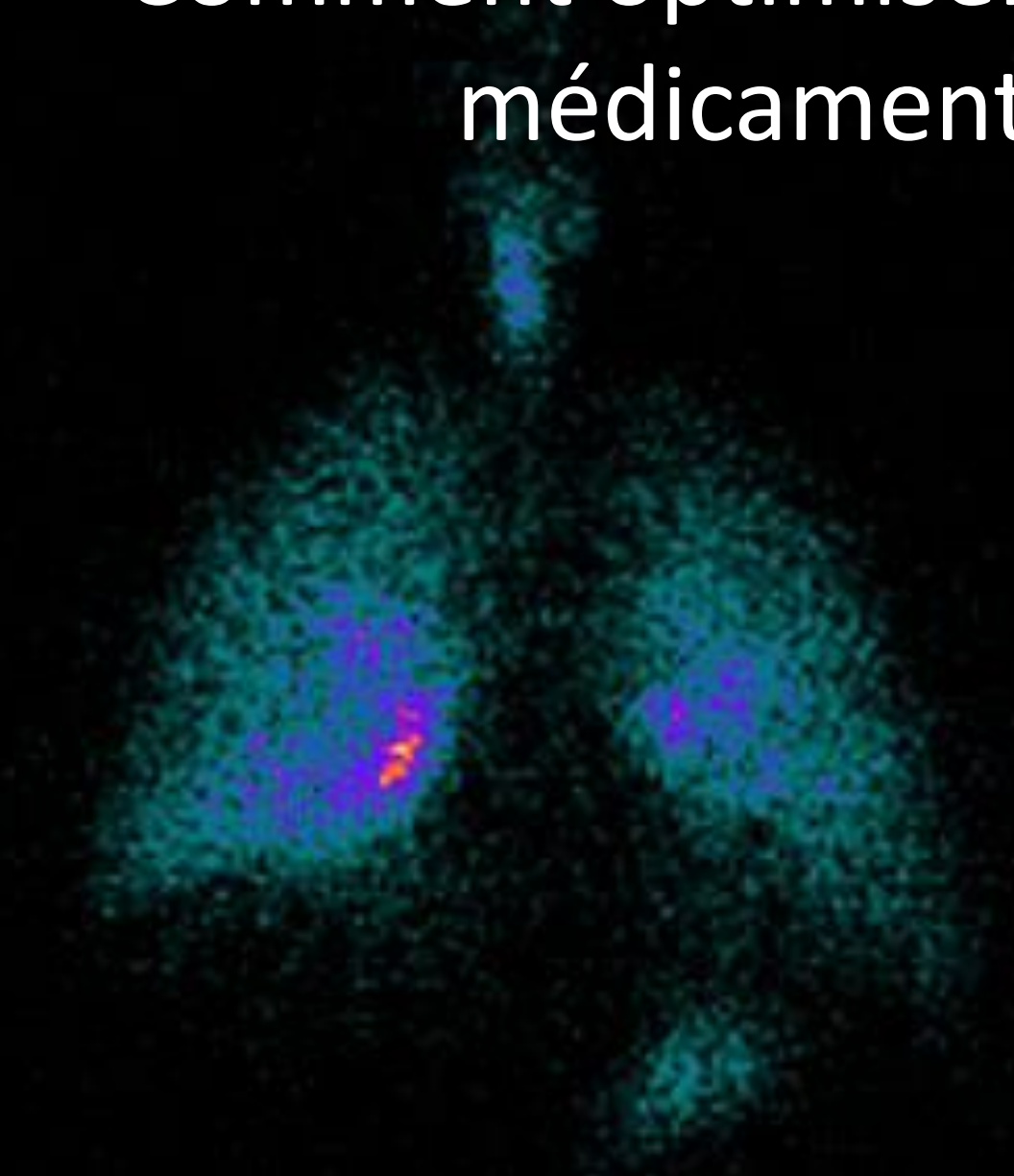


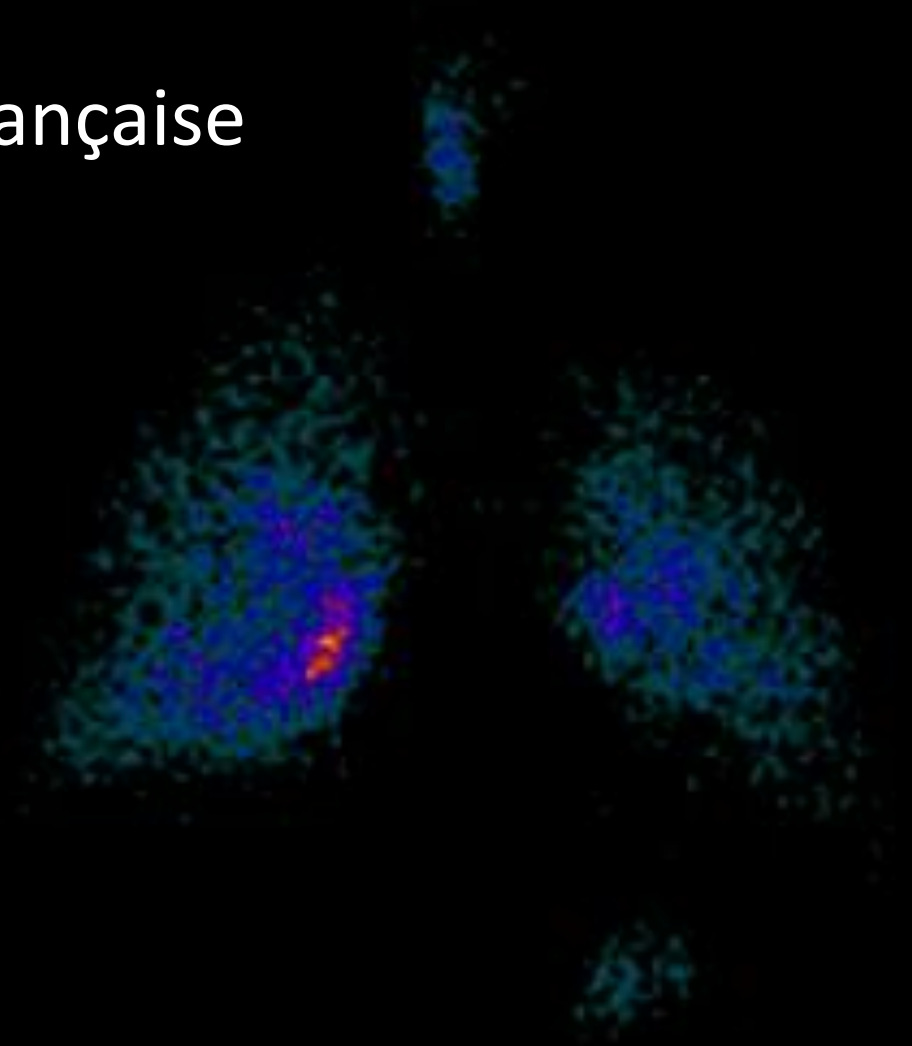
Comment optimiser la déposition médicamenteuse ?



G. Reyckler
Service de Pneumologie
Cliniques universitaires Saint-Luc
Bruxelles

Conflits d'intérêt

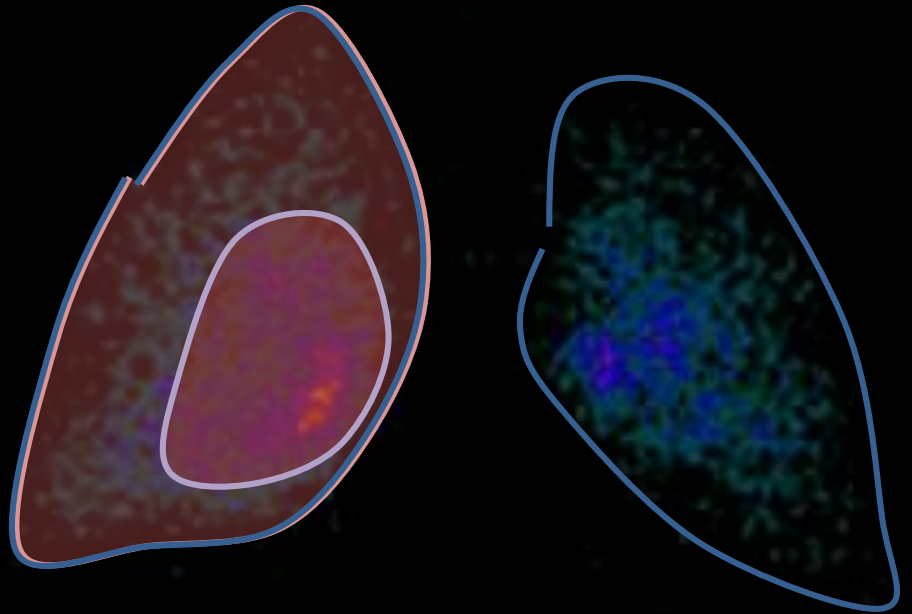
- Diffusion technique française
- Aerogen

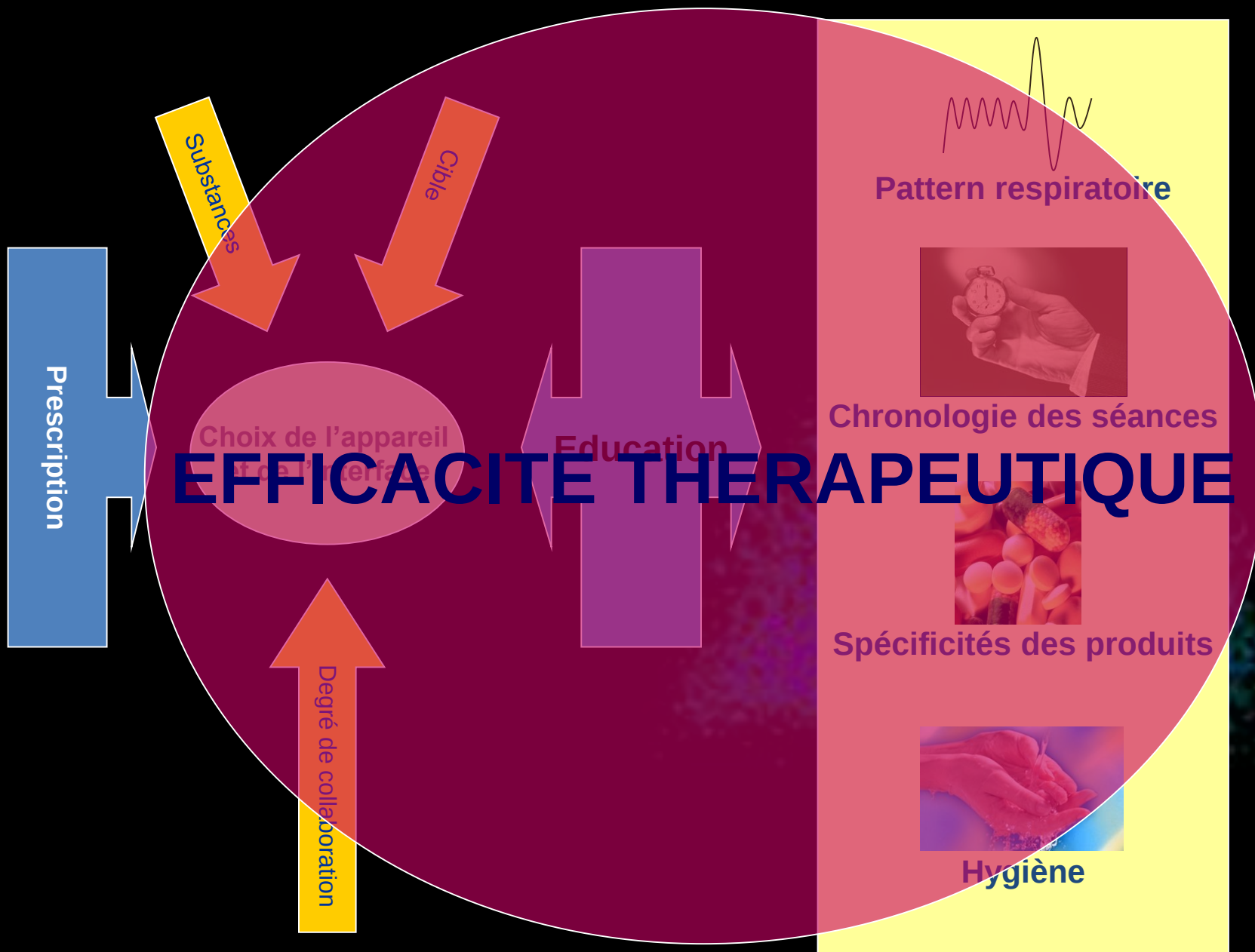


Background

L'efficacité de
l'aérosolthérapie dépend de la
dose qui atteint les poumons

L'efficacité médicamenteuse
dépend de la localisation de la
déposition au niveau de la
cible



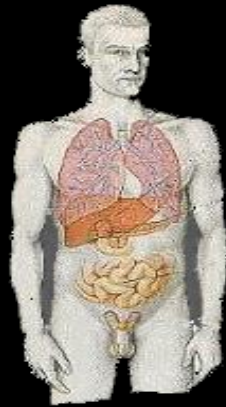




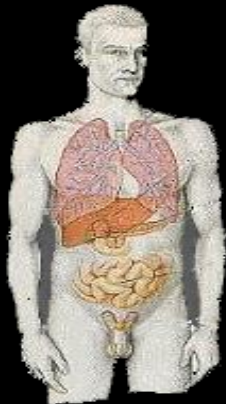
Nominal Dose

100%

Residual and Lost Doses



Inhaled Dose

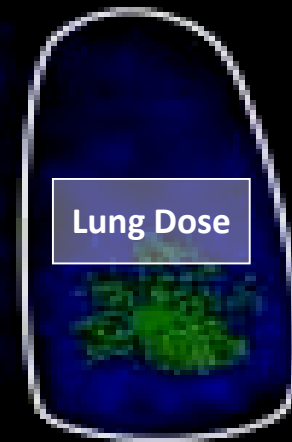
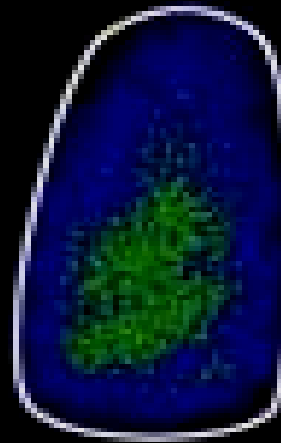


Inhaled Dose

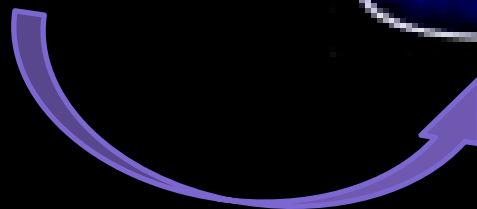
Exhaled Dose



Mouth and extrathoracic doses



Lung Dose



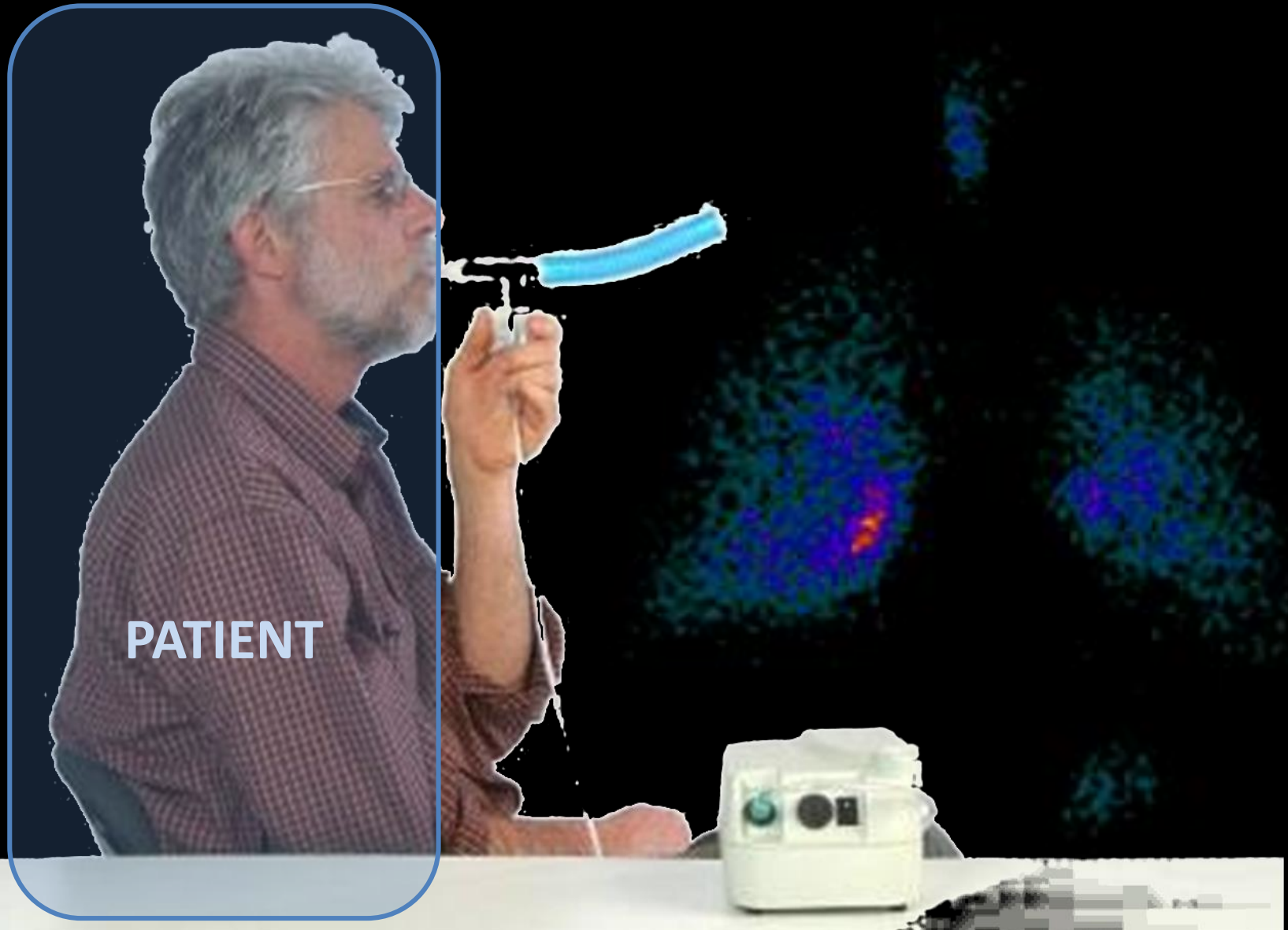
Influences possibles



PATIENT

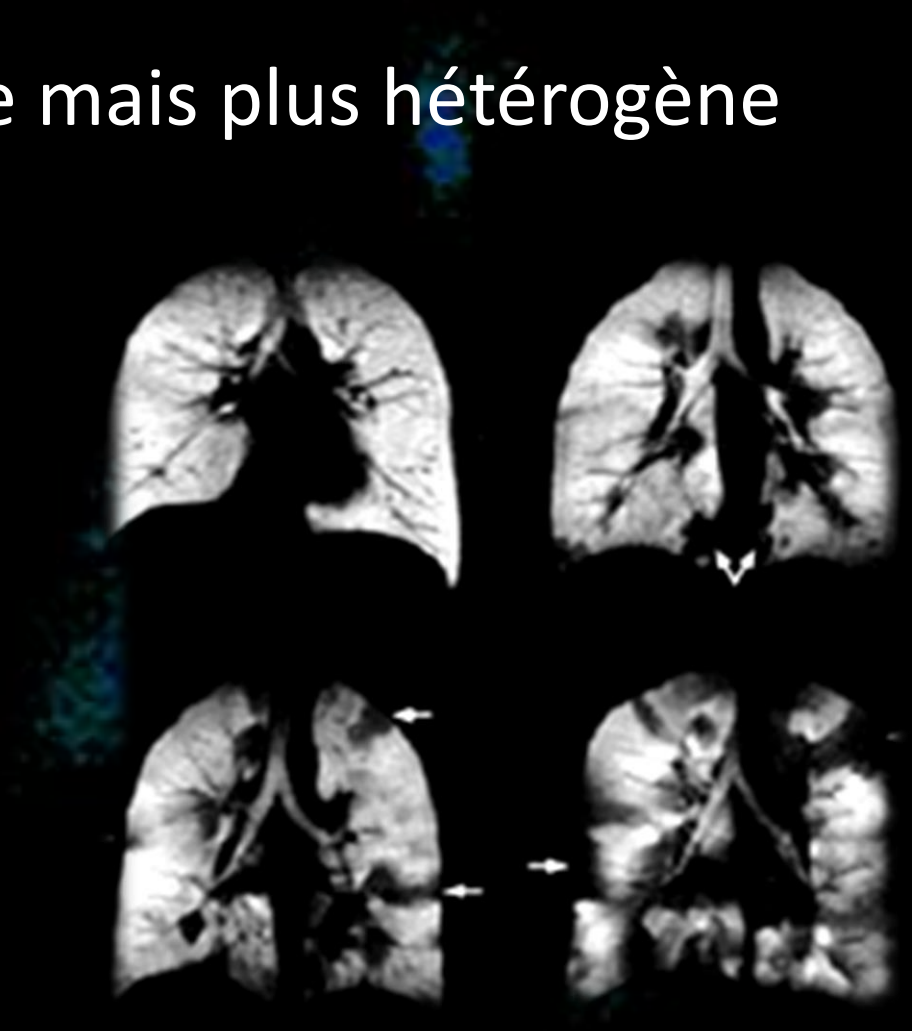
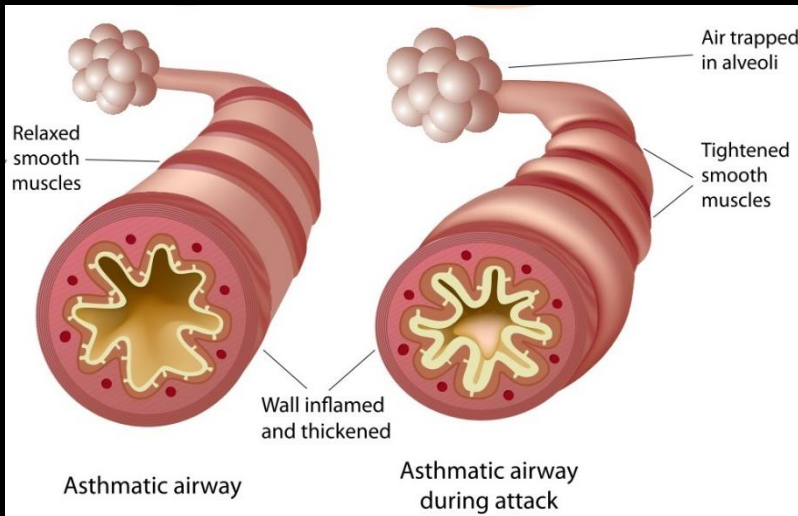
APPAREILLAGE

Influences possibles

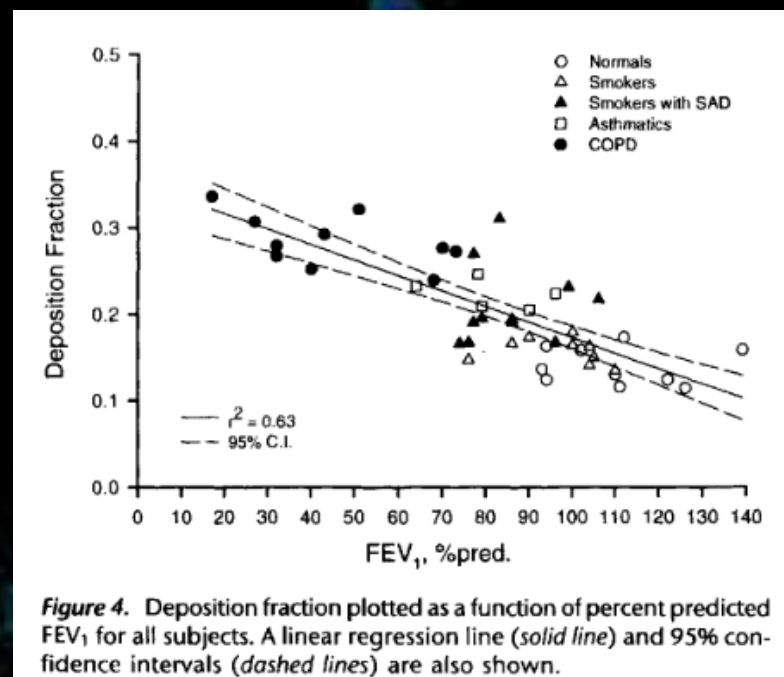
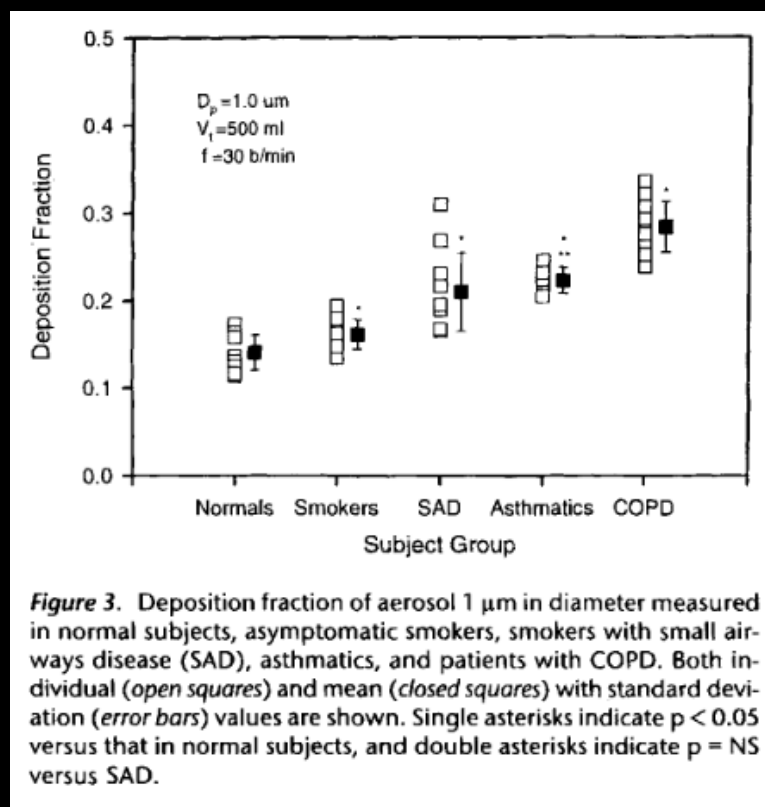


Pathologies (obstructives)

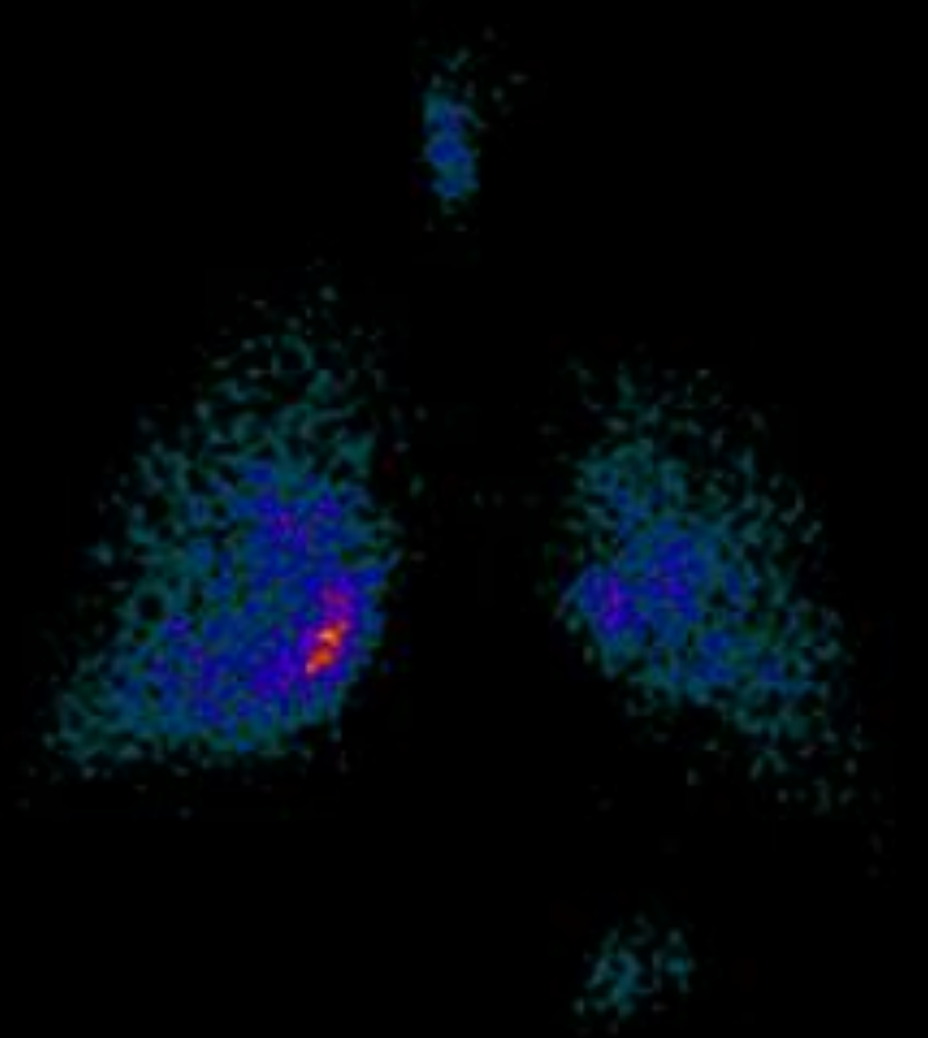
- Déposition augmentée mais plus hétérogène et moins périphérique



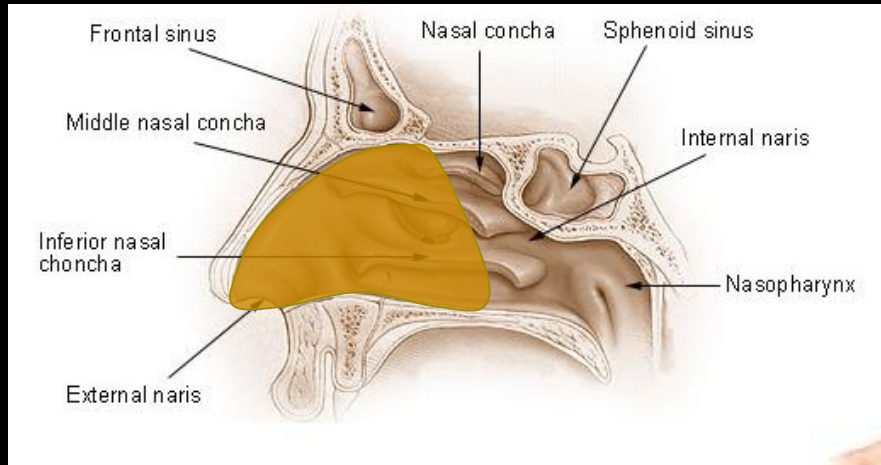
Degré d'obstruction



Entraves à la déposition

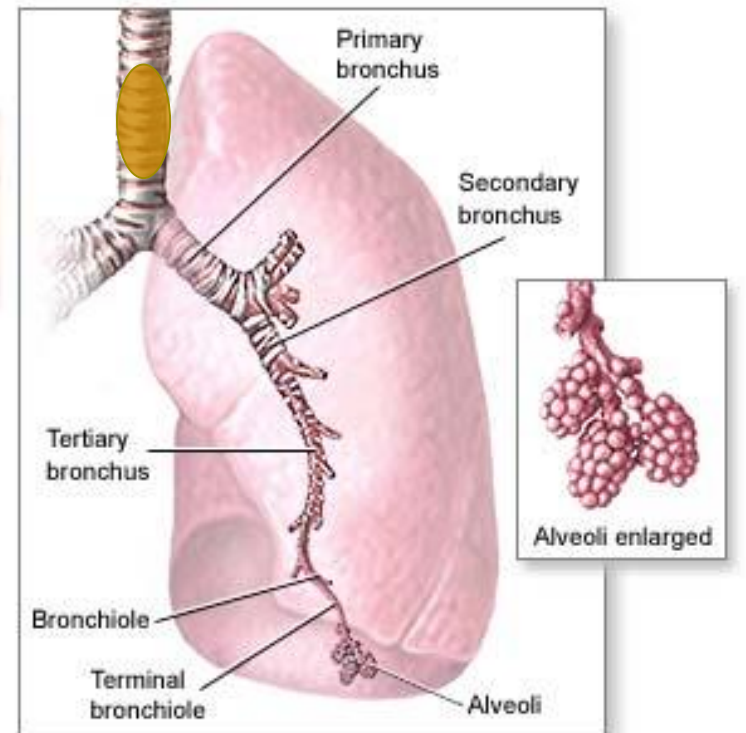


Site de déposition

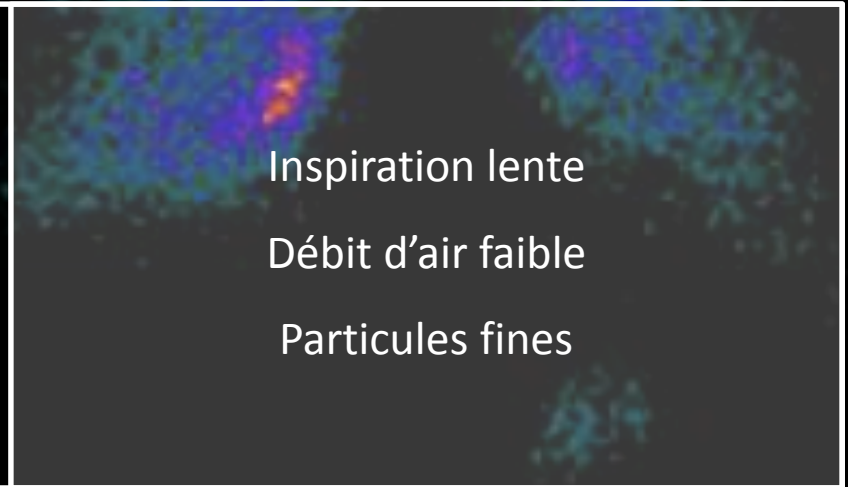
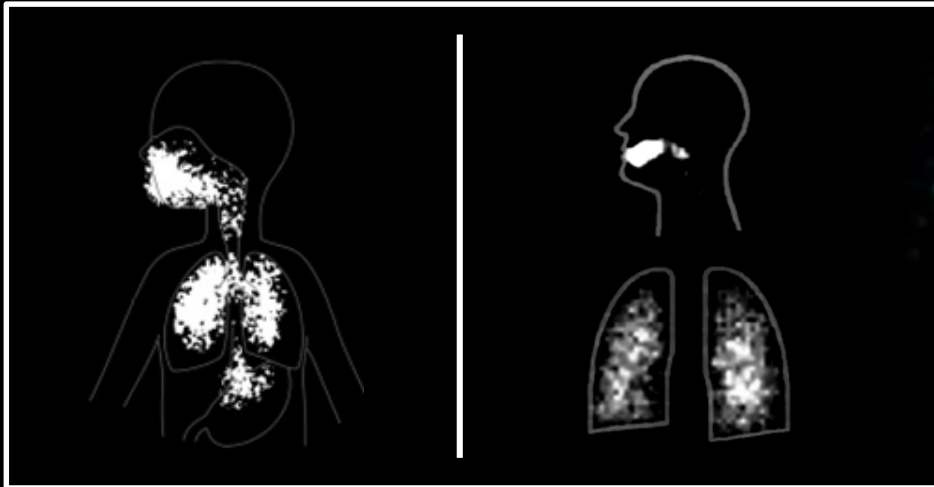
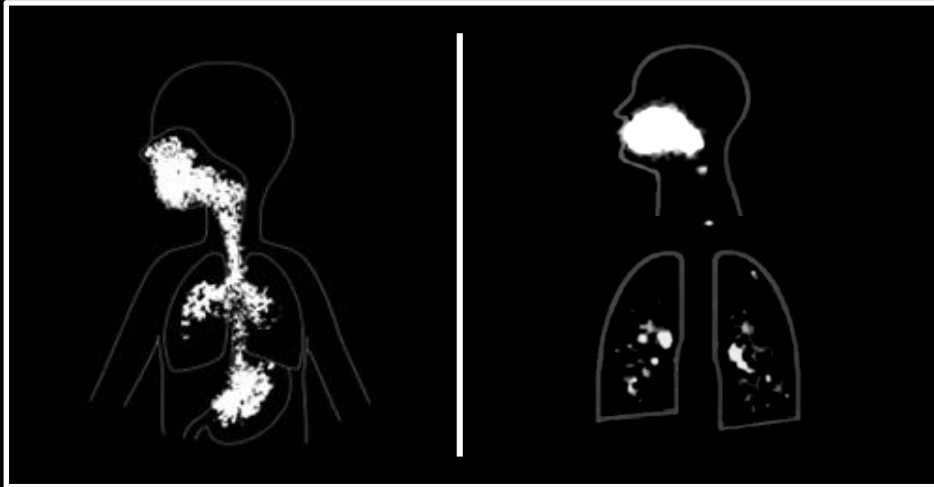


Selon la
médication...

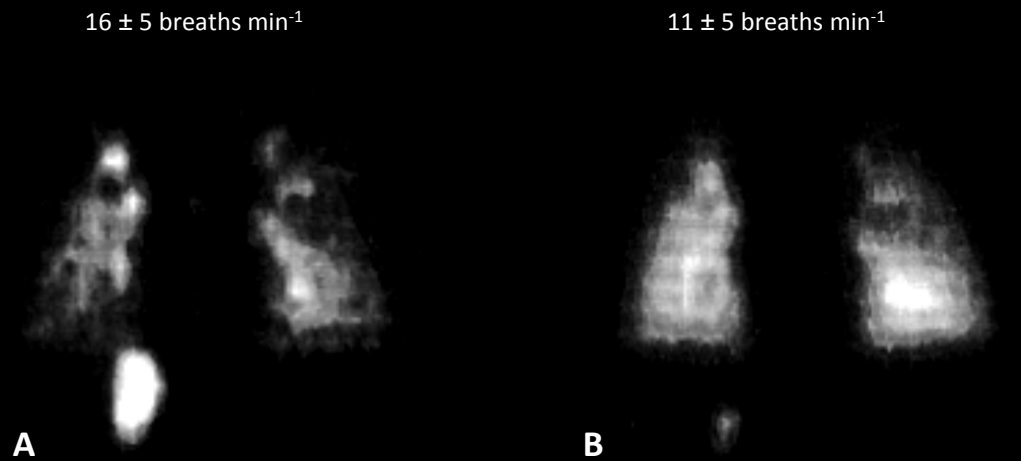
- Bronchodilateurs
- Corticoïdes
- Antibiotiques



Modification de la déposition liée au débit inspiratoire



Fréquence respiratoire

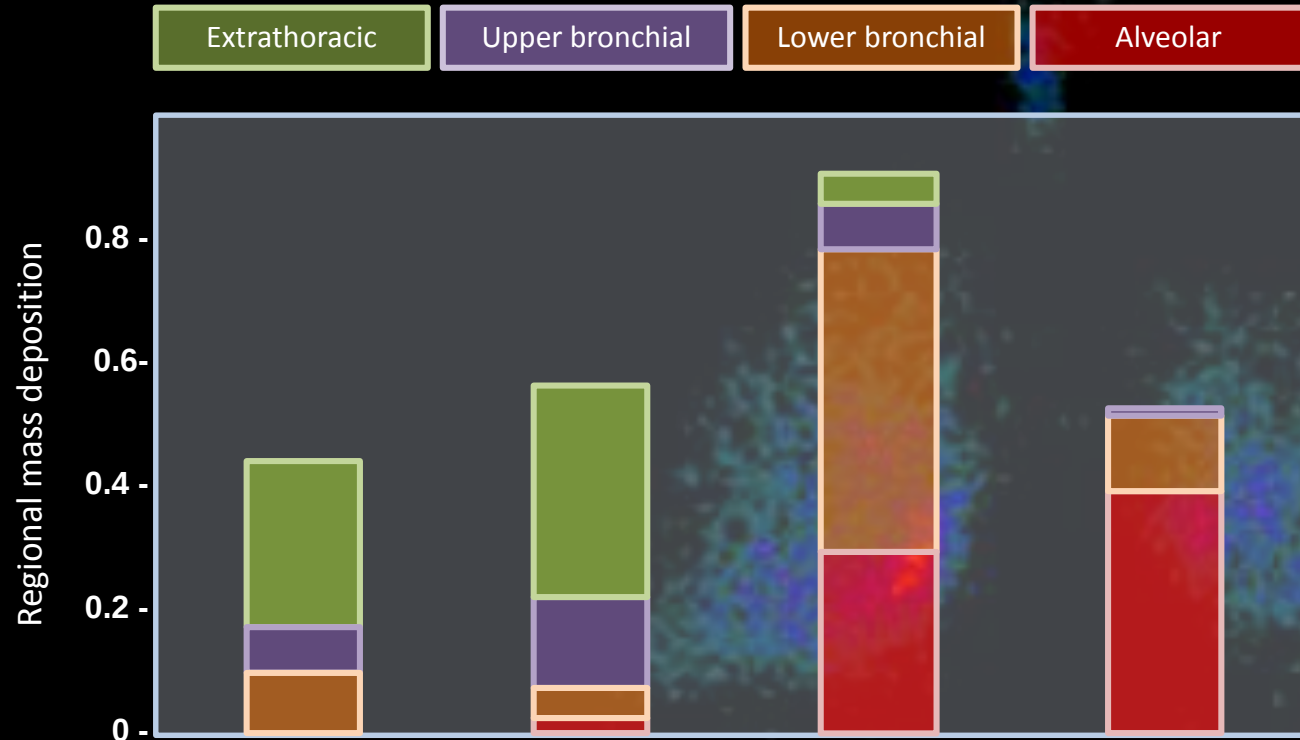


Deposition of aerosol in a healthy subject when breathed with his own (A) and guided (B) frequency

	Percentage proportions		<i>P</i> -value
	Own frequency (16 ± 5)	Guided frequency (11 ± 5)	
Lungs	48 ± 14	60 ± 17	0.003
GI tract	25 ± 9	22 ± 11	<0.3
Tongue	6 ± 4	5 ± 2	<0.14
Upper airway tract	19 ± 13	10 ± 9	0.004
Lower airway tract	3 ± 2	4 ± 4	<0.9

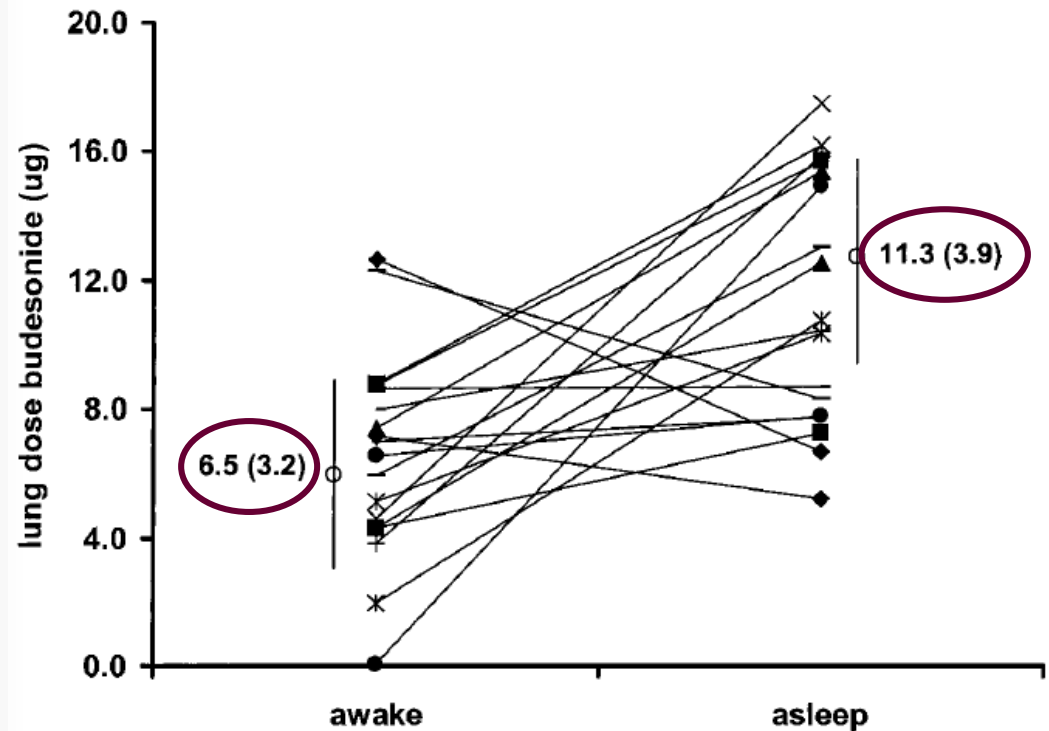
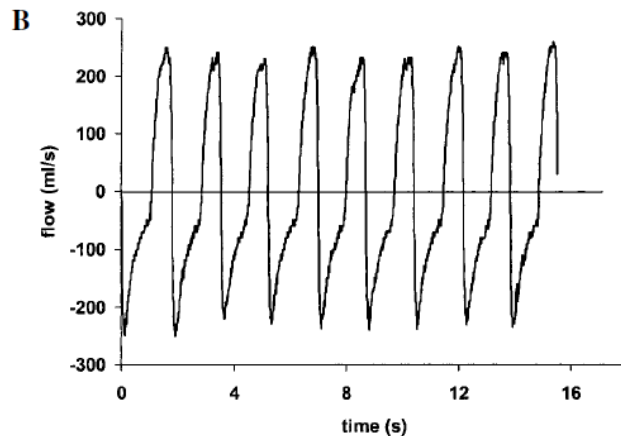
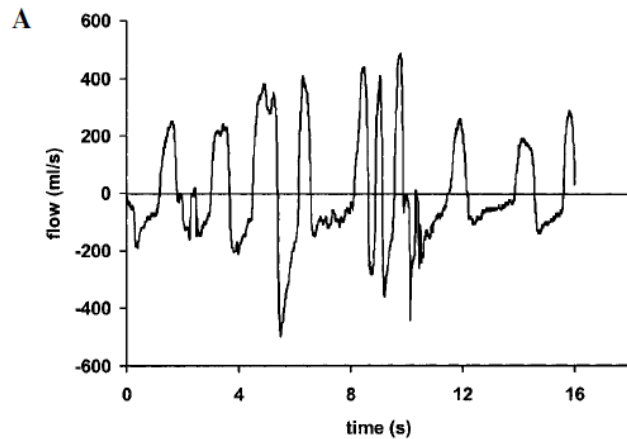
P<0.05 is considered significant.

Pattern respiratoire



Tidal volume (mL)	150	180	1000	1000
Flow rate (mL/s)	500	600	550	100
Period (s)	0.6	0.6	40	20

Influence du mode respiratoire



N=18 – pMDI + Spacer

Modes de déposition

IMPACTION

Impaction

- Par inertie
- Grosses particules
- Débit élevé



SEDIMENTATION

Sédimentation

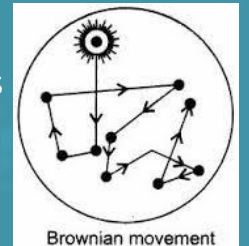
- Par gravité
- Faible débit



DIFFUSION

Diffusion

- Par mouvements Browniens
- Très petites particules



Education thérapeutique



TABLE 4. PERCENTAGE OF MISTAKES PER STEP, TOTAL PERCENTAGE OF PATIENTS MAKING AT LEAST ONE MISTAKE PER DEVICE, AND MULTIVARIATE ANALYSIS PER DEVICE

	<i>Diskus</i> n = 41	<i>Turbuhaler</i> n = 51	<i>Diskhaler</i> n = 24	<i>Single-dose dry powder inhaler</i> n = 20	<i>pMDI with spacer</i> n = 36	<i>pMDI</i> n = 32
Shake inhaler thoroughly					25 ^a	16 ^a
Remove duster cap						0 ^a
Keep inhaler in upright position		77				3 ^a
Activate inhaler	5 ^a					
Twist the grip to the right and twist back until the "click" sound		14 ^a				
Place inhaler in horizontal position		26	0			
Open and close device			21 ^a			
Place canister correctly in spacer					3 ^a	
Open device in vertically position with body below				11 ^a		
Place capsule in the device				19 ^a		
Turn back mouthpiece				11 ^a		
Push the buttons once				35 ^a		
Sit upright or stand	17	16	17	25	22	22
Breathe out to residual volume	61	75	63	70		59
Tilt head back (hyperextend)	63	61	75	55		63
Close lips on inhaler	0	0	8	15	0	3
Activate canister in beginning of Slow inhalation						72 ^a
Continue to inhale slowly and deeply						31 ^a
Inhale forcefully and deeply	10 ^a	6 ^a	0 ^a	0 ^a		
Activate inhaler once					25 ^a	
Breath in and out through mouthpiece at least three times					33	
Hold breath for at least 5 sec	51	38	58	80		50
Brath out away from mouthpiece	10	2	8	10		13
Patients performing at least one essential step incorrectly	15%	18%	21%	45%	47%	81%
Odds ratio	1.0	1.1	1.5	5.2	4.4	25.7
95% confidence interval		0.4-3.6	0.4-5.8	1.5-18.3	1.5-13.3	7.3-90.7

^aEssential step.

Percentage of patients performing at least one step incorrectly does not have to be sum of the essential steps separately since per demonstration multiple essential steps can be performed incorrectly. Odds ratio from Diskus is reference value for other devices. Odds ratios were adjusted for whether or not receiving inhalation instruction. pMDI, pressurized meter dose inhaler.

Influence de l'éducation

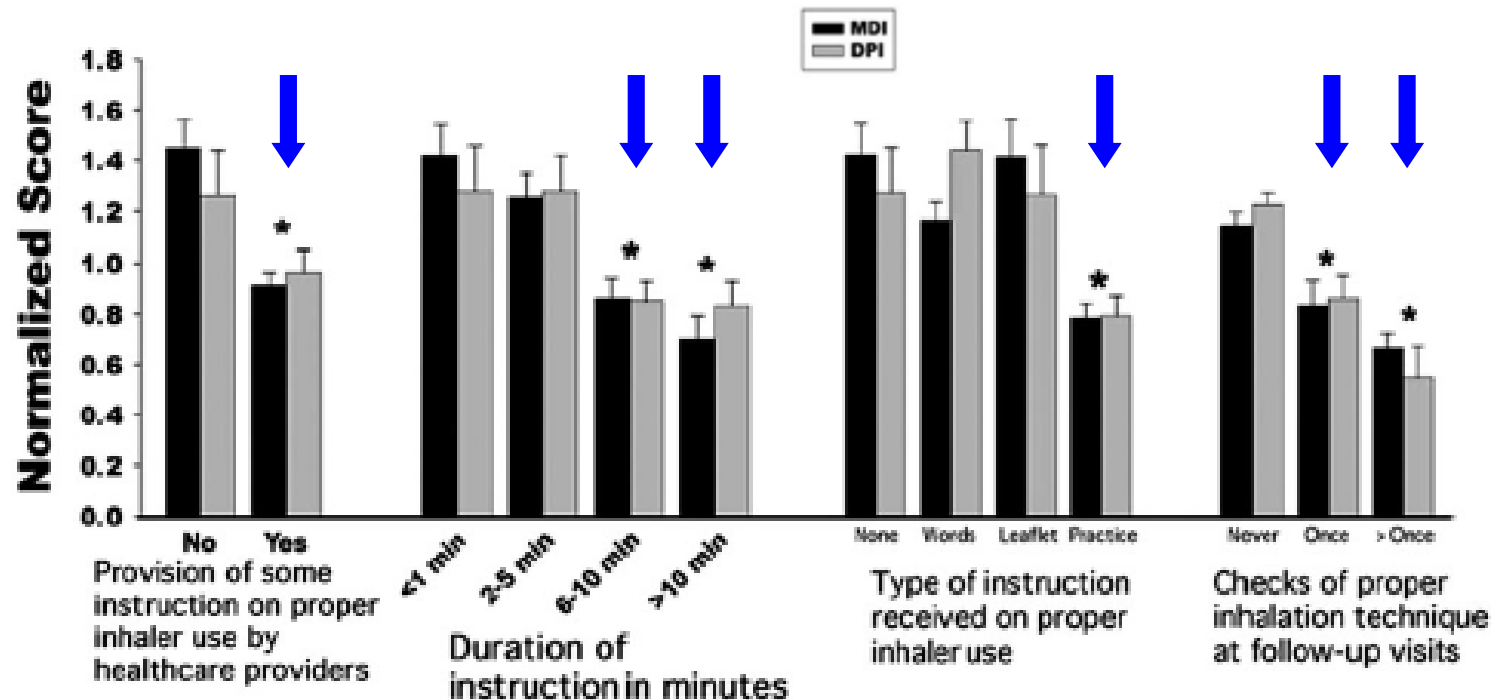
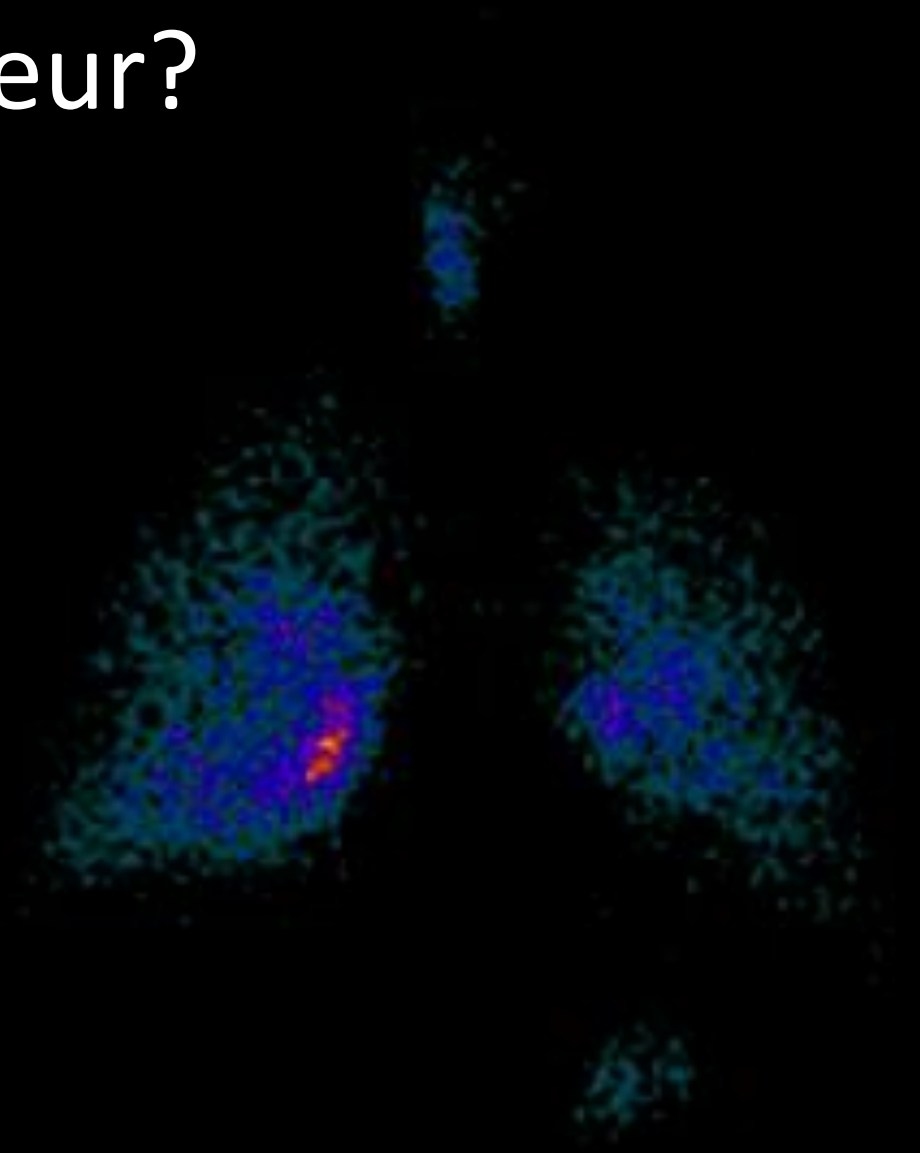
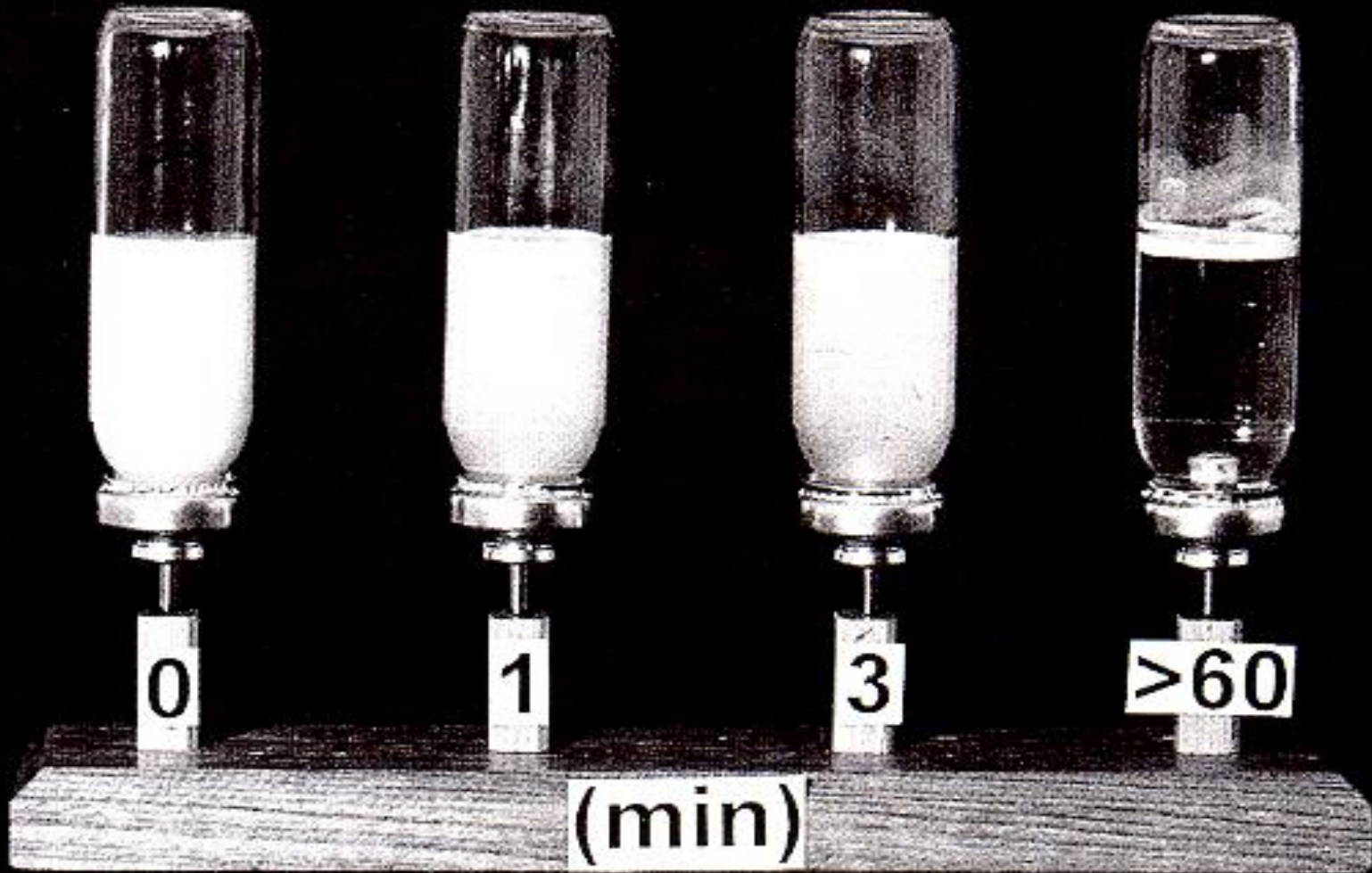


Fig. 22. Normalized score of Inhalation technique (lower is better) with pressurized metered-dose Inhalers (pMDIs) and dry-powder Inhalers (DPIs), relative to: having received any instruction from a health-care provider; the duration of the initial instruction; the type of instruction; and the number of times that a health-care provider re-checked the patient's inhalation technique. * $p < 0.001$. (From Reference 280, with permission.)

Comment utiliser un aérosol doseur?

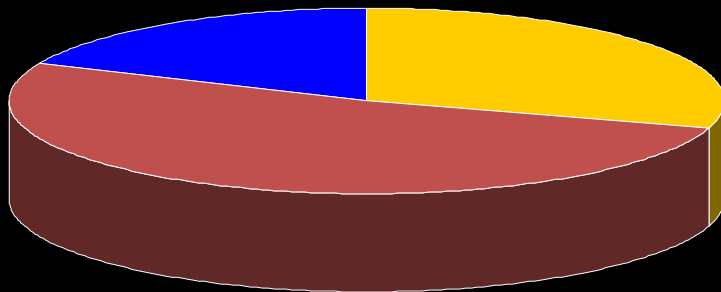


Bon usage...

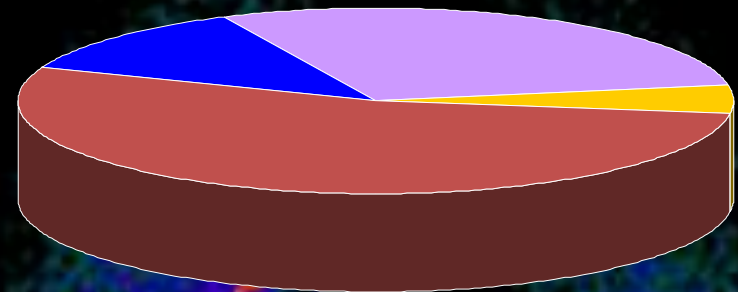


Effet de la chambre

Deposition (% ND)

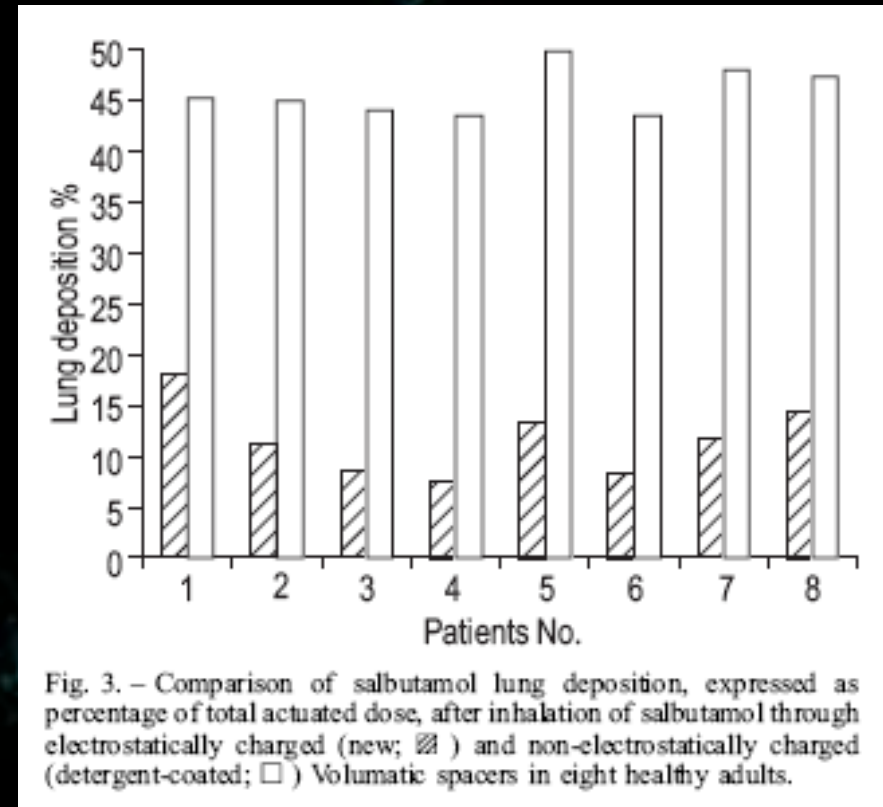
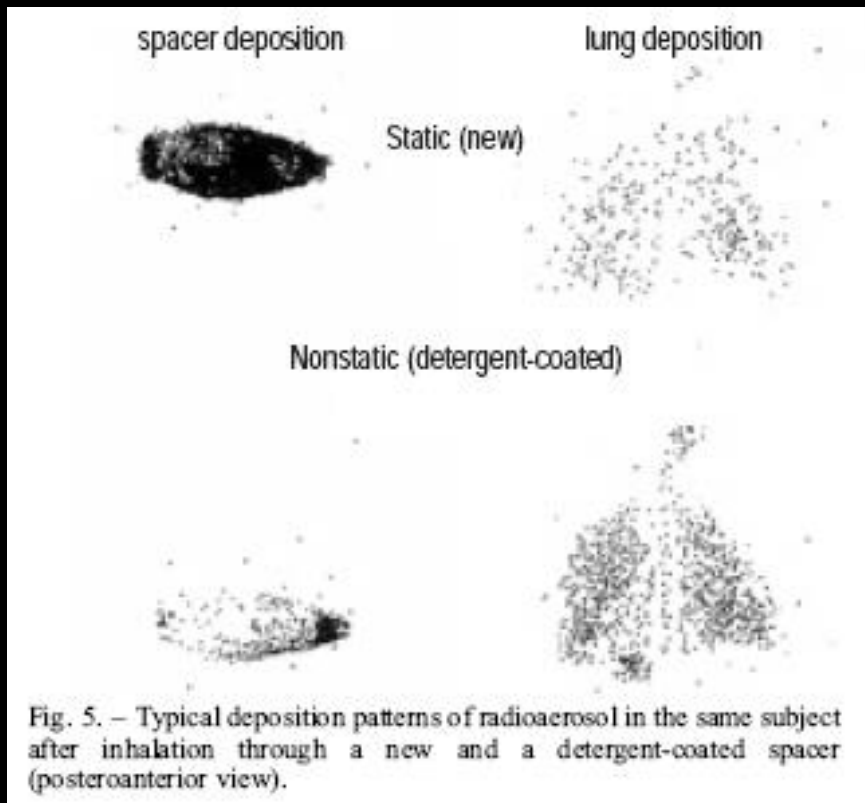


 Exhaled	 Spacer
 Lungs	 Oropharynx



+ Spacer

Influence du rinçage



Influences possibles



APPAREILLAGE

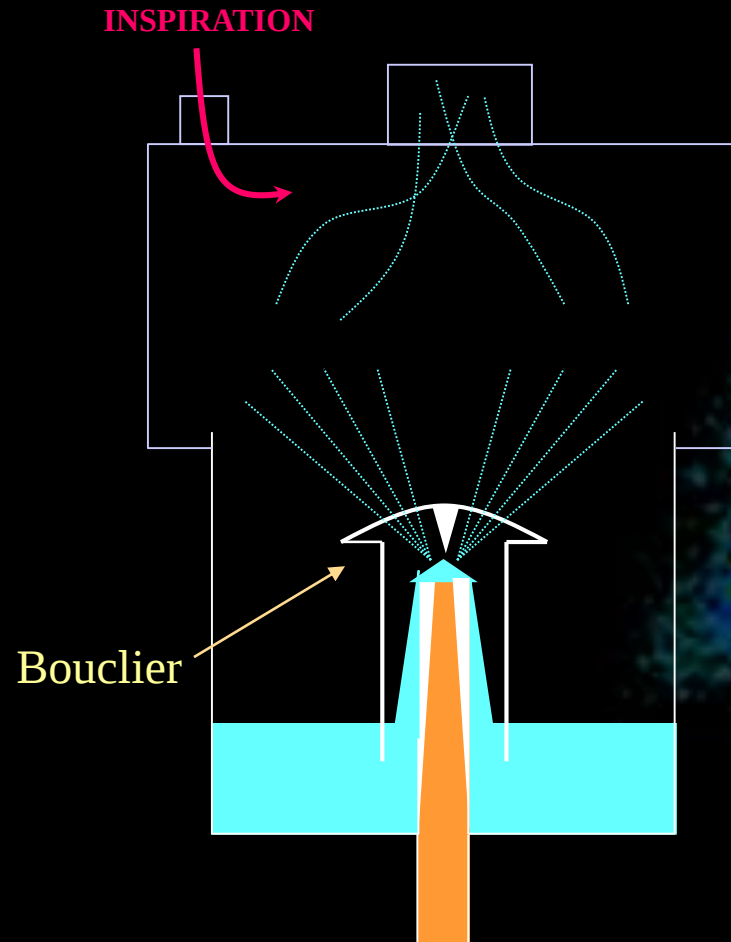


Quel est le mode le plus efficace?

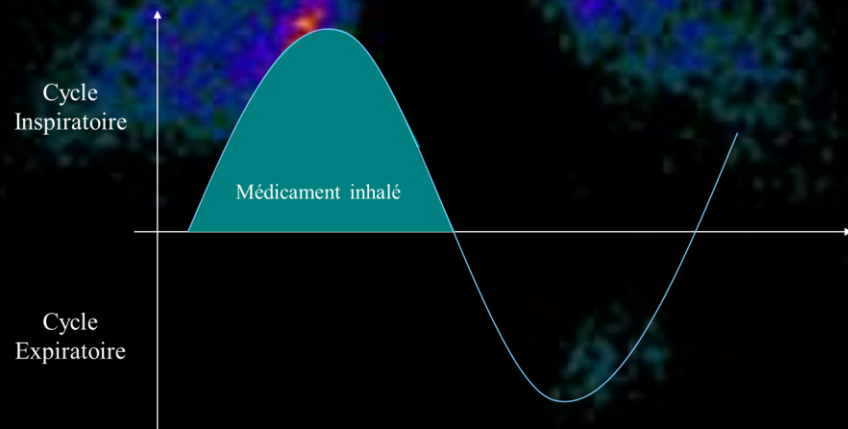
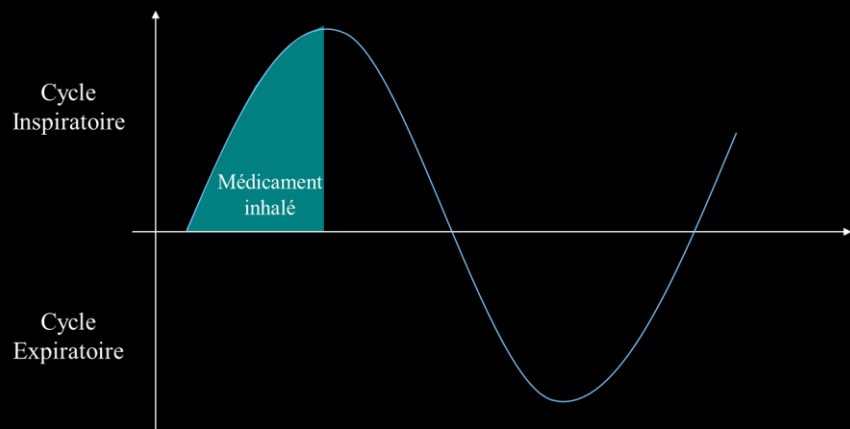
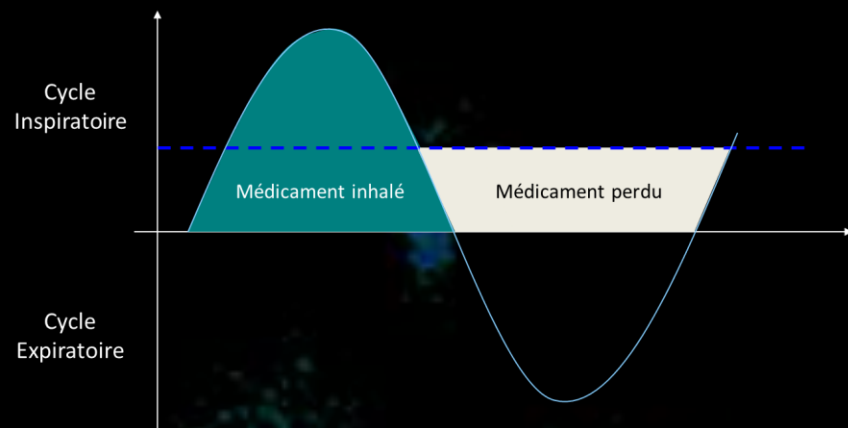
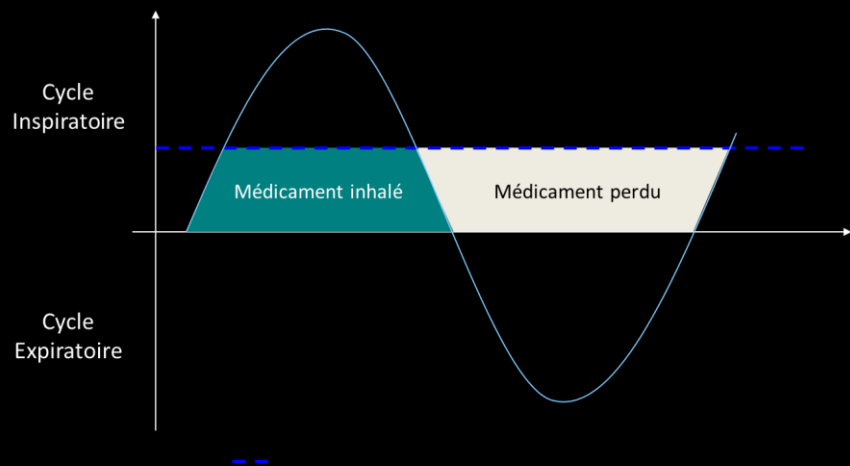
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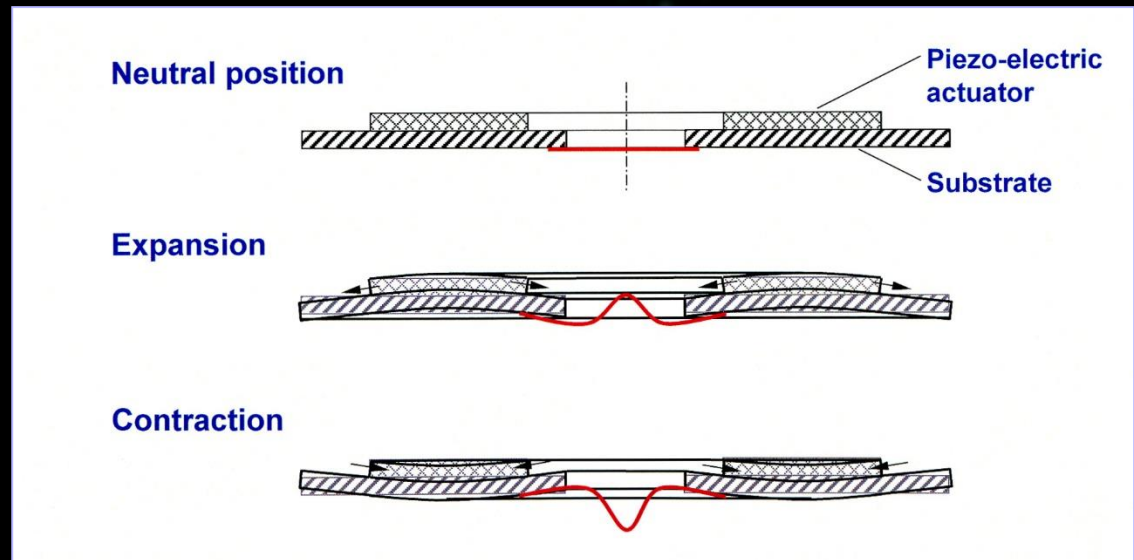
Pneumatique



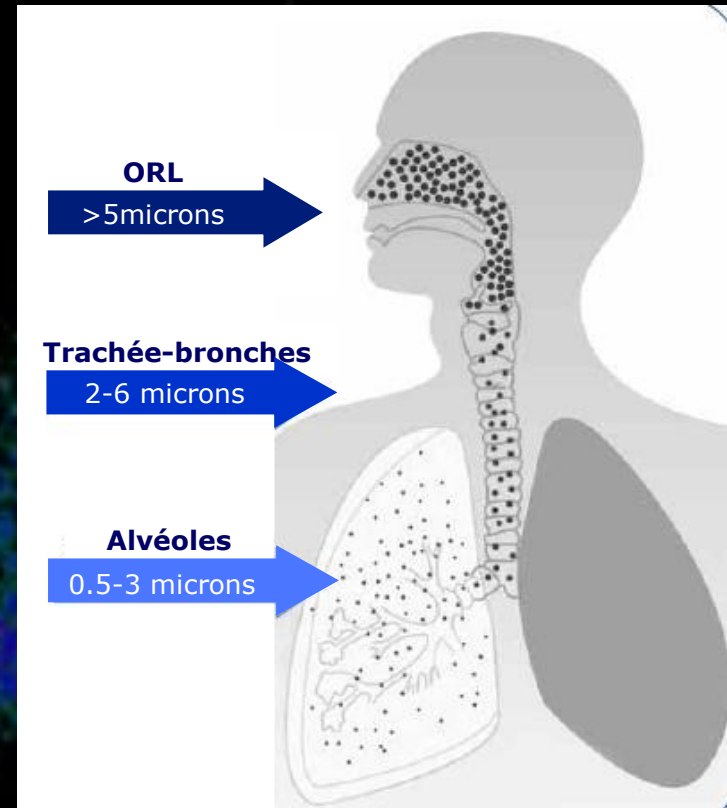
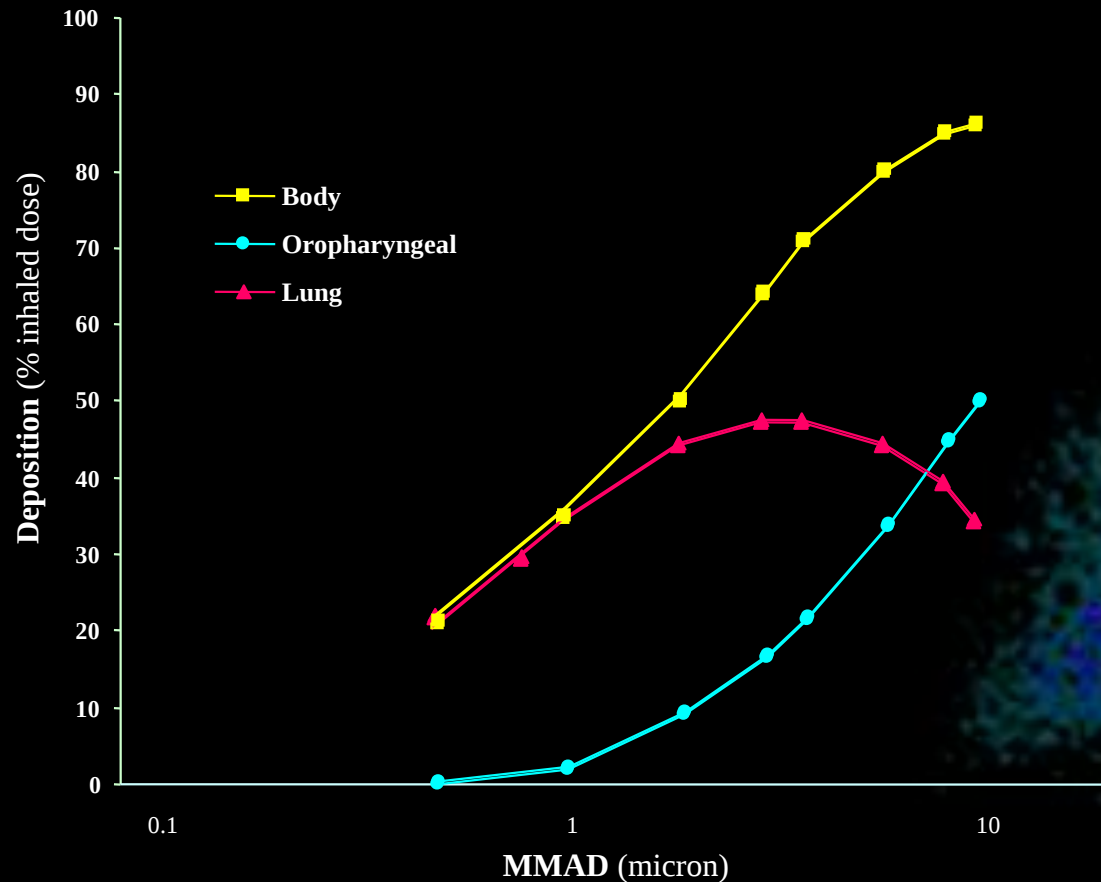
$$\frac{1}{2} m \cdot v^2 + P = \text{constant}$$



Membrane vibrante



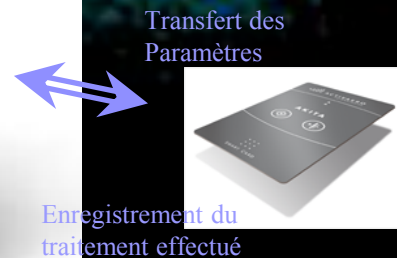
Relation *In vitro* – *In vivo*



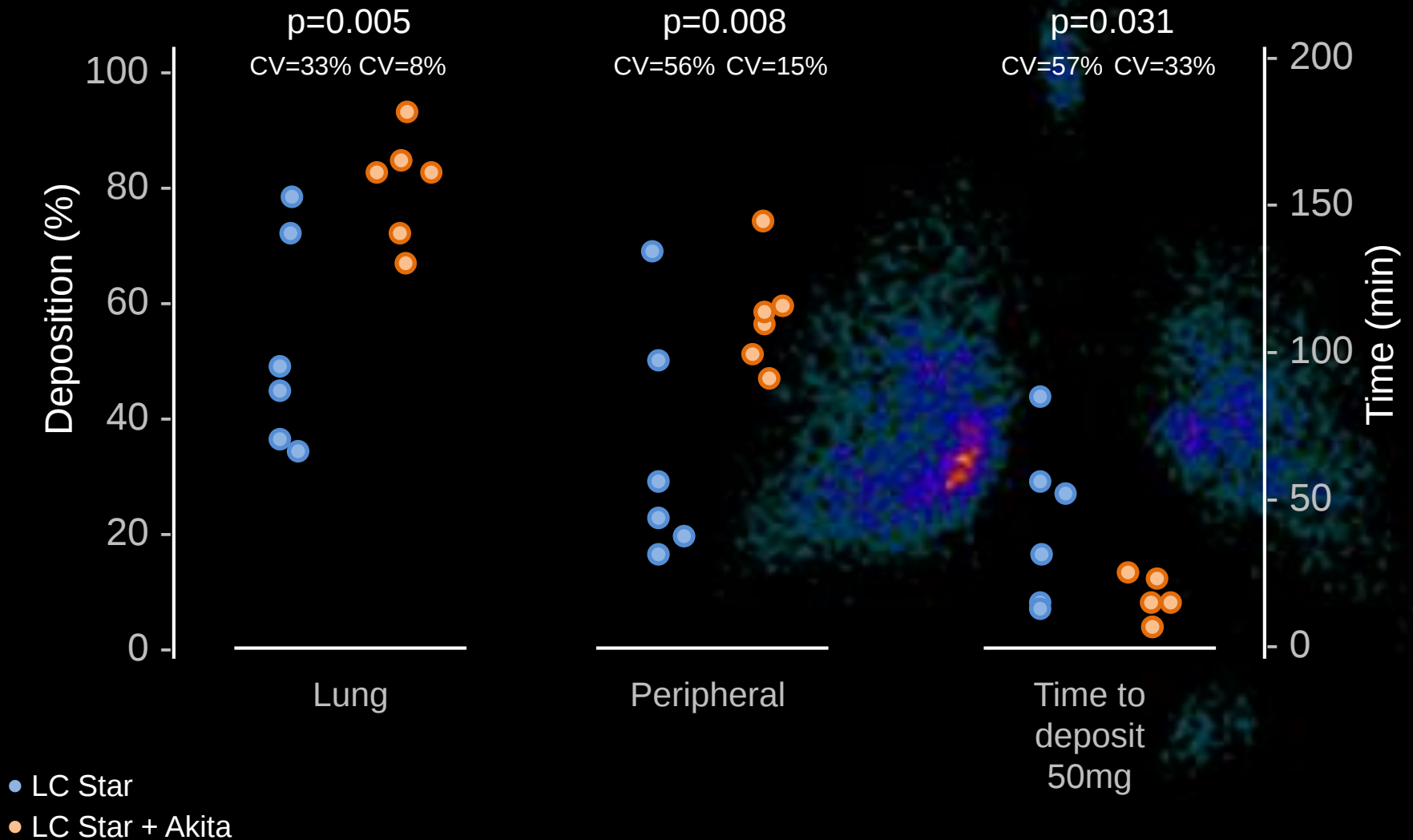
**MMAD must be around 3 microns
for an optimal lung deposition**

AKITA (Activaero)

- Contrôle complet du débit médicamenteux et pas de perte durant l'expiration
- Adapté à chaque patient et à la cible
- Contrôle de compliance



Akita - *Déposition*



Quelle est la meilleure interface?

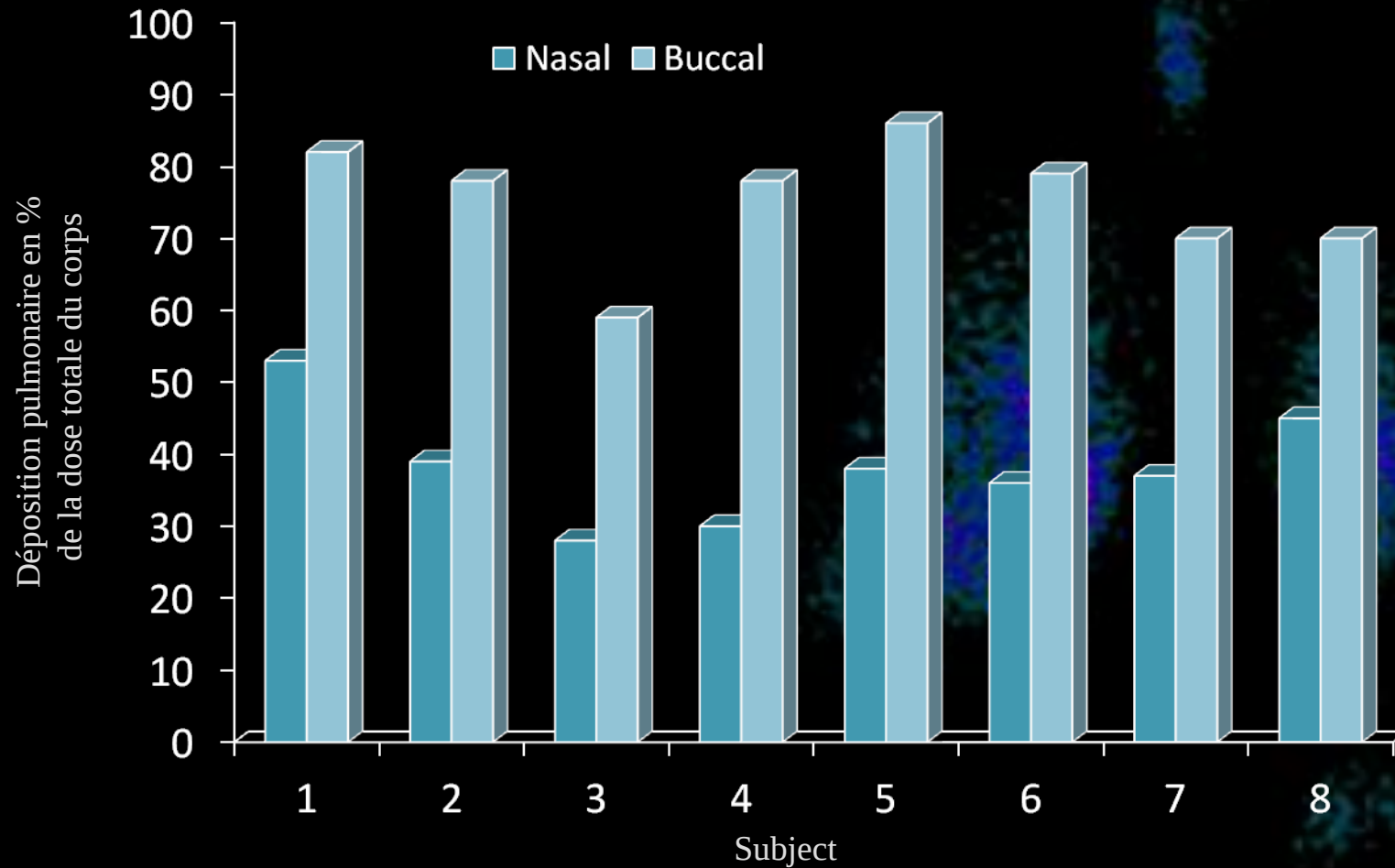
Masque **A**

Embout **B**

Start the presentation to activate live content

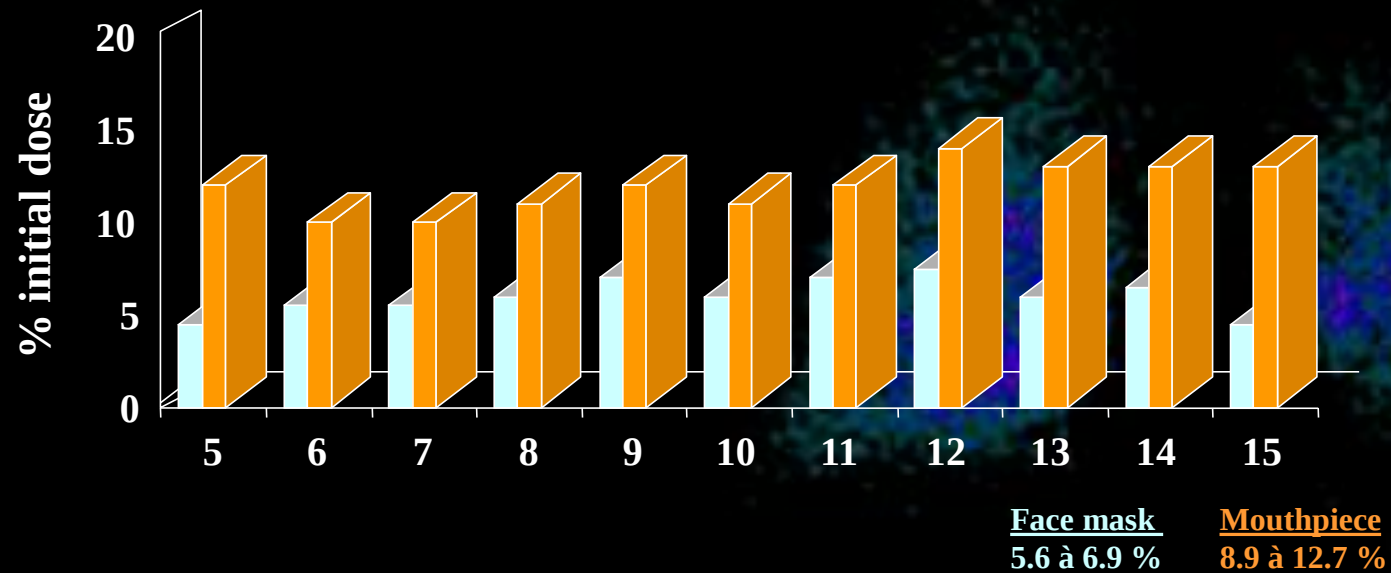
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Interface



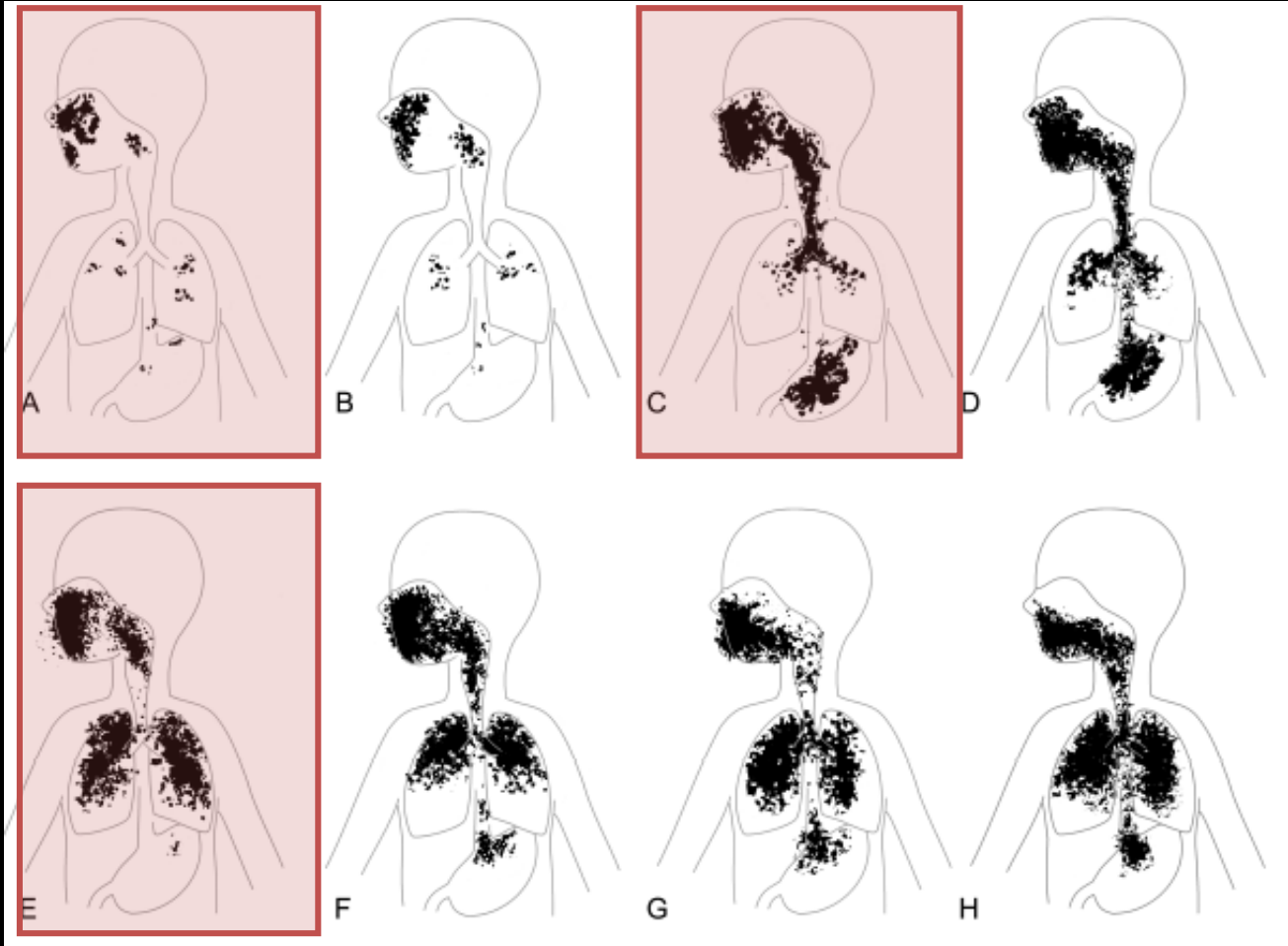
Fixed flow = 8lm^{-1}

Interface



323 asthmatics (5-15y)
budesonide 0.5mg/ml in 2 ml
Compressor: 7,5 L/min
Time : 5 minutes

Masque et pleurs



Déposition de Salbutamol marqué chez un enfant

- (A) Avec un pMDI + spacer et masque non adapté
- (B) Avec un nébuliseur et un masque non adapté
- (C) Avec un pMDI + spacer et masque adapté, en criant
- (D) Avec un nébuliseur et masque adapté, en criant
- (E) Avec un pMDI + spacer et masque adapté, en respiration calme
- (F) Idem
- (G) Avec un nébuliseur et masque adapté, en criant
- (H) Idem

Faut-il diluer le produit à nébuliser?

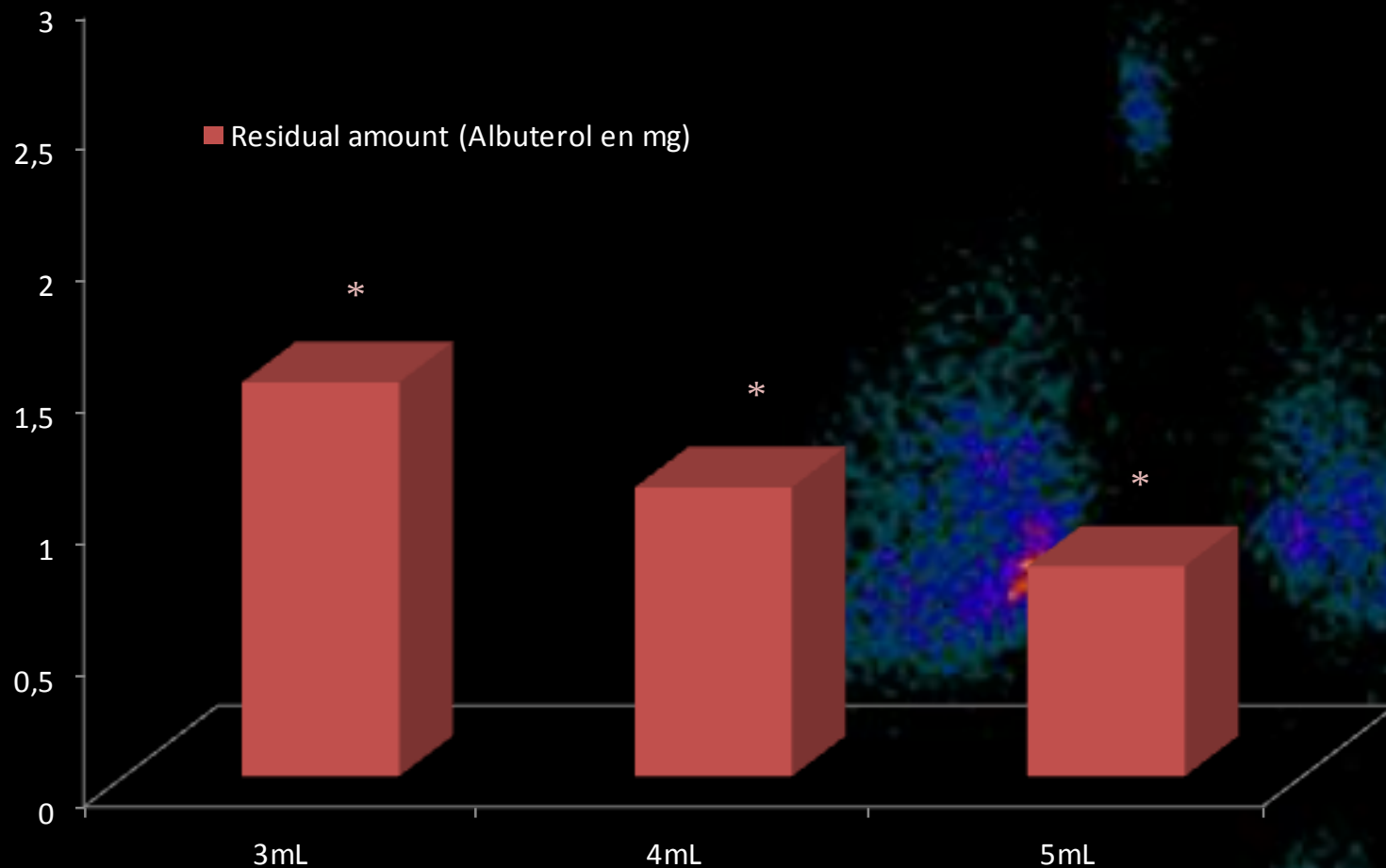
Oui

Non

Start the presentation to activate live content

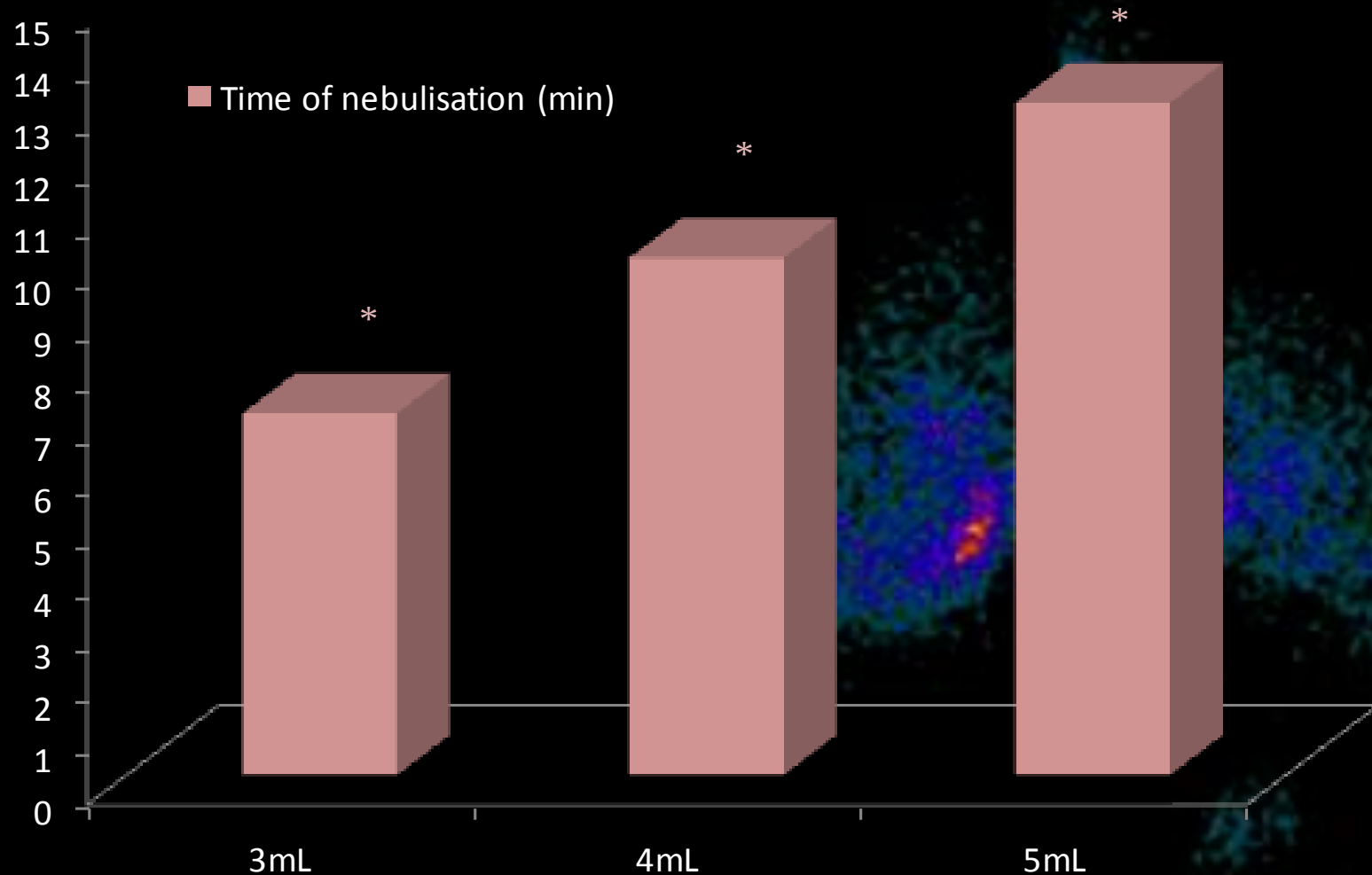
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Volume de dilution



Flow = 8L/min

Volume de dilution



Flow = 8L/min

Take home message

- Bien connaître
- Réévaluer en permanence la technique



Merci!

