How smoking might exacerbate COVID-1 disease



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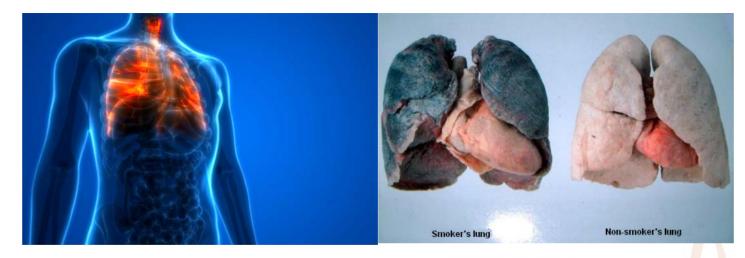
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Presentation Objectives

- In this presentation, you will be introduced to:
 - The general architecture of the lungs and lung epithelial tissue.
 - The basic of how the SARS-CoV-2 Virus infects cells.
 - The impact of cigarette smoke on the COVID-19 Disease.



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The Respiratory Tract Anatomy

Upper respiratory tract

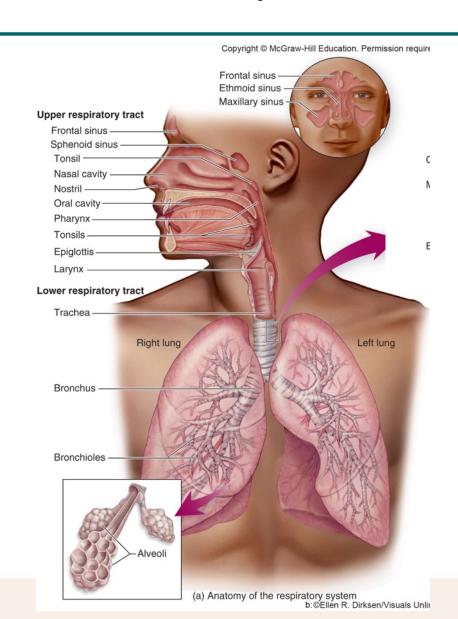
- Mouth
- Nose
- Nasal cavity
- Sinuses
- Throat (pharynx)
- Epiglottis
- Larynx

Lower respiratory tract

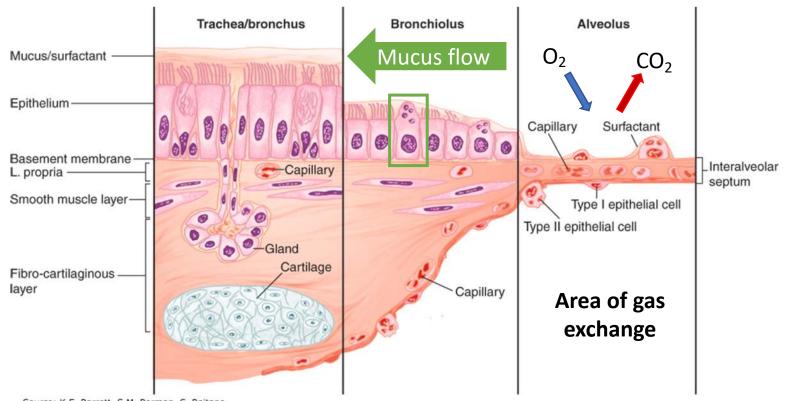
- Trachea
- Bronchi
- Bronchioles
- o alveoli







The lung cilia move mucus to the pharynx for clearance in the GI track



Source: K.E. Barrett, S.M. Barman, S. Boitano, J.F. Reckelhoff: Ganong's Medical Physiology Examination & Board Review: www.accessmedicine.com Copyright © McGraw-Hill Education. All rights reserved.

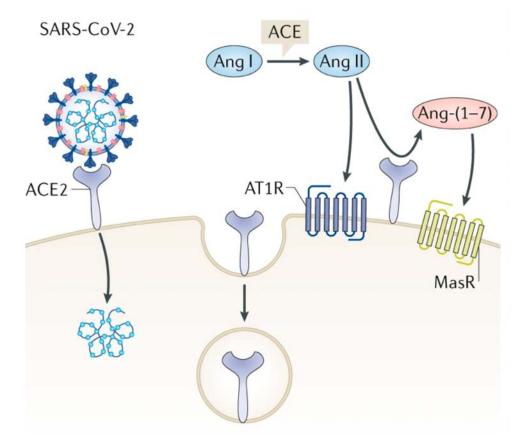




- The ciliary epithelium moves mucus to the trachea, where it passes the vocal cords and reaches the larynx.
- Mucus enters the pharynx and is swallowed (approximately 1 fluid oz of airway mucus/day).

SARS-CoV-2 uses the angiotensin I converting enzyme 2 (ACE2) protein to infect cells

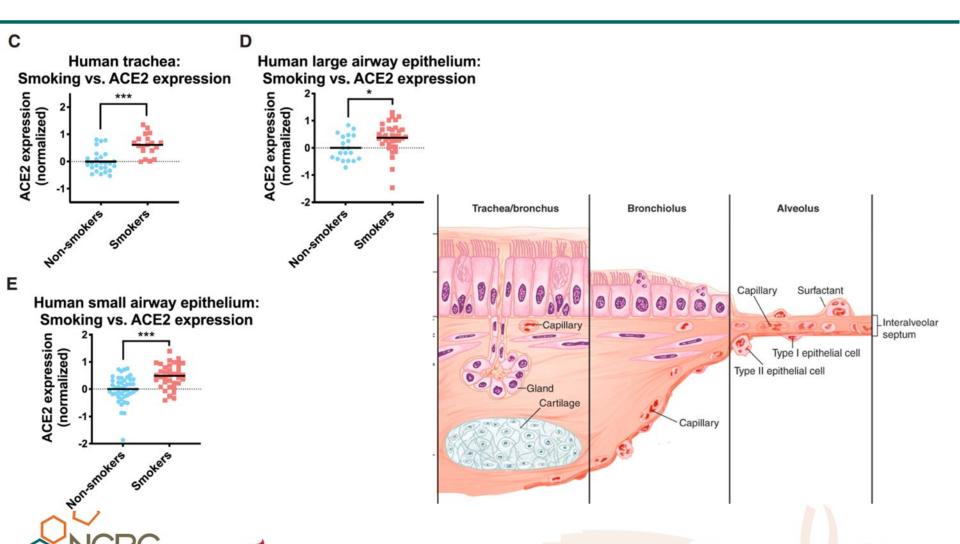
Viral binding







Smoke increases ACE2 expression in lung tissue

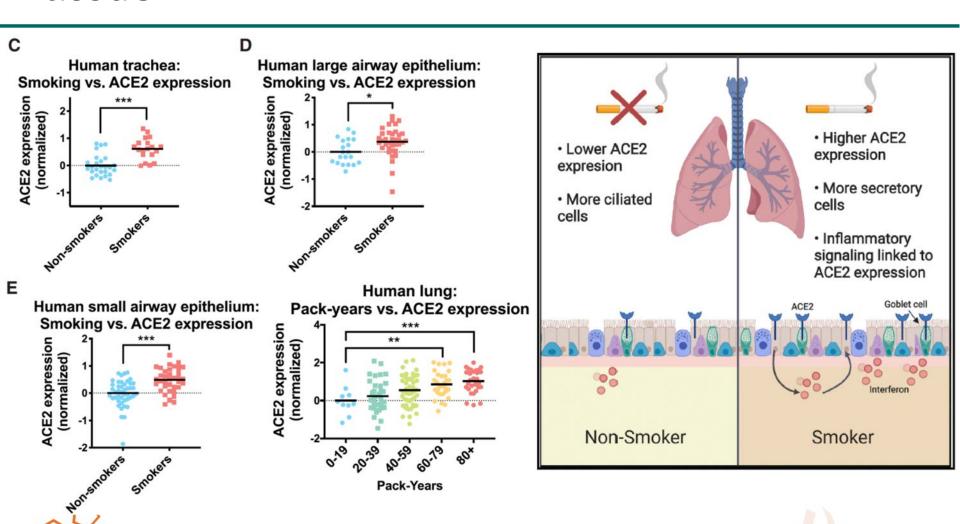


Nicotine & Cannabis

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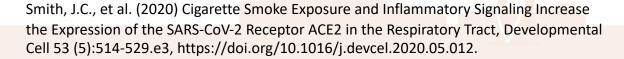
Smith, J.C., et al. (2020) Cigarette Smoke Exposure and Inflammatory Signaling Increase the Expression of the SARS-CoV-2 Receptor ACE2 in the Respiratory Tract, Developmental Cell 53 (5):514-529.e3, https://doi.org/10.1016/j.devcel.2020.05.012.

Smoke increases ACE2 expression in lung tissue

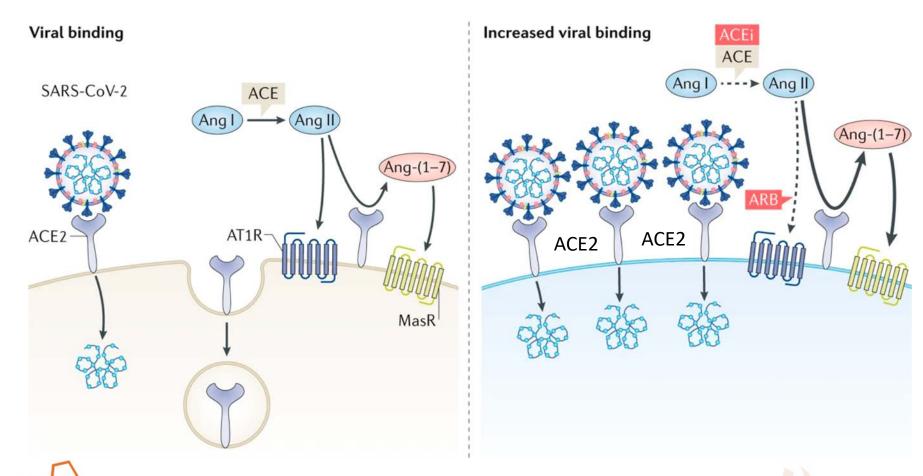


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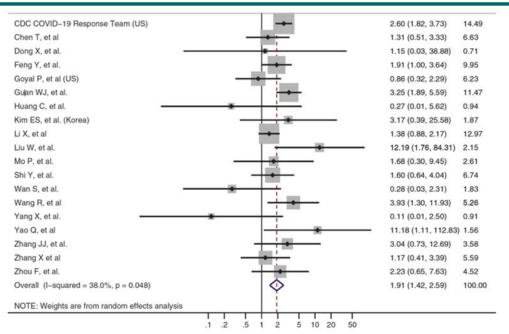
Increasing ACE2 receptors might increase viral infectivity







Smokers are almost 2-times more likely to have severe COVID-19 disease



- 218 smokers (29.8%) experienced disease progression, compared with 17.6% of non-smoking patients.
- Conclusion: significant association between smoking and progression of COVID-19 (OR 1.91, 95% confidence interval [CI] 1.42-2.59, p = .001).

Study	Smokin Events		Non-si Events		Odds Ratio	OR	95%-CI	Weight (fixed)	Weight (random)
X. Chen 2020	3	14	28	125	-+:	0.94	[0.25; 3.62]	16.9%	16.5%
W. Guan 2020	17	137	49	948	-	2.60	[1.45; 4.66]	41.4%	29.9%
C. Huang 2020	0	3	13	38	* -	0.27	[0.01; 5.62]	8.4%	5.0%
W. Liu 2020	3	5	8	73	l i	12.19	[1.76; 84.31]	1.6%	10.3%
X. Yang 2020	0	2	32	50 —	<u> </u>	0.11	[0.01; 2.50]	11.5%	4.9%
F. Zhou 2020	5	11	49	180		2.23	[0.65; 7.63]	11.8%	18.1%
J. Zhang 2020	6	9	52	131	+ + -		[0.73; 12.69]	8.5%	15.3%
Fixed effect model		181		1545	\	1.98	[1.29; 3.05]	100.0%	
Random effects mode Heterogeneity: $I^2 = 44\%$,		, p = 0).10	0.0	1 0.1 1 10 10		[0.95; 4.10]		100.0%

 smoking increases the risk of severe COVID-19 by around twofold (OR = 1.98; 95% CI: 1.29-3.05).





Patanavanich & Glantz. (2020). Smoking is associated with COVID-19 progression: a meta-analysis. *Nicotine & Tobacco Research*

Zhao et al. (2020). The impact of COPD and smoking history on the severity of COVID-19: a systemic review and meta-analysis. Journal of medical virology.

Conclusions

- Smoking increases the expression of ACE2 protein in lung epithelial cells.
 - This might increase the infectability of lung tissue from smokers.

- Patients that smoke experience greater disease progression than non-smoking patients.
 - Meta-analysis of data from peer-reviewed papers



Questions

- UC Merced
 - Dept. of Psychology
 - Dr. Anna Song
 - Dept. of Molecular Cell Biology

- UC San Francisco
 - The Center for Tobacco Control Research and Education
 - Dr. Arthur Durazo





