy | 89 | 0.73 | Yes |  |
| OA-H7 | Male | 21 | 173 | 21.3 | Healthy | 95 | 0.81 | Yes |  |
| OA-COPD1 | Male | 57 | 164 | 26.1 | COPD | 60 | 0.56 | Yes |  |
| OA-COPD2 | Male | 55 | 178 | 20.8 | COPD | 56 | 0.48 | Yes |  |
| OA-COPD3 | Male | 45 | 180 | 25.6 | COPD | 69 | 0.67 | Yes |  |
| OA-COPD4 | Male | 54 | 187 | 24 | COPD | 58 | 0.52 | Yes |  |