

## Applications

- Nose-to-brain drug delivery
- Nose-to-lungs drug delivery
- Respiratory drug delivery to infants and children
- Non-invasive ventilation system
- Lung delivery for aerosol testing in animals

## Advantages

- Minimized deposition in the device
- Improved oral, nasal and tracheal delivery
- Streamlined flow passages

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## Market Need

Delivering a therapeutic respiratory aerosol from the aerosol generator to the intended target within the airways is technically challenging and currently very inefficient. For conventional inhalers and aerosol delivery systems, the drug dose depositing in the desired region of the respiratory tract is significantly less than the initial nominal dose. Aerosol delivery efficiencies through nasal interfaces are not efficient due to high flow rates, humidification, small delivery line diameters, and nasal cannulas with narrow flow passages and abrupt changes in flow direction. This significant amount of drug loss wastes valuable medication, which contributes to therapeutic cost, increases side effects, and can render many medications ineffective. Methods to improve the delivery efficiency of respiratory drug delivery are clearly needed.

## Technology Summary

This invention describes methods and devices to improve nose-to-brain and nose-to-lungs aerosol delivery. Improved heat transfer and streamlined flow passages in the device allow for precise oral, nasal or tracheal delivery of submicrometer ( $<1\mu\text{m}$ ) and micrometer ( $>1\mu\text{m}$ ) aerosols with minimal depositional losses of the aerosol. A combination of *in vitro* experiments and computational fluid dynamics (CFD) simulations have shown that depositional losses for the particles in the mixer, connective tubing, and patient interface (e.g., nasal cannula) are 3 to 4 times lower than in any other currently available devices. This significant improvement results in delivery of approximately 90% of initial drug dose to the patient, which is crucial for many next-generation inhaled medications like antibiotics and vaccines, which require dosing efficiency and reliability.

## Technology Status

Patent pending: U.S. and foreign rights are available.

This technology is available for licensing to industry for further development and commercialization.

