In Vitro Characterization of Nasal Powder Drug Products

SBIA 2022: Advancing Generic Drug Development: Translating Science to Approval

Day 2, Session 6: Current Challenges and Scientific Advancements for Nasal Products

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Learning Objectives

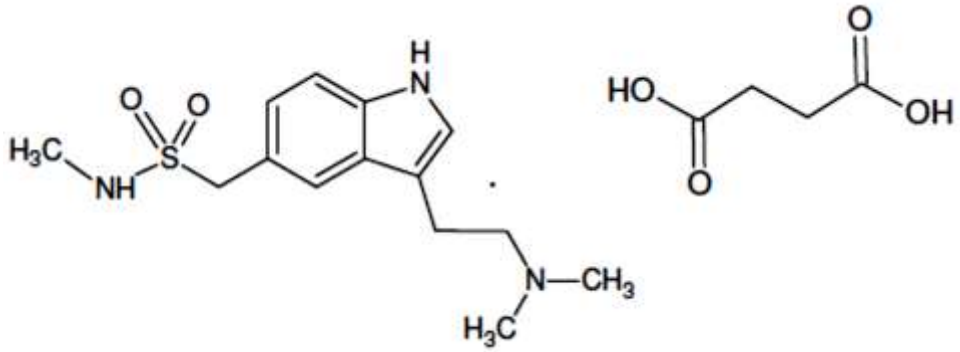
- Describe nasal powder delivery device
- Learn about in vitro characterization using laser diffraction and subsequent data
- Explore preliminary in vitro data on nasal powder delivery into 3D printed nasal cavity model

Nasal Powder Delivery Device

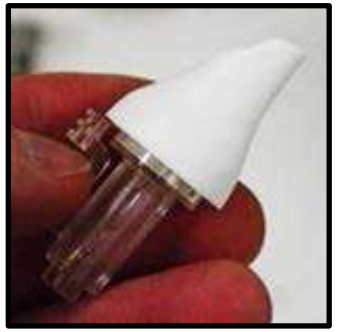
- Breath-actuated delivery device
- Capsules contain 11 mg of sumatriptan base in disposable nosepiece

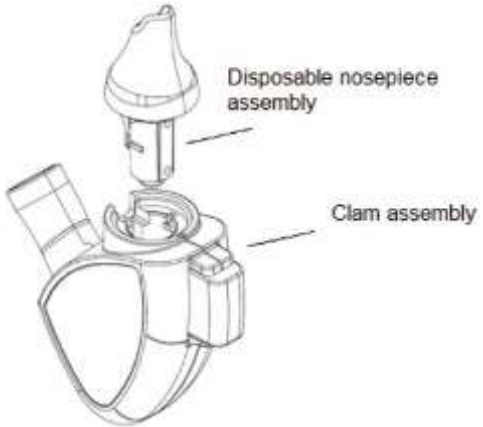
Nasal Powder Delivery Device

- Formulation is 15.4 mg sumatriptan succinate (equivalent to 11 mg sumatriptan base)
- Use for acute treatment of migraine in adults
- No excipients present

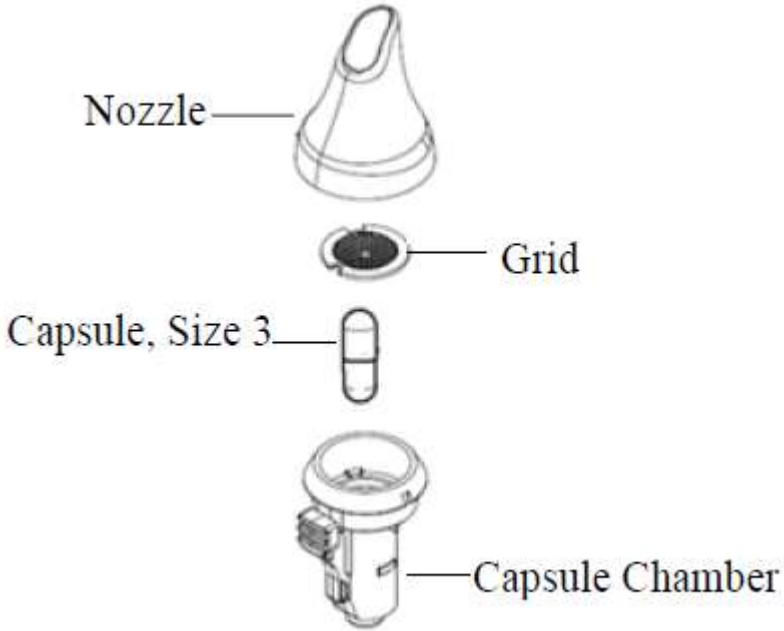


Nasal Powder Delivery Device



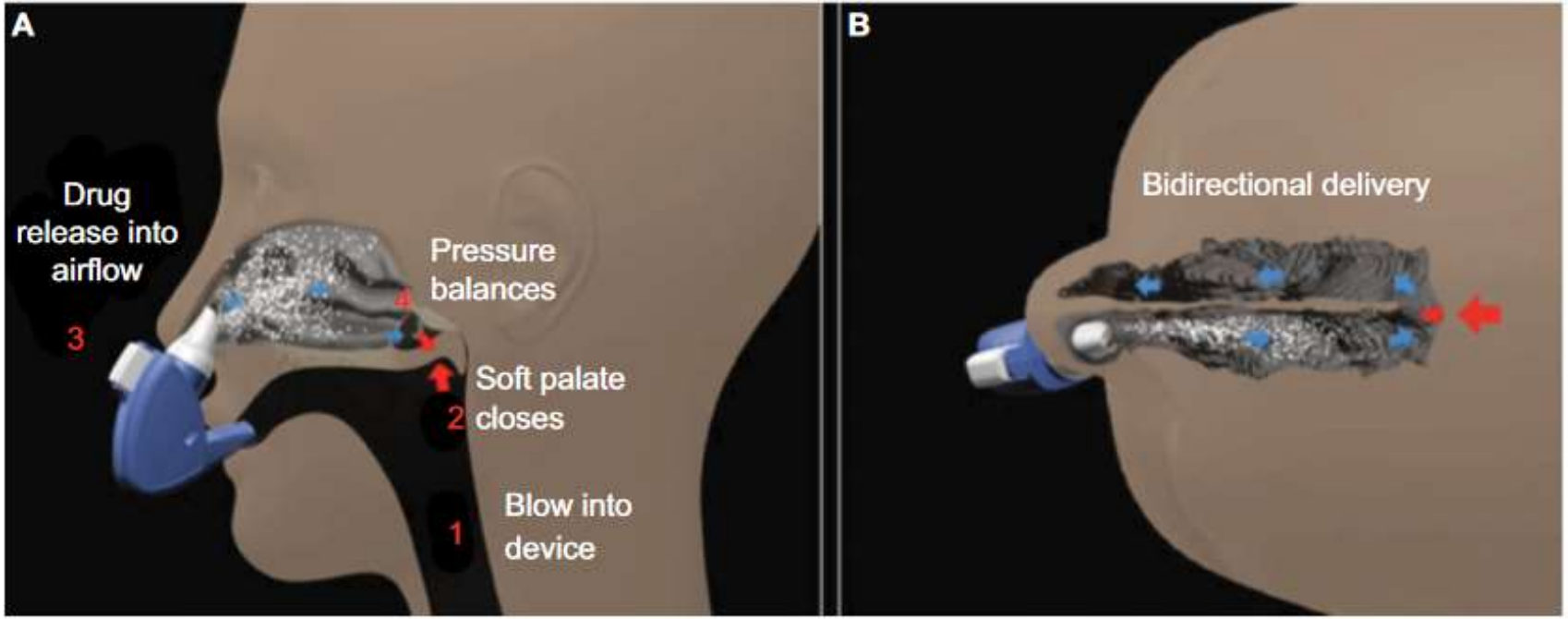


Nosepiece



Nasal Powder Delivery Device

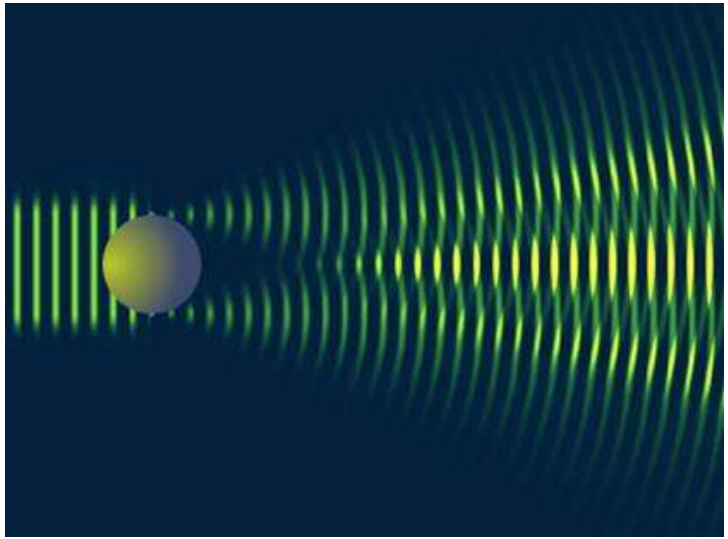
- Bidirectional delivery

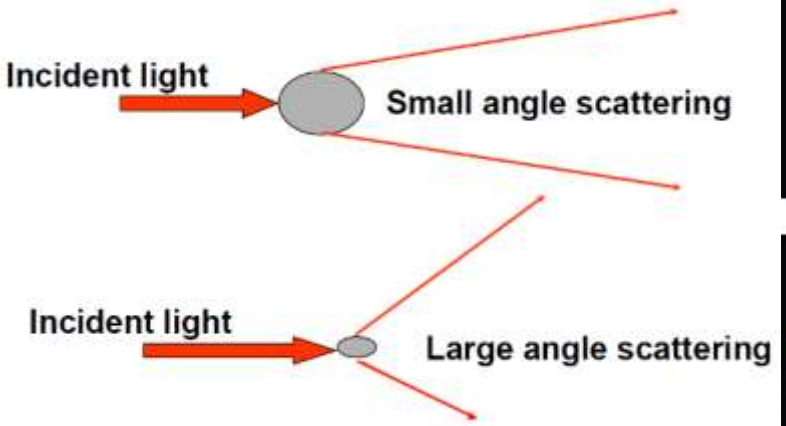


***Source**: Global Submit Review: 206099 (New Drug Application) – 3.2.R Regional Information, "3.2.R.4 Device Summary."*

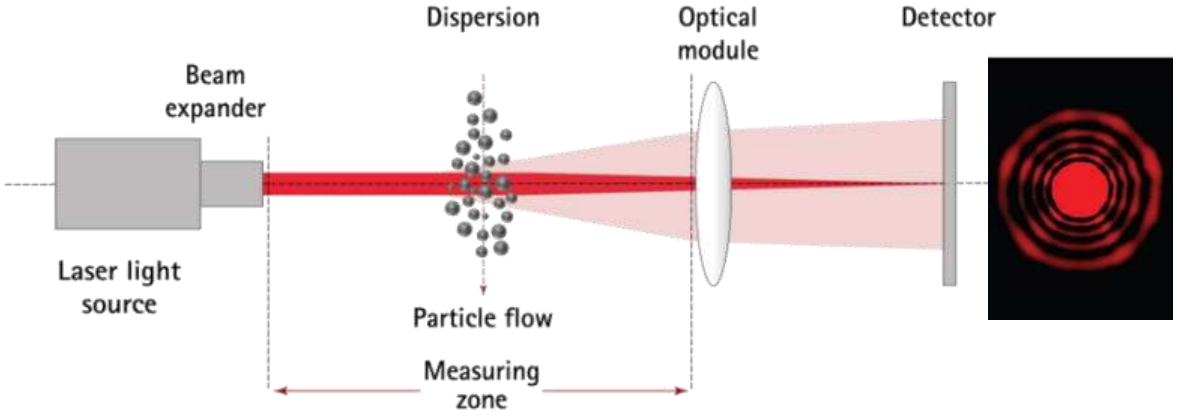
In Vitro Laser Diffraction

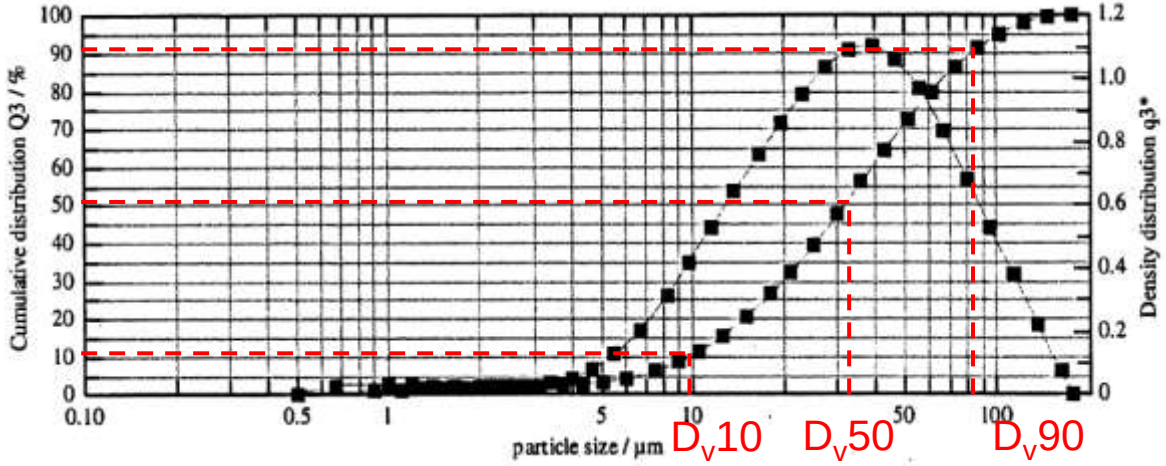
- Obtains fast volume-weighted particle size distributions (PSD)





In Vitro Laser Diffraction

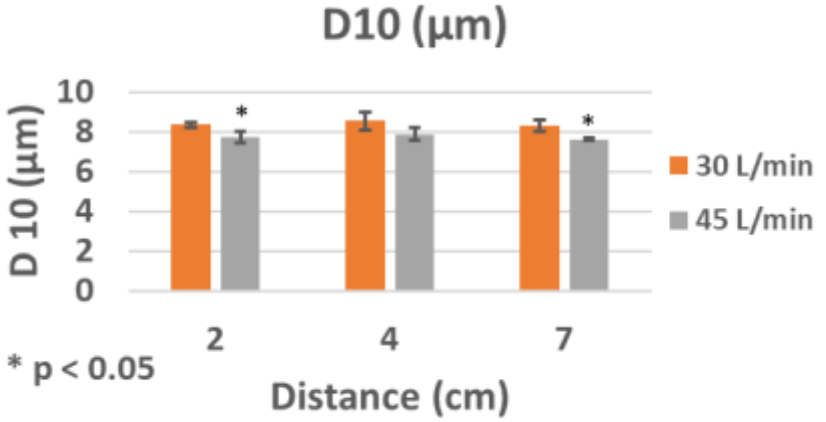


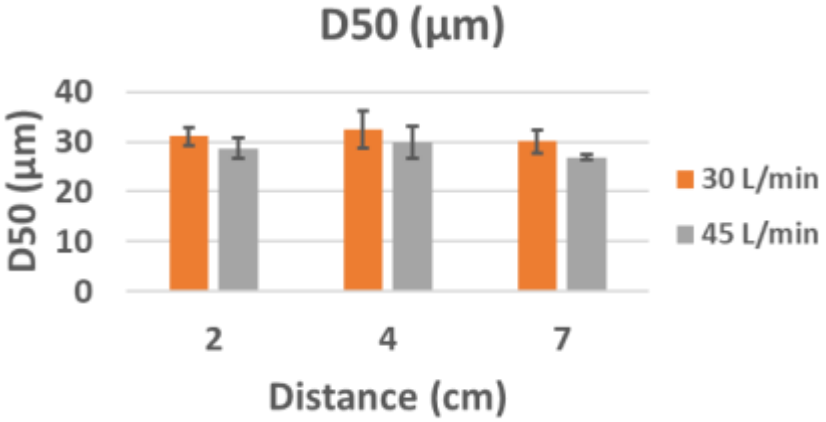


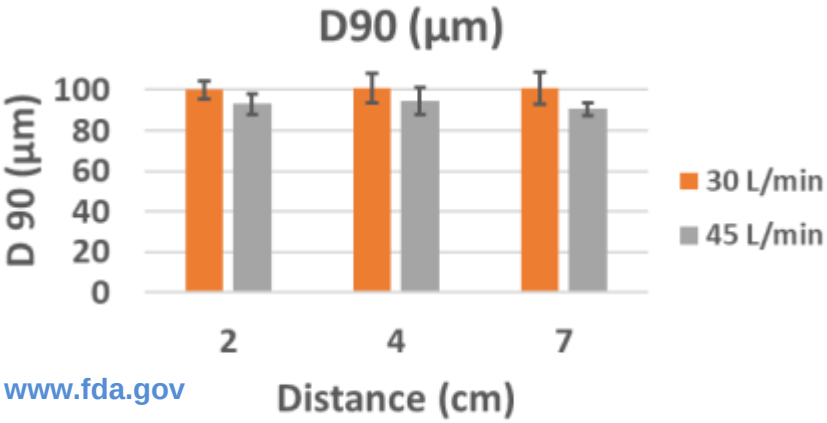
In Vitro Laser Diffraction

- What effect does distance from the laser beam have on PSD?
- What flow rate is optimal for activation of the device?

In Vitro Laser Diffraction



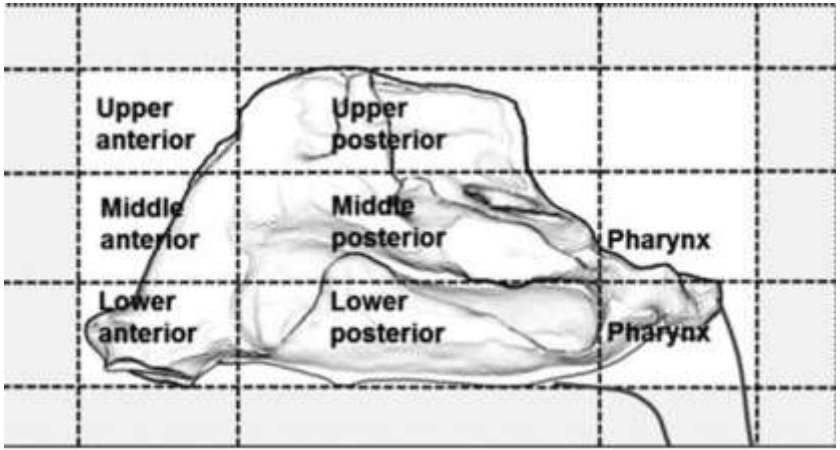




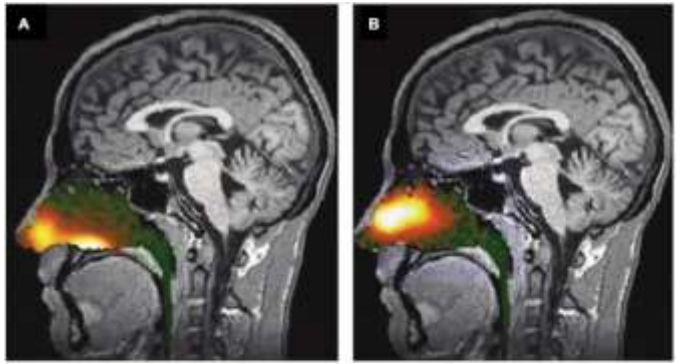
- 15 L/min was insufficient for actuation of the device.
- Statistical difference for D_v10 at different flow rates (2 cm, 7 cm)

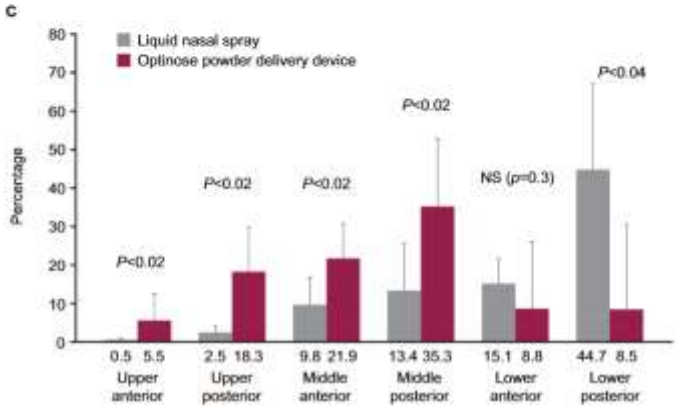
In Vitro Nasal Model

- Nasal liquid vs powder delivery



DOI: 10.1089/jamp.2011.0924

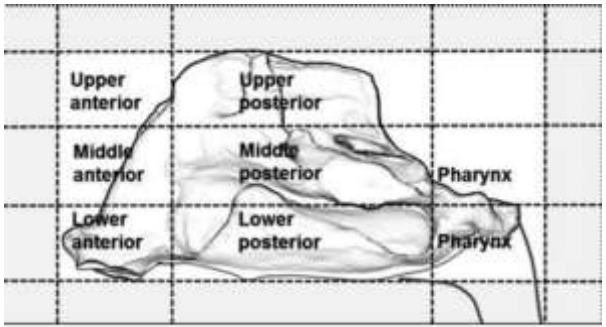




Tepper and Johnstone, Medical Devices: Evidence and Research 2018:11 147–156

In Vitro Nasal Model

- 3D printed model pieces on resin printer



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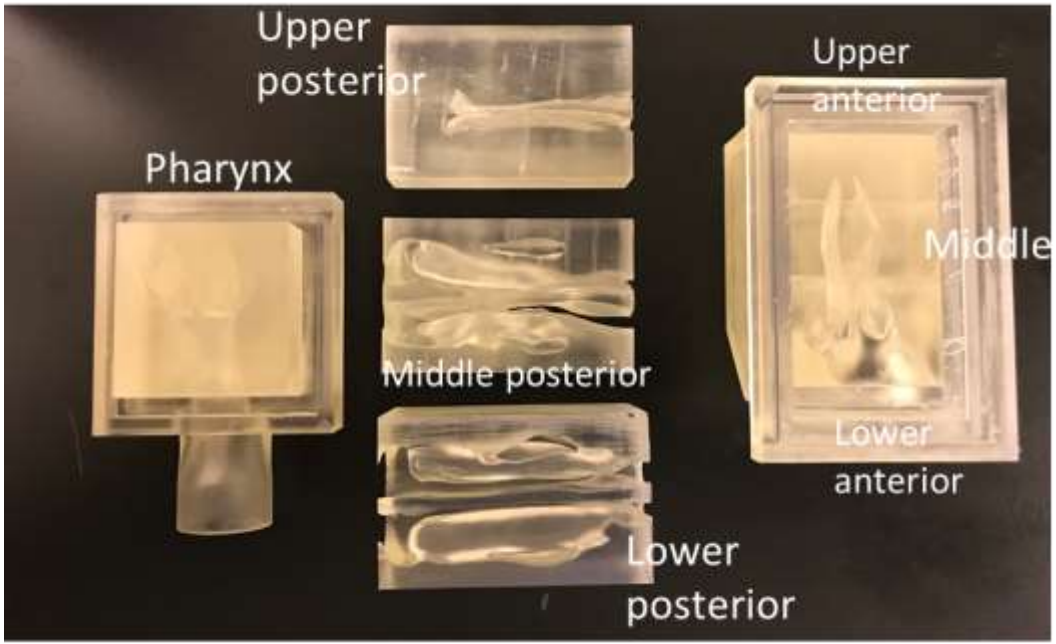
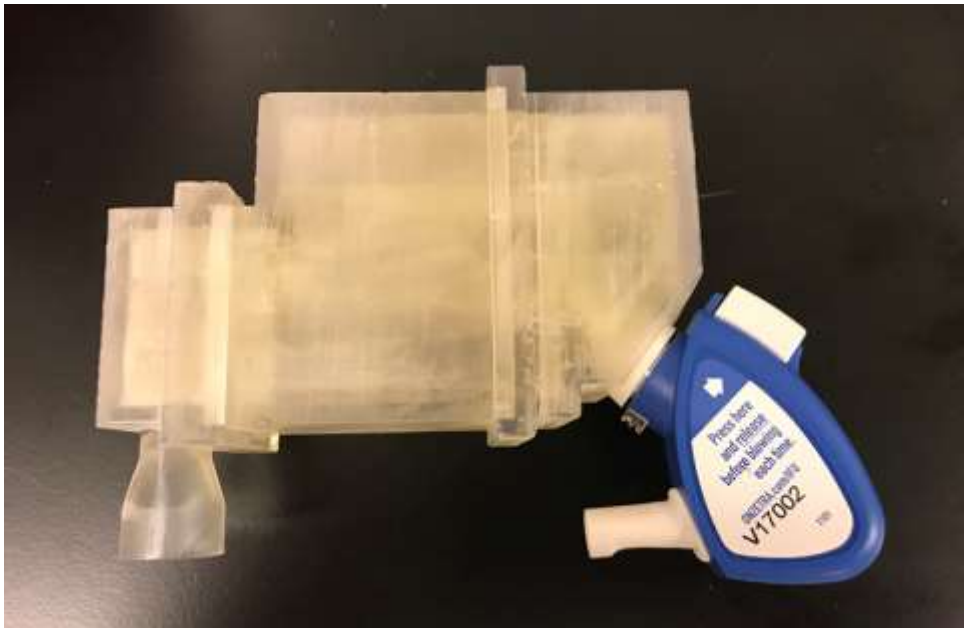
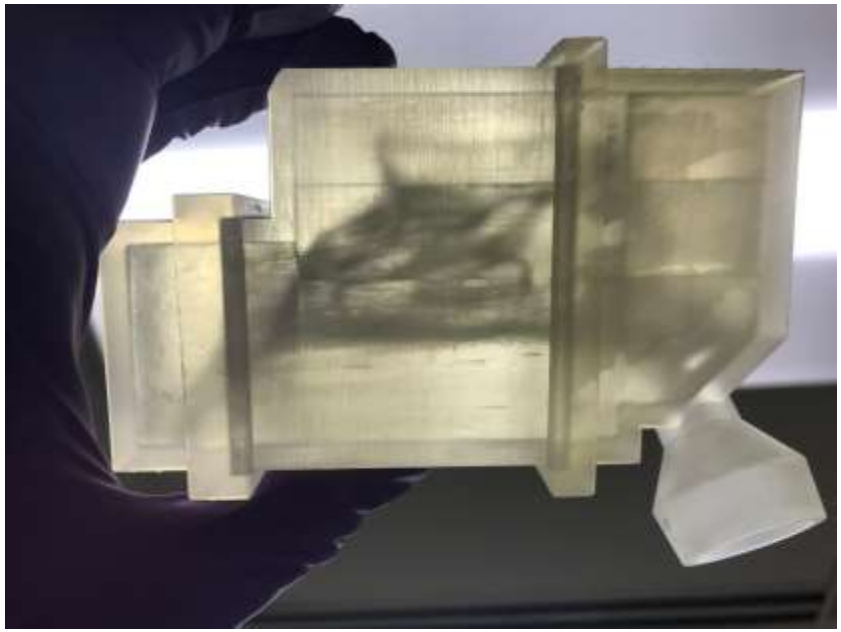


In Vitro Nasal Model

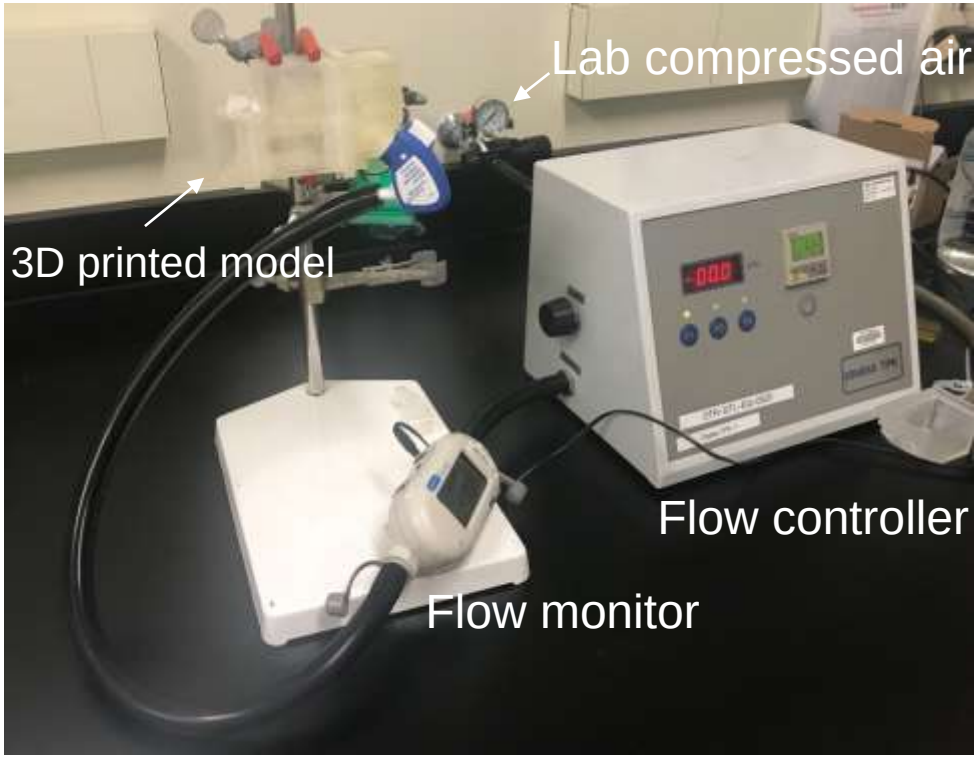
- Glyerol/Methanol mixture was used as coating to simulate nasal fluid

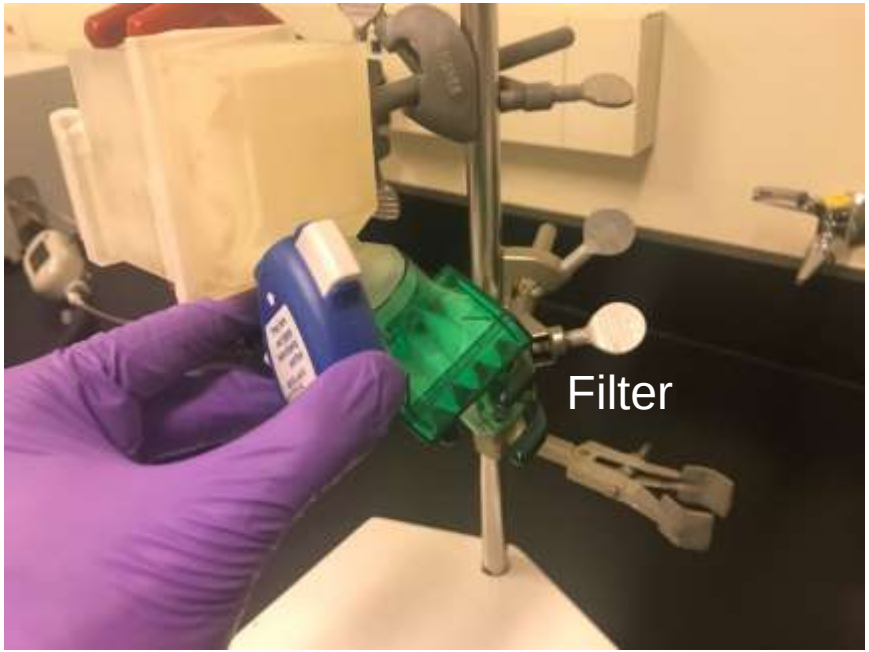




In Vitro Nasal Model

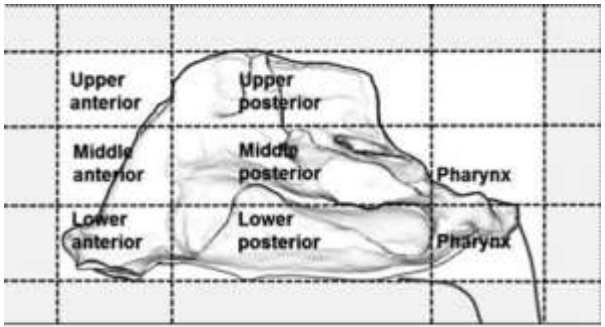
Experimental Setup





In Vitro Nasal Model

- Less than 5% of LC deposition in filter and outer casings



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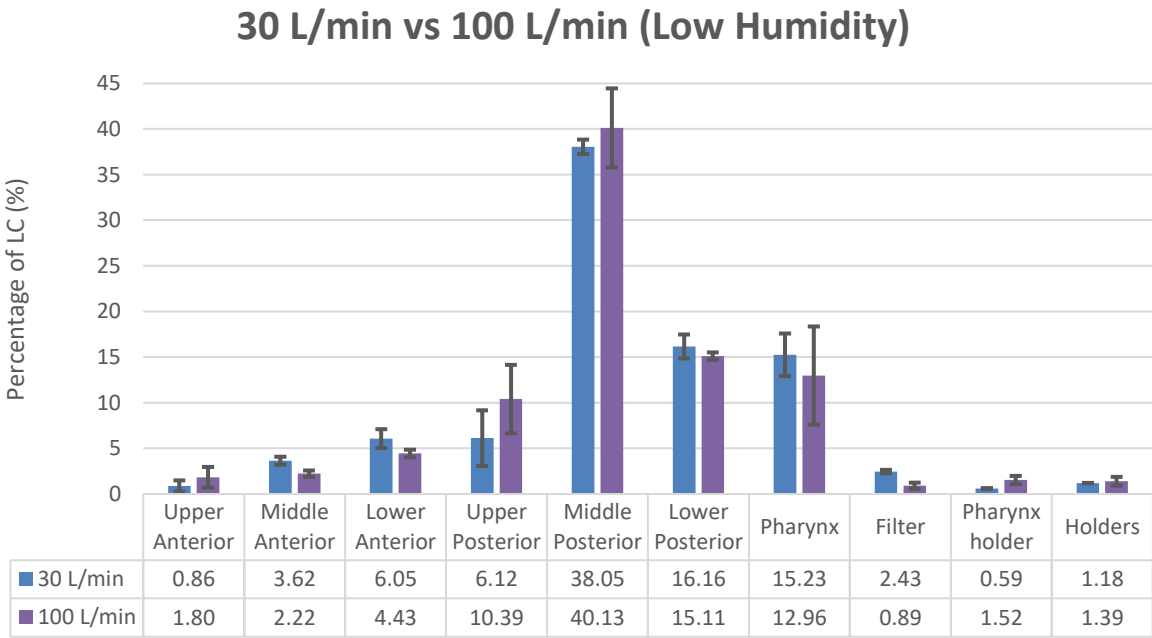


	Upper Anterior	Middle Anterior	Lower Anterior	Upper Posterior	Middle Posterior	Lower Posterior	Pharynx	Filter	Pharynx holder	Holders
30 L/min	0.86	3.62	6.05	6.12	38.05	16.16	15.23	2.43	0.59	1.18
100 L/min	1.80	2.22	4.43	10.39	40.13	15.11	12.96	0.89	1.52	1.39

Challenge Question #1

What characterization parameter does laser diffraction measure?:

A. Number-weighted particle size distribution

B. Mean number of particles

C. Volume-weighted particle size distribution

D. Particle shape

Challenge Question #2

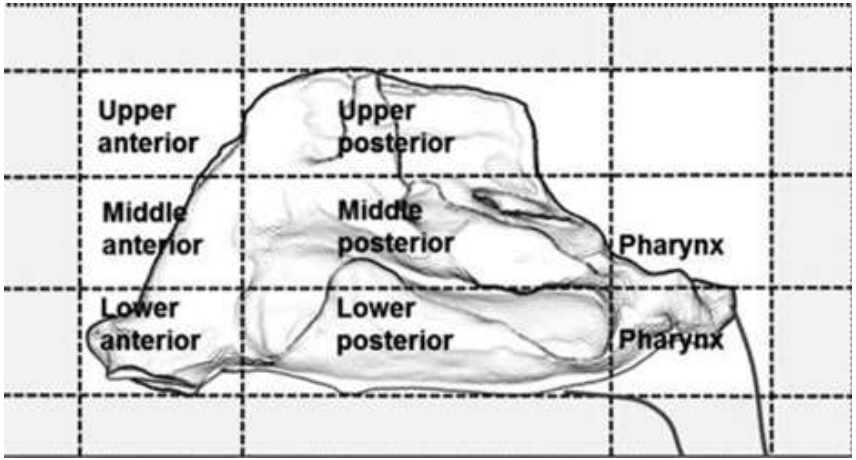
The dry powder delivery device deposits mainly in which region of the nasal cavity?

A. Lower posterior

B. Middle anterior

C. Lower anterior

D. Middle posterior



Summary

- The dry powder delivery device utilizes bi-directional delivery by closing the soft palate on exhale.
- Laser diffraction is a fast in vitro characterization tool that measures volume-weighted PSDs.
  - Blind to API and particle shape (assumes spherical particles)
- 3D printed nasal models can be useful for simulating drug deposition.
  - Preliminary data looks promising, but still needs validation.

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  - Changning Guo
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Questions?

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