HUMIDIFICATION
REQUIRED OR NECCESARY ON THE WORKPLACE?

New Royal Resolution 23/03/2016 about art.3/36 en 4 ARAB/RGPT

13 October 2016

Msc. Dirk Vanhove

Sales Manager CONDAIR

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RR 23/03/2016 about art.3/36 and 4 ARAB/RGPT

- In a airconditioning installation the average relative humidification must between 40 and 60% on a working day, unless it's not possible for technical reasons.
- *Exception* :The relative humidity are allowed between 35% and 70% when the employer shows that there are no polution (chemical or biological argentia)in the air and no risks for safety and health for the people on the workfloor/shop.

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Humidity level

- ***Relative humidity RH in %***
- $$\frac{\text{Quantity water vapor in the air}}{\text{Maximum quantity water vapor in the air (dewpoint)}}(\%)$$
- ***Absolute humidity***
- The quantity water vapor present in some quantity air by a certain temperature and pressure g/m3 or g/kg
- 20°C/40% = 5,79 g/kg and Pressure 101.325 kPa (Density 1,2 kg/m3)
- 40% / 20°C is the same as 55% / 15°C and 30%/ 25°C
- Always in relation to the temperature !

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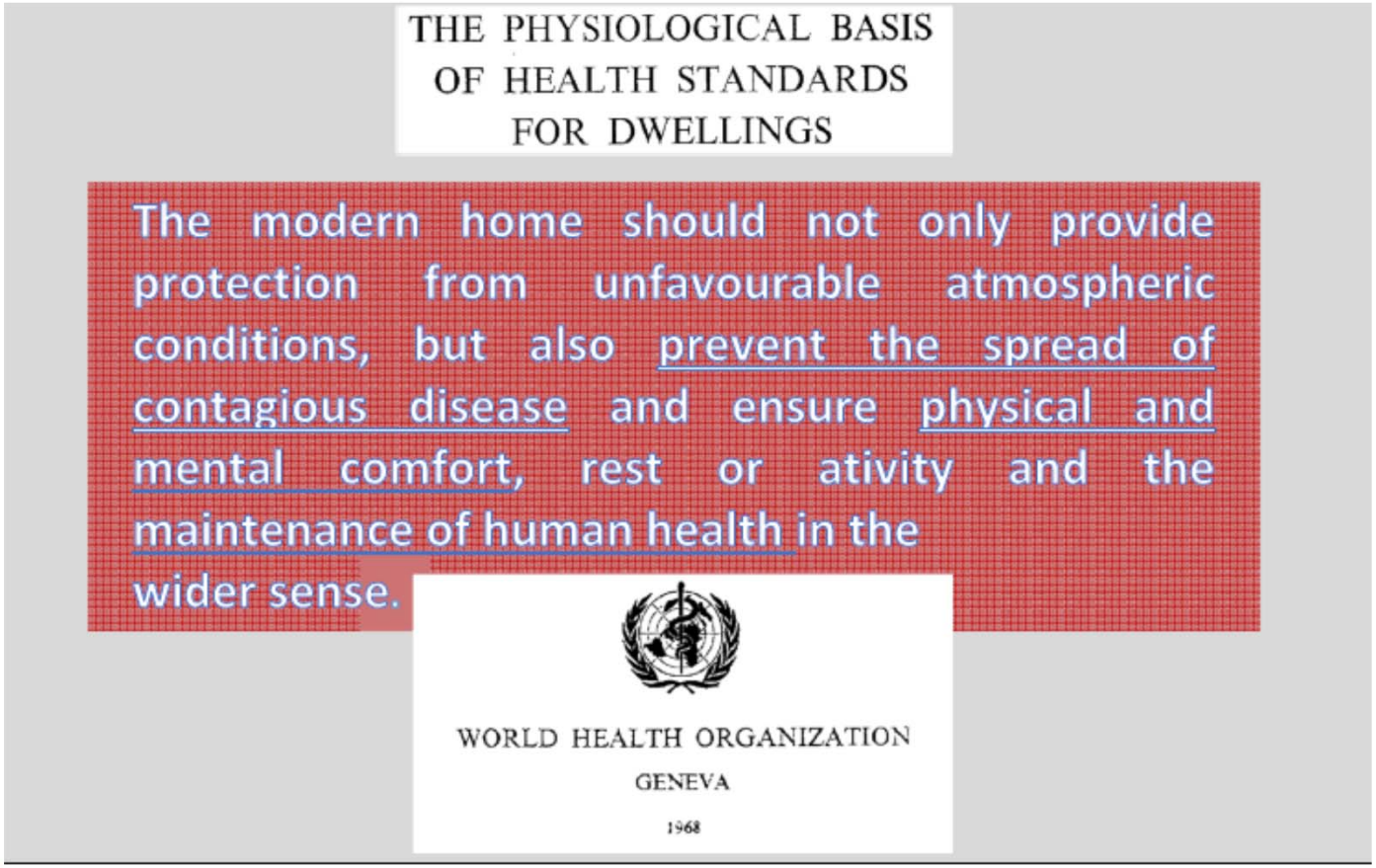
Humidity and health standards



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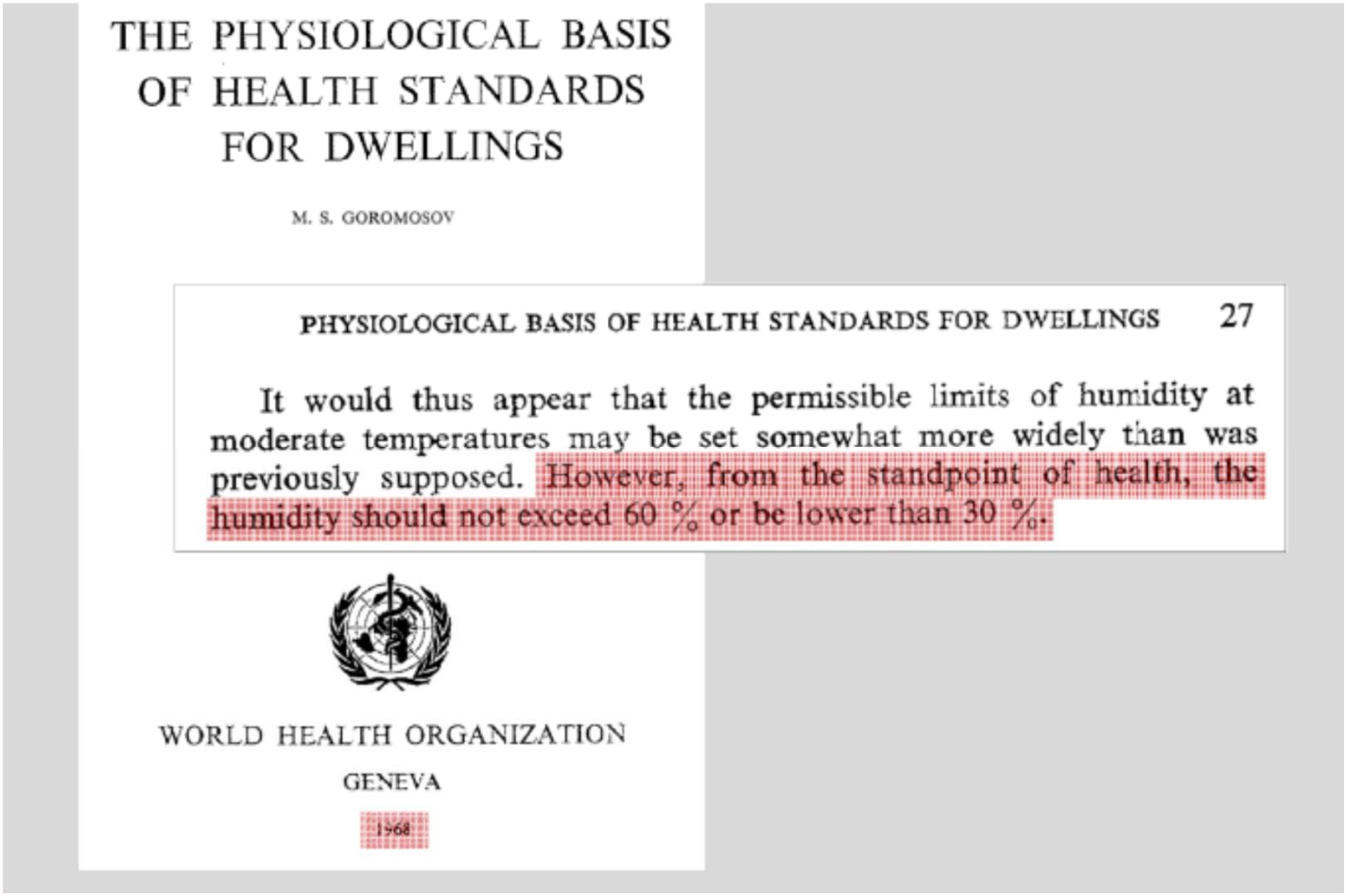
Humidity and health standards



THE PHYSIOLOGICAL BASIS OF HEALTH STANDARDS FOR DWELLINGS

M. S. GOROMOSOV

PHYSIOLOGICAL BASIS OF HEALTH STANDARDS FOR DWELLINGS 27

It would thus appear that the permissible limits of humidity at moderate temperatures may be set somewhat more widely than was previously supposed. However, from the standpoint of health, the humidity should not exceed 60 % or be lower than 30 %.

WORLD HEALTH ORGANIZATION

GENEVA

1968

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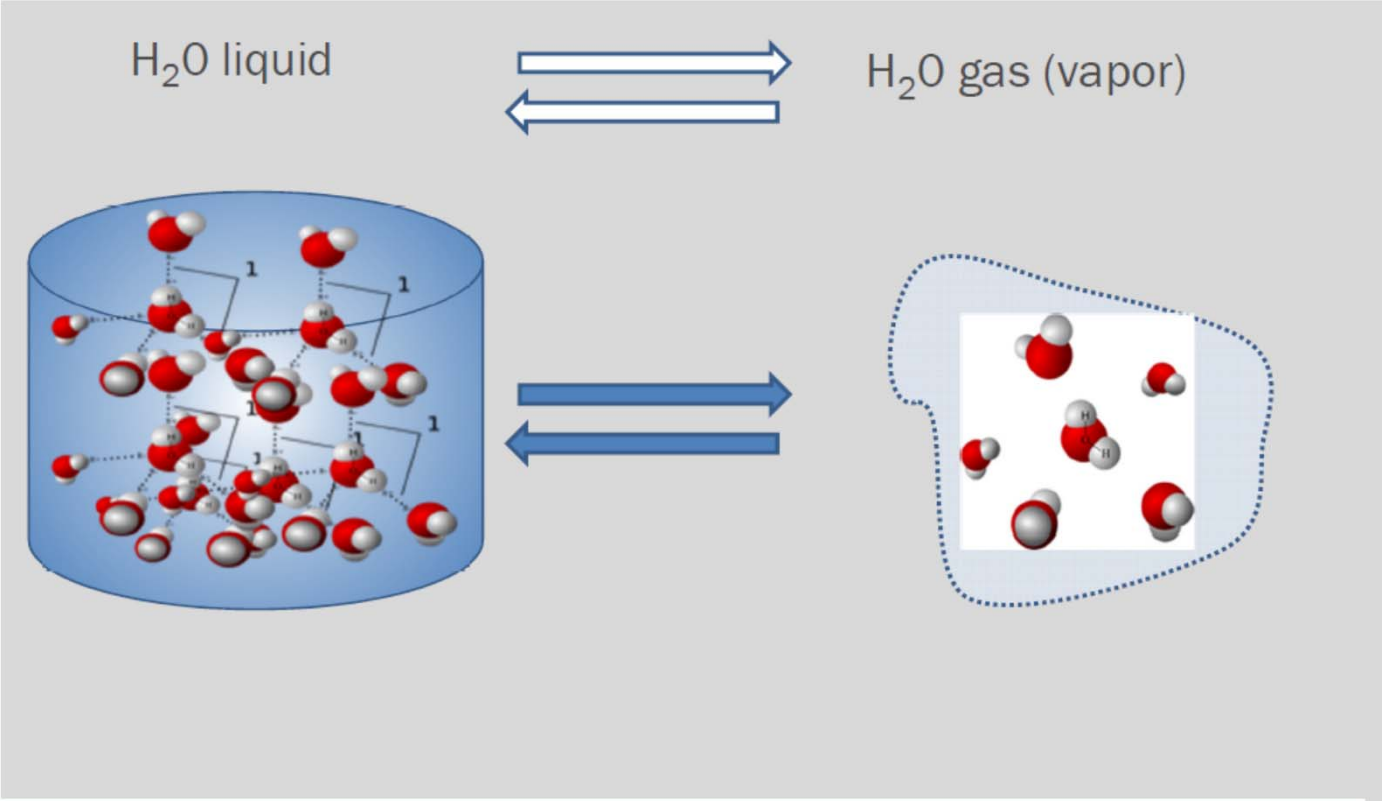
Water and vapor



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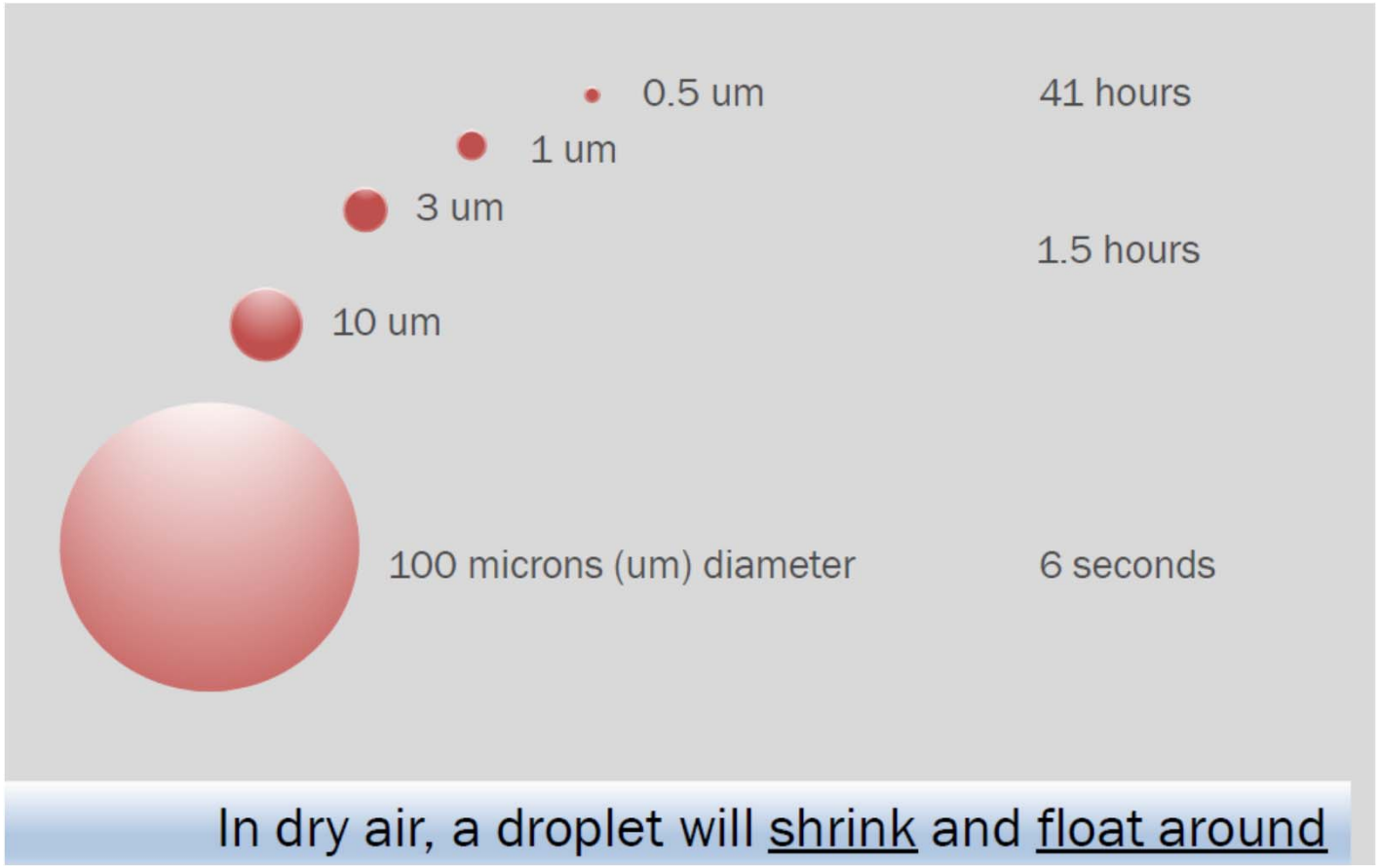
Water droplets



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Dehydration

this makes us vulnerable to dehydration

- an average sized human at rest inhales and exhales approx. 14,000 L of air per day
- in air with RH 20%, about 800 ml of water is lost through respiration and through the skin in 8 hrs
- a 50 kg person loses 1 - 2% body weight while DOING NOTHING
- by the time our body volume sensors activate thirst centers, we are already clinically dehydrated

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What dry air do with our body

Dry air is a dangerous indoor pollutant for humans!

dehydration

- respiratory infections
- asthma and allergies
- fatigue, weight gain
- constipation and digestive disorders
- increased cholesterol
- joint pain and stiffness
- increased blood viscosity

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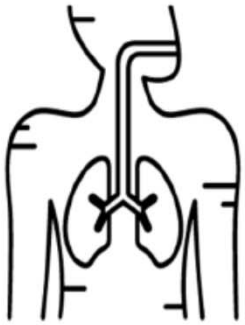
What dry air do with us

low indoor humidity causes

decreased brain function

eye irritation

skin thinning



increased infections

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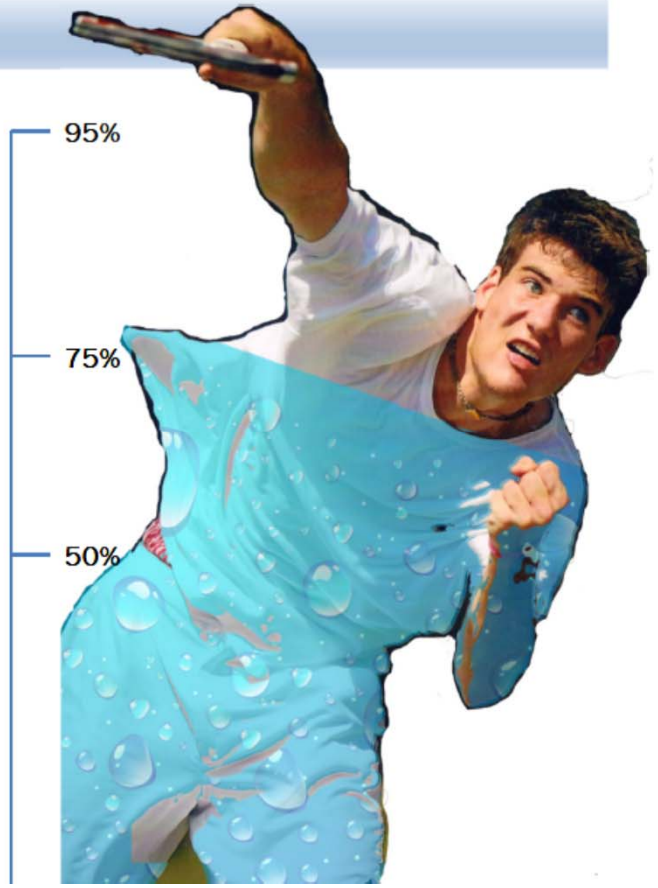
Hydration

proper hydration is **essential**

the average person requires 75% H_2O

- to facilitate food digestion to produce energy and build tissues
- to transport dissolved O_2 and CO_2 (breathing)
- to keep our structure and epithelial layers intact
- to allow immune system training for allergy and infection prevention



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Dehydration

even mild dehydration impairs our performance

1% decrease of our body weight from water losses diminishes our:

- ability to think
- short-term memory
- concentration
- reaction times
- visual-motor tracking

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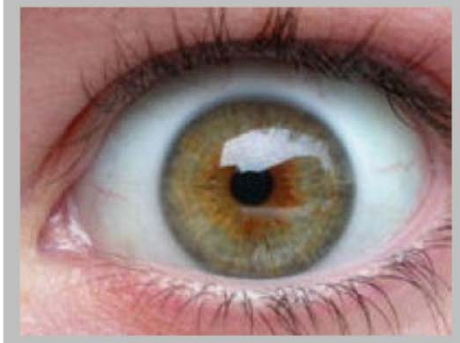
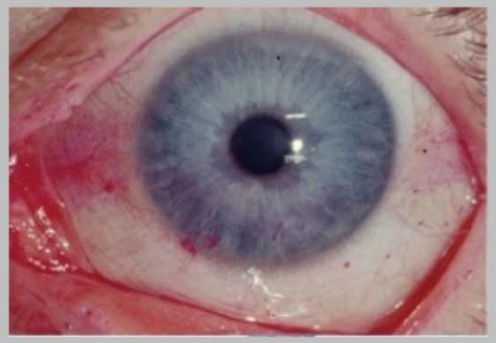
Dry air and Eyes

Dry Eye Syndrome

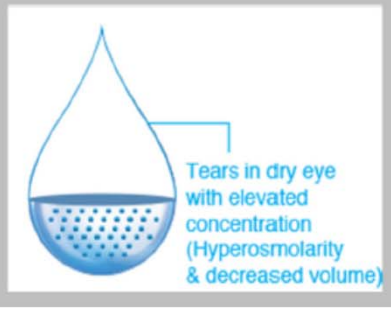




- redness
- scratchiness
- burning sensation

Well hydrated

Dry



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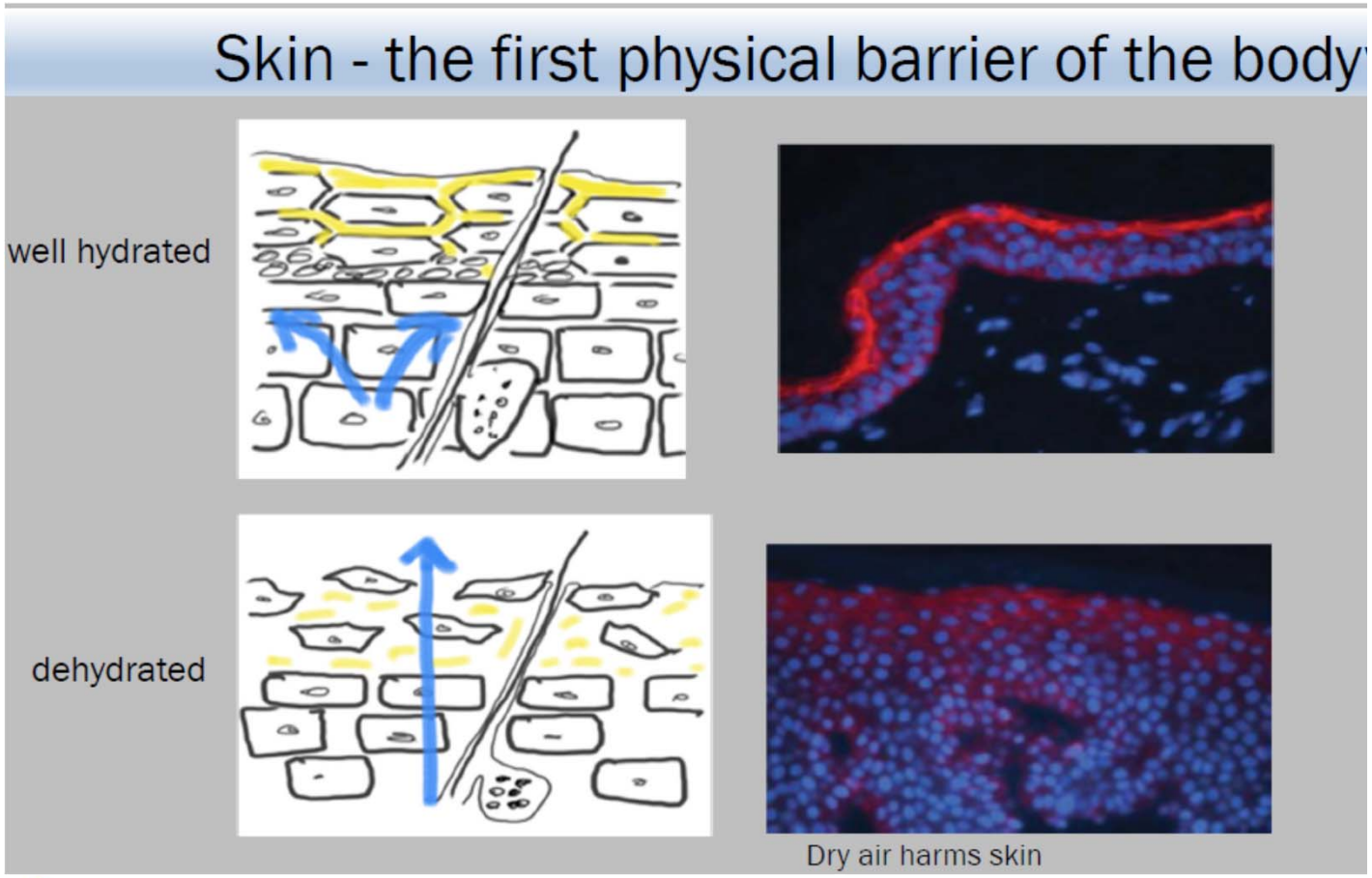
Dehydration



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Our skin loves humidity

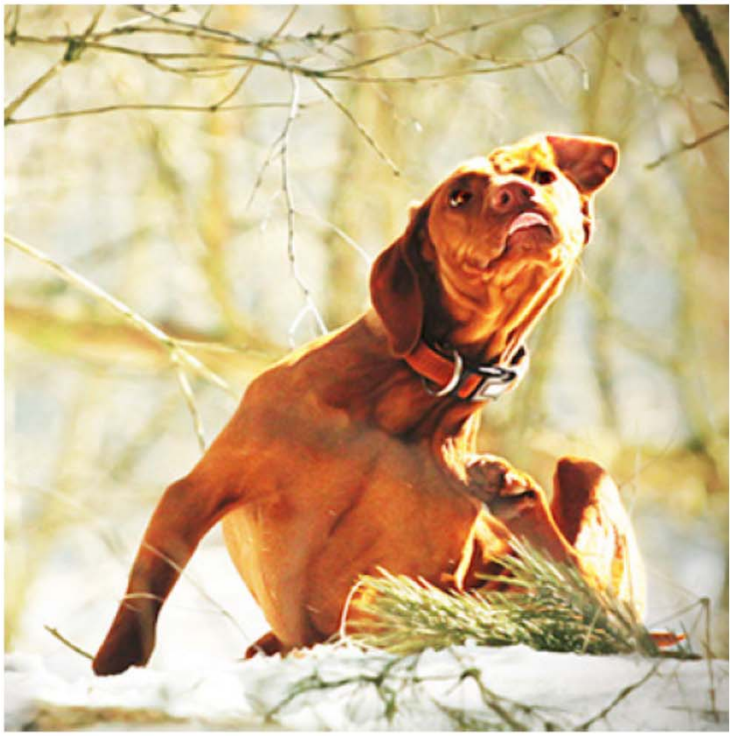
The importance of healthy skin: beyond comfort & cosmetics

Our defense against

- environmental
- physical
- chemical
- microbial insults

Essential for

- wound healing
- immune system development



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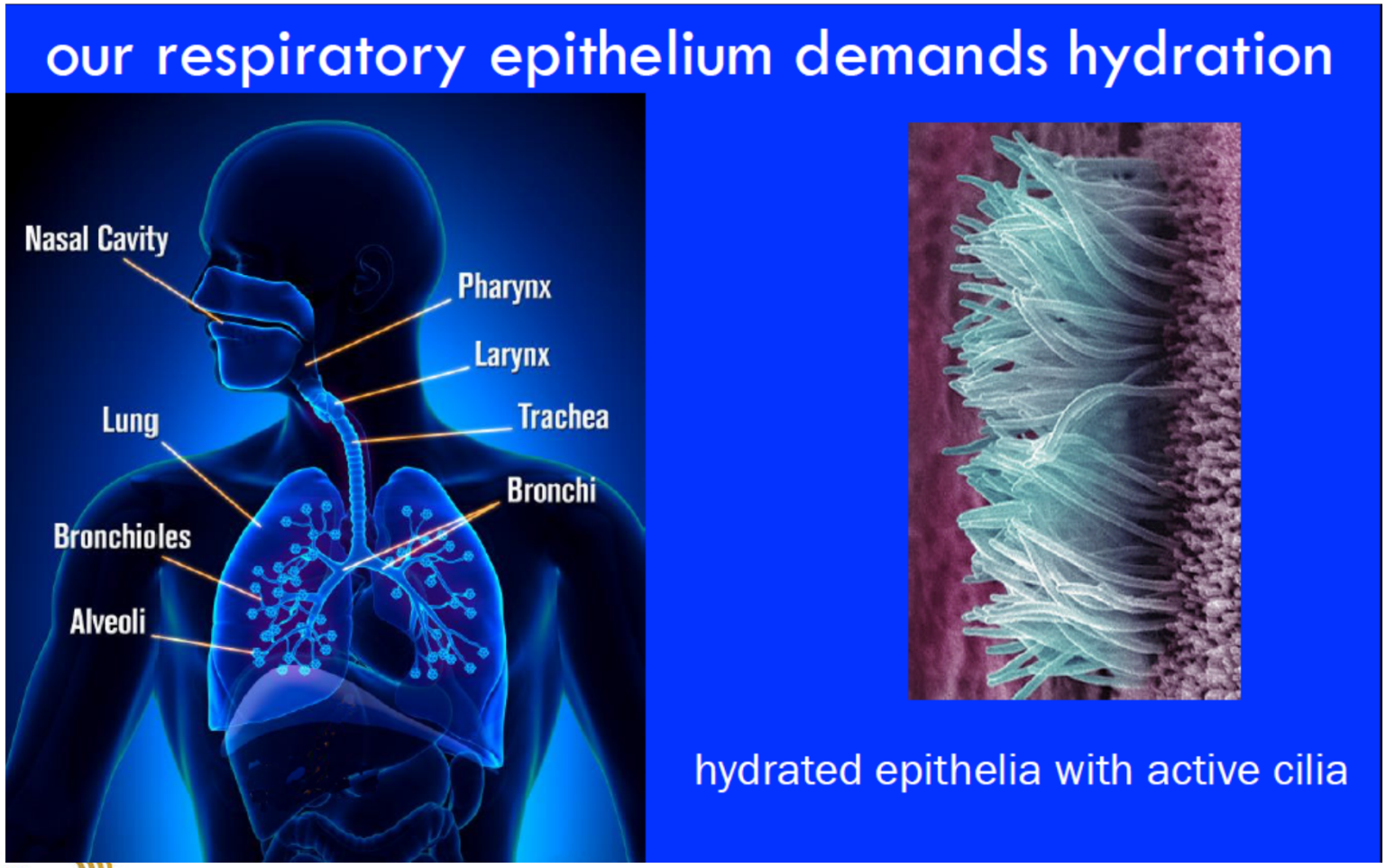
Respiratory system and dry air



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Viruses and bacteria

Conversely, pathogens love dry indoor air!

wider spread

longer life
for many

re-suspension

reproduction
through more
infected hosts

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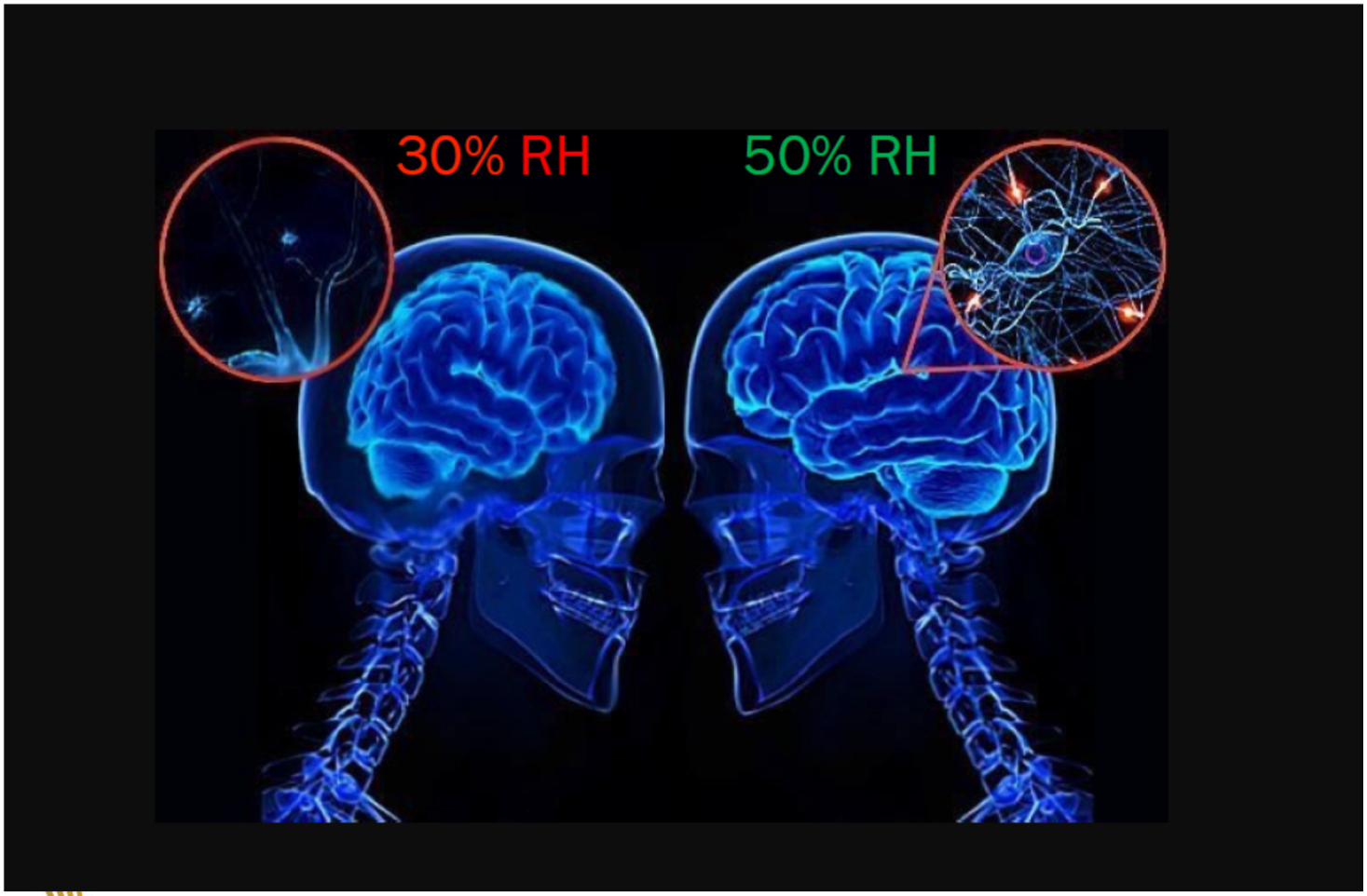
Brain activity



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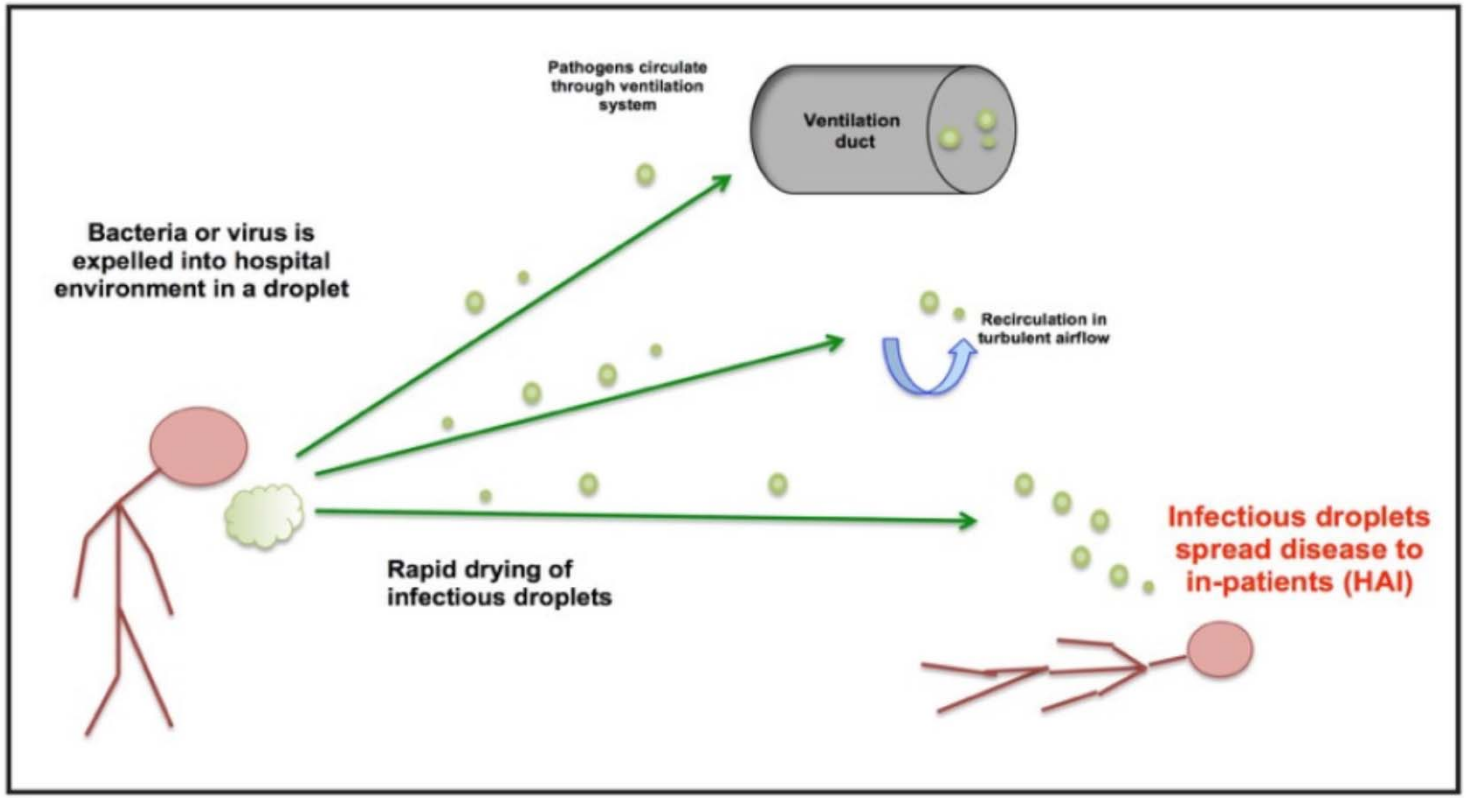
Dry air and healht

Indoor RH < 20 %



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Scientific study about RH influence

- Built 2013, LEED Silver
- 1.2 million square feet
- 240 single-occupancy inpatient rooms
- 52 ICU beds. 28 operating suites
- green roof
- levels 8, 9, 10 - surgical, oncology and transplant patient rooms
- humid, continental climate (cold winter & hot, humid summer)

Microbiome Project in a New Hospital

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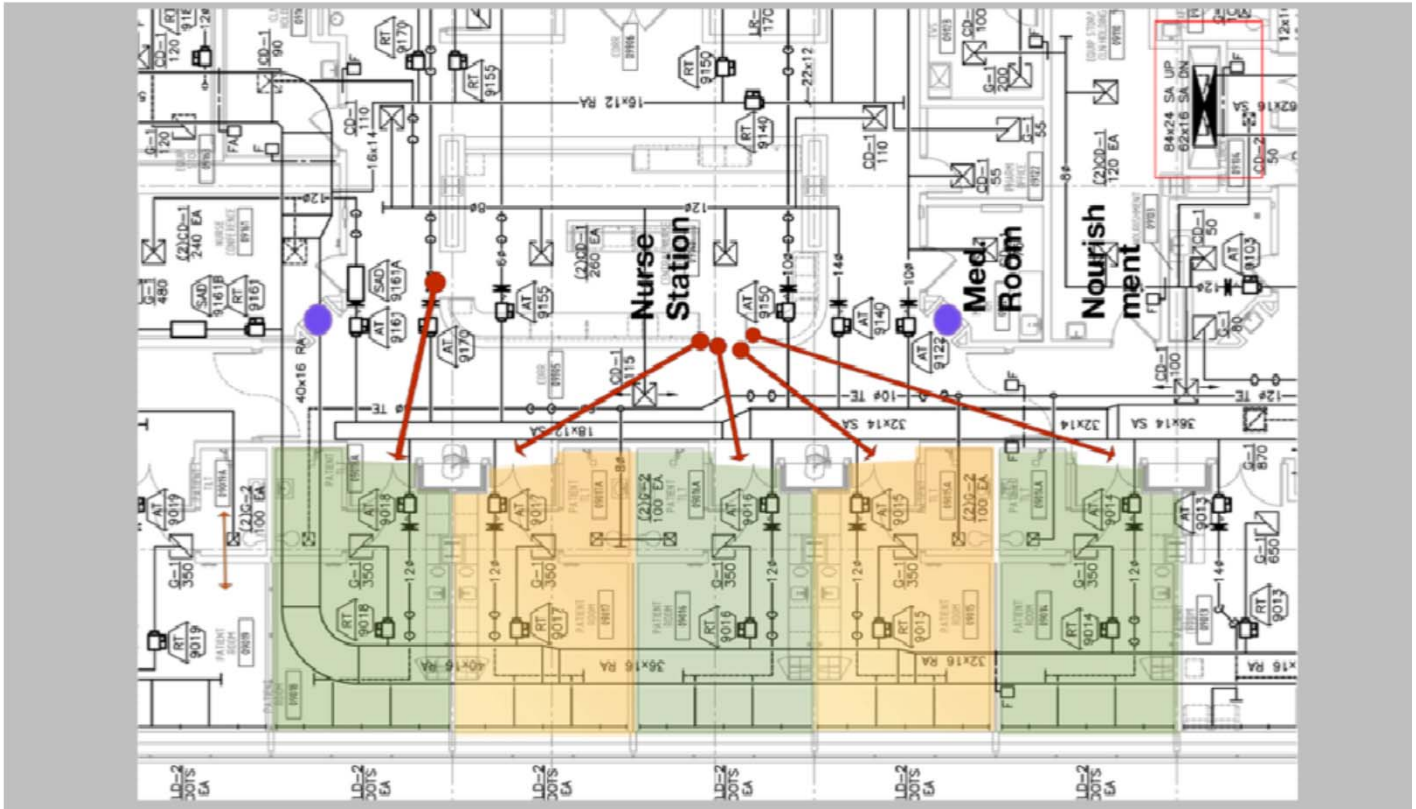
Scientific study about RH influence



10 patient rooms, 2 nurse stations

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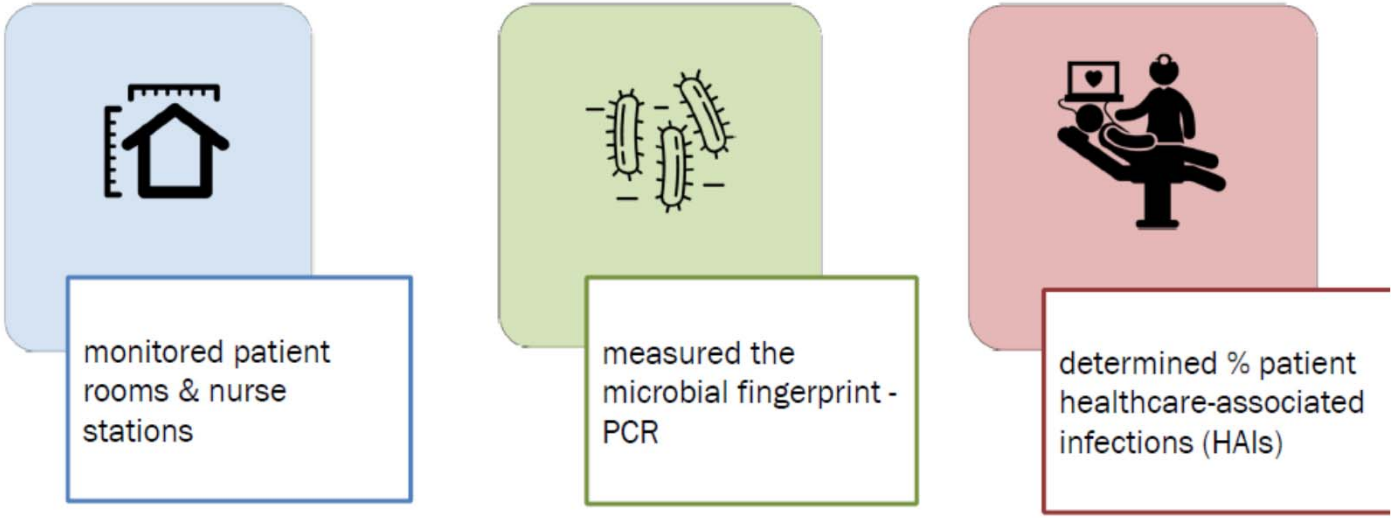
Scientific study about RH influence

Does the room environment influence microbe spread &/or patient infection rates?



a three layer study over 13 months

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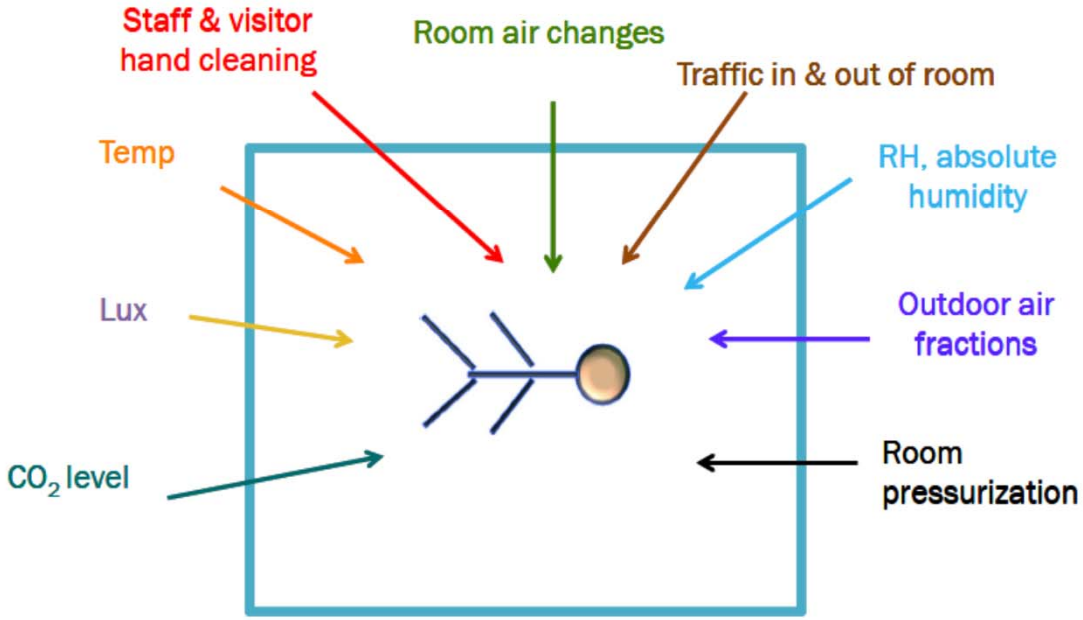
Scientific study about RH influence

Collect information on the patient room environment



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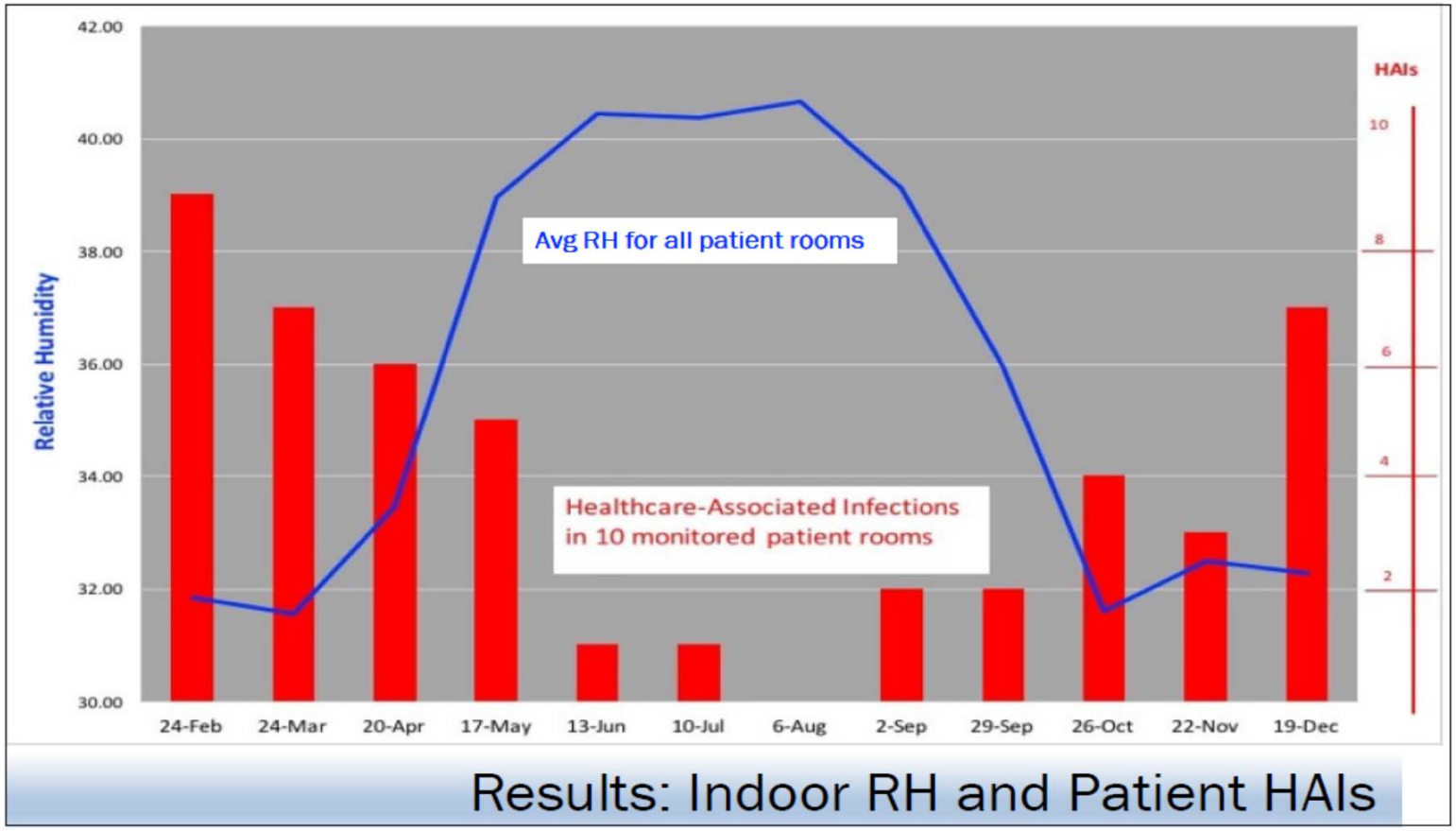
Scientific study about RH influence



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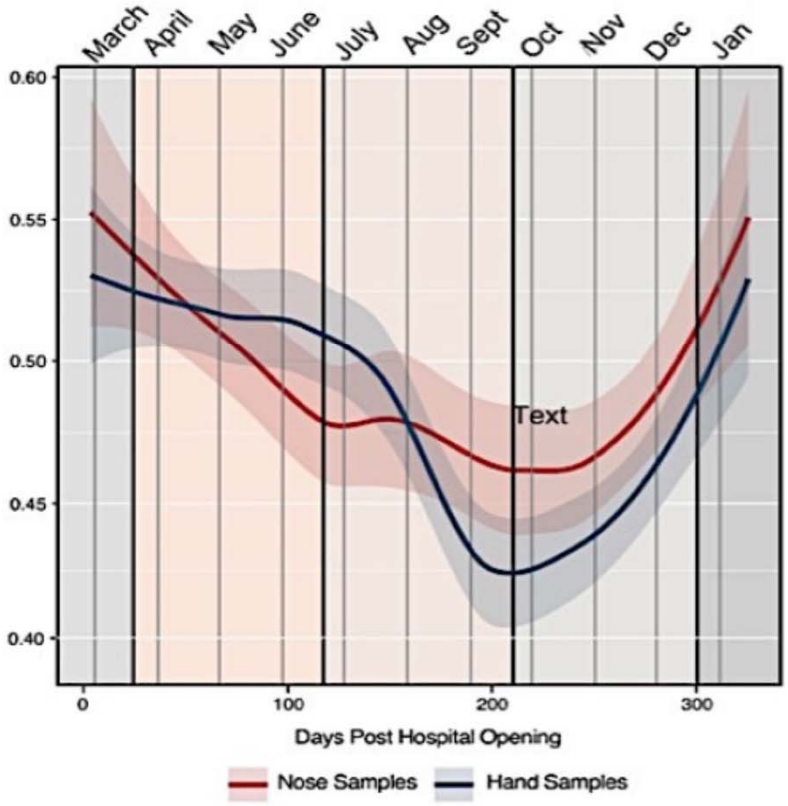
Scientific study about RH influence

Results: Indoor RH and bacterial spread

Spread of skin bacteria from clinical staff



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Conclusions

Conclusion

As RH goes ↓ ... infections go ↑

$t < 0.02$

Conclusion

As RH goes ↓ ... bacterial spread ↑

$t < 0.01$

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Dry air and health

We cannot just give up!
Dry indoor air has created a public health crisis.

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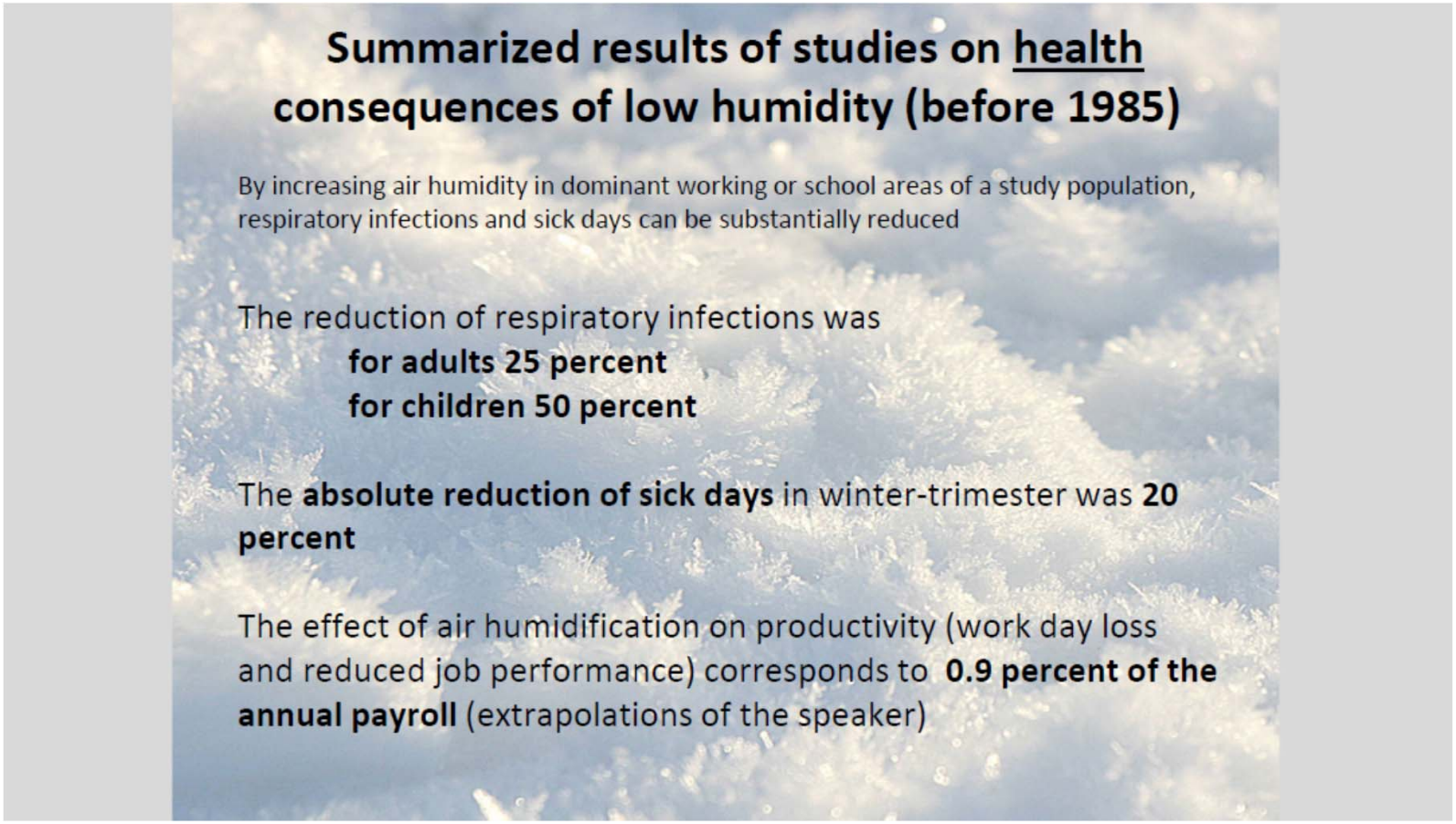
Study in working or school areas



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Air indoor

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Air in modern buildings

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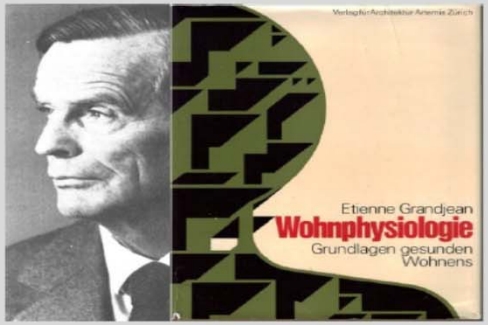
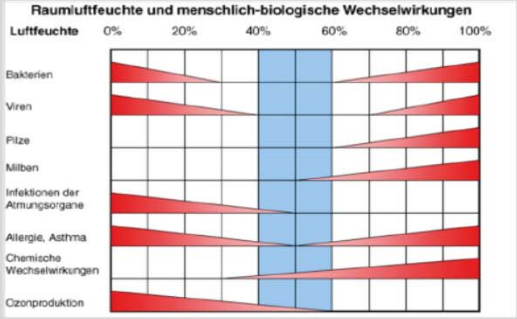
Indoor humidity

Assessment of Indoor humidity between then and now .....

Back then: standards for indoor climate and humidity were based on human needs, physiology and health concerns .....

Prof. Dr. W. Diebschlag Technical University Munich, engineer **and** occupational physician





Prof. Etienne Grandjean ETH Zurich, chair of Institute for Hygiene and Occupational Physiology, Physician and engineer, 1950-1983

Scofield, Sterling, Arundel, Ing. ASRAE

Scofield Sterling Diagramm, 1985

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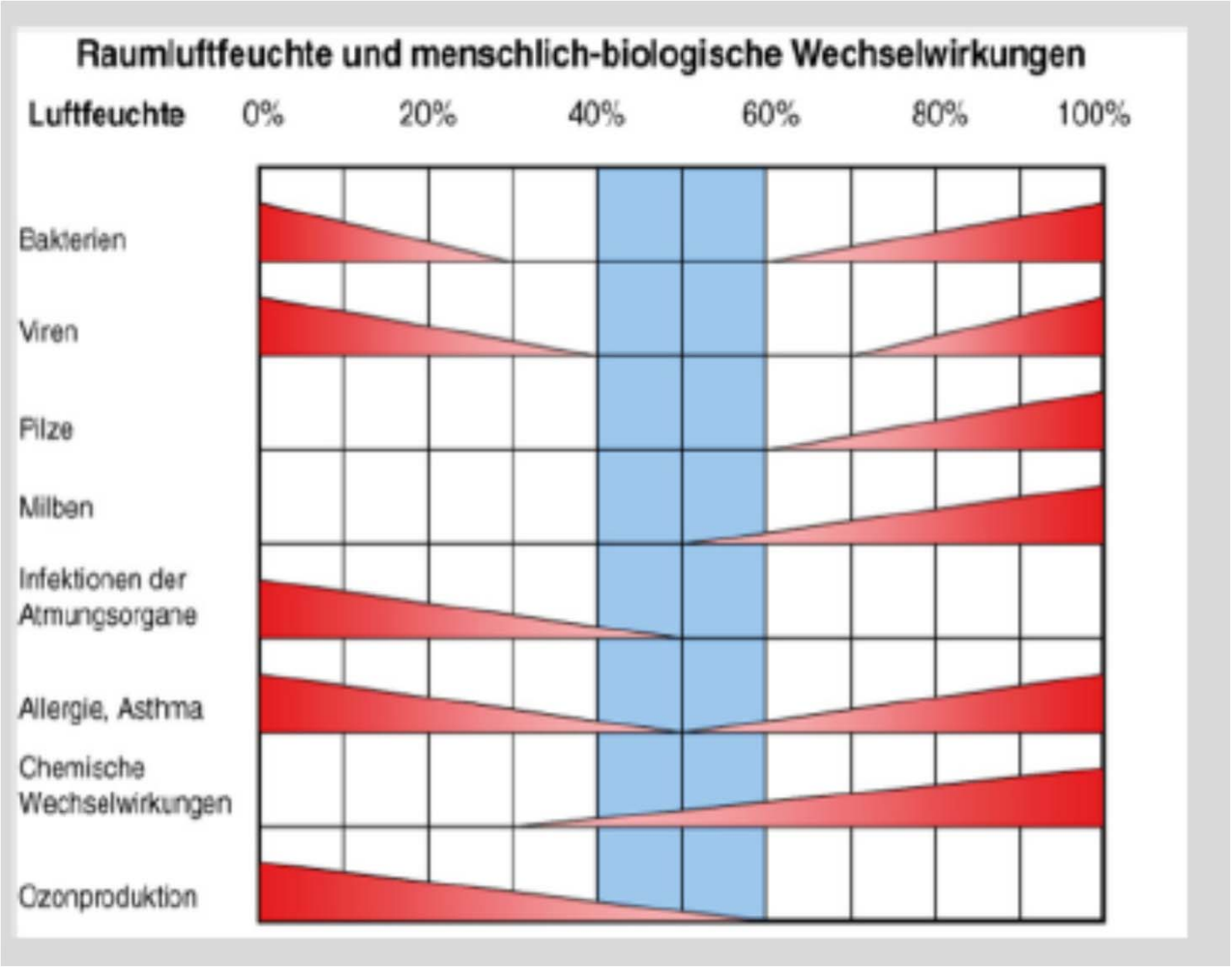
Optimal Humidity %RH ?



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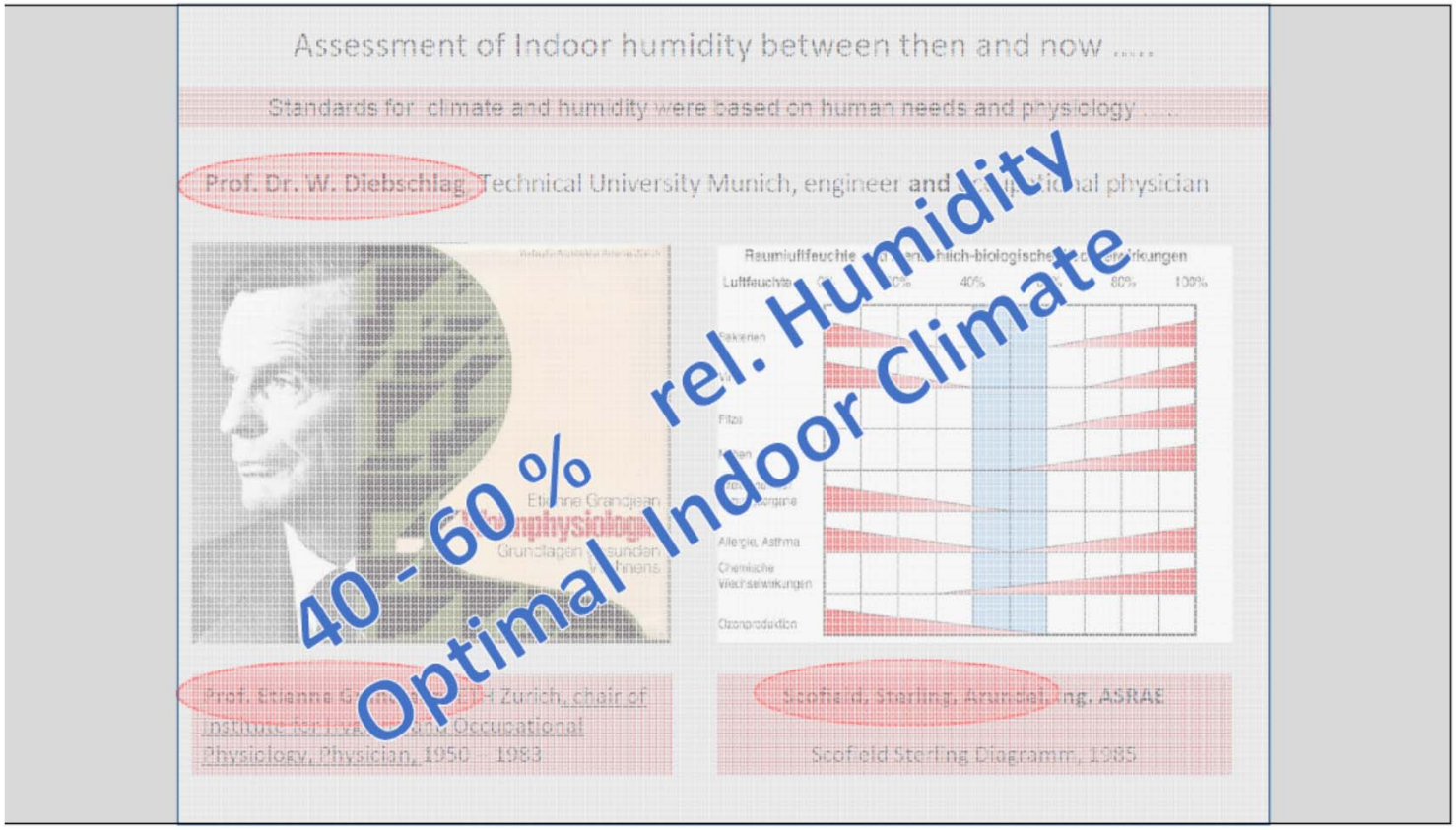
Indoor humidity



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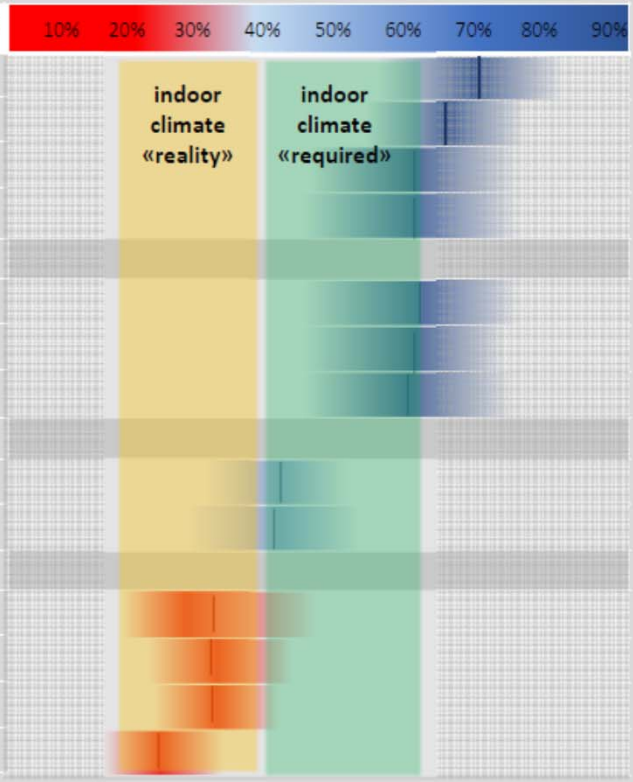
Temperature and humidity

How humid is ambient air at room temperature of 20 to 24 °C ?

city	type	No*	MV*	StDe*
Palermo	coastal cities	1765	70.5	12.0
San Diego (USA)		1829	66.7	12.2
Malaga		1702	61.9	14.3
Hamburg		498	61.9	15.4
Vienna	inland cities	914	61.4	15.5
Munich		736	60.3	15.5
Berlin		735	58.8	16.3
St. Moritz (CH)	mountain cities	233	40.4	11.2
Denver (USA)		791	39.1	14.7
Tucson (USA)	desert cities	1225	31.0	16.6
Riyadh (KSA)		1035	30.6	10.1
Medina (KSA)		1146	29.3	8.5
Tamanrasset (ALG)		1544	22.1	9.2



No = number of countable hourly averages at location, **MV =** median value RH at 20-24 °C
StDe = standard deviation (≈ 68% of values are within ± standard deviation)
Climatic data from Word Meteorological Organisation: www.wmo.int

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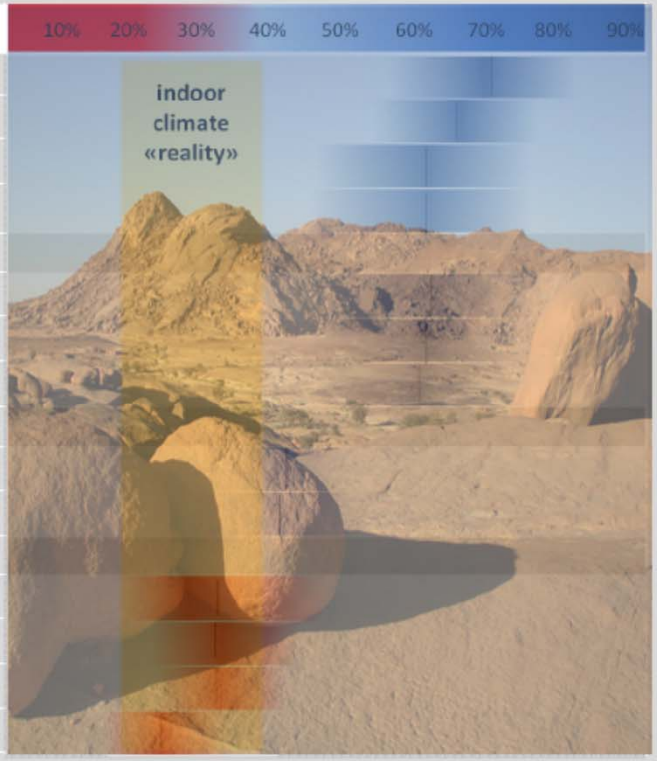

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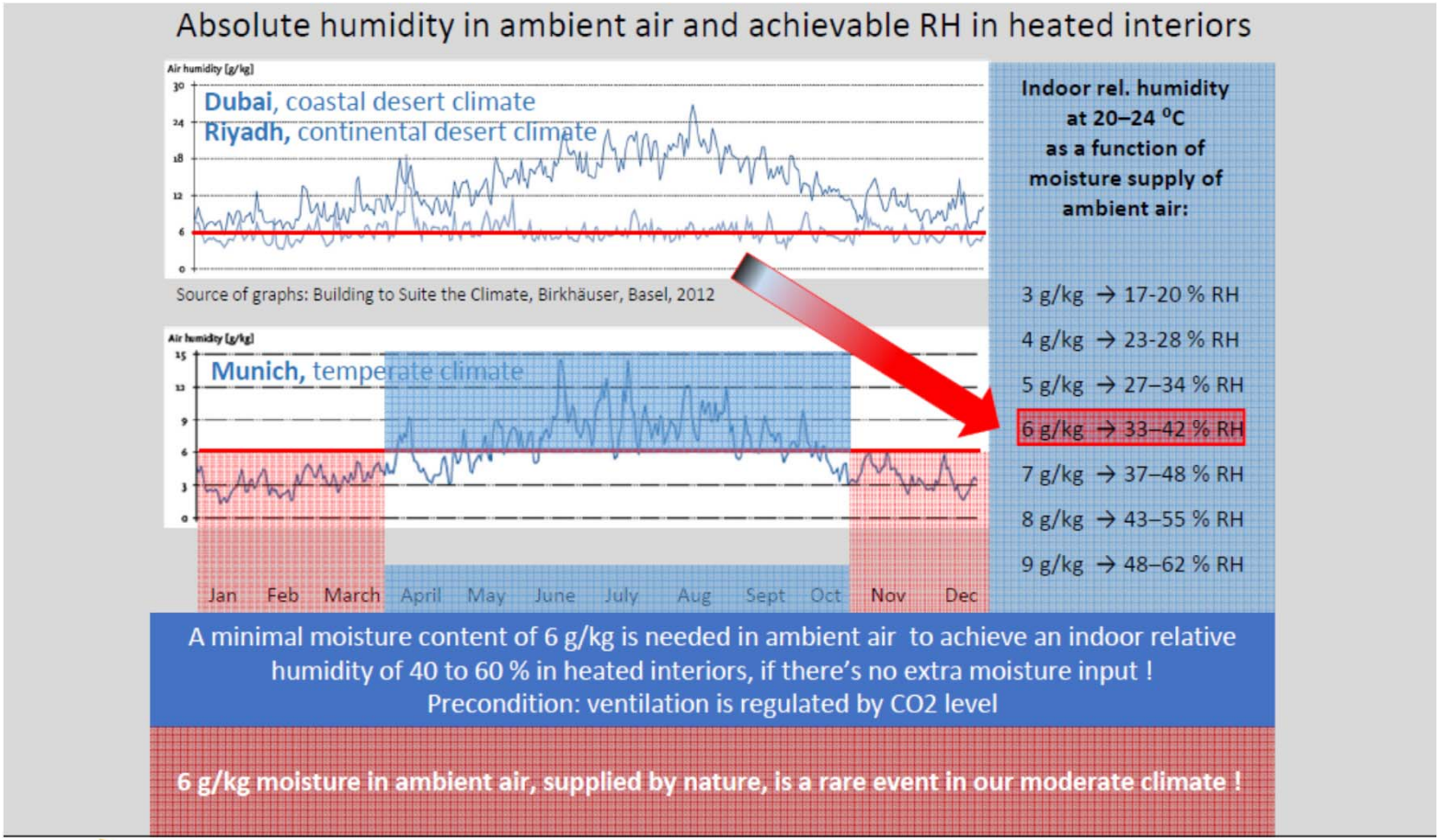

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Temperature and humidity

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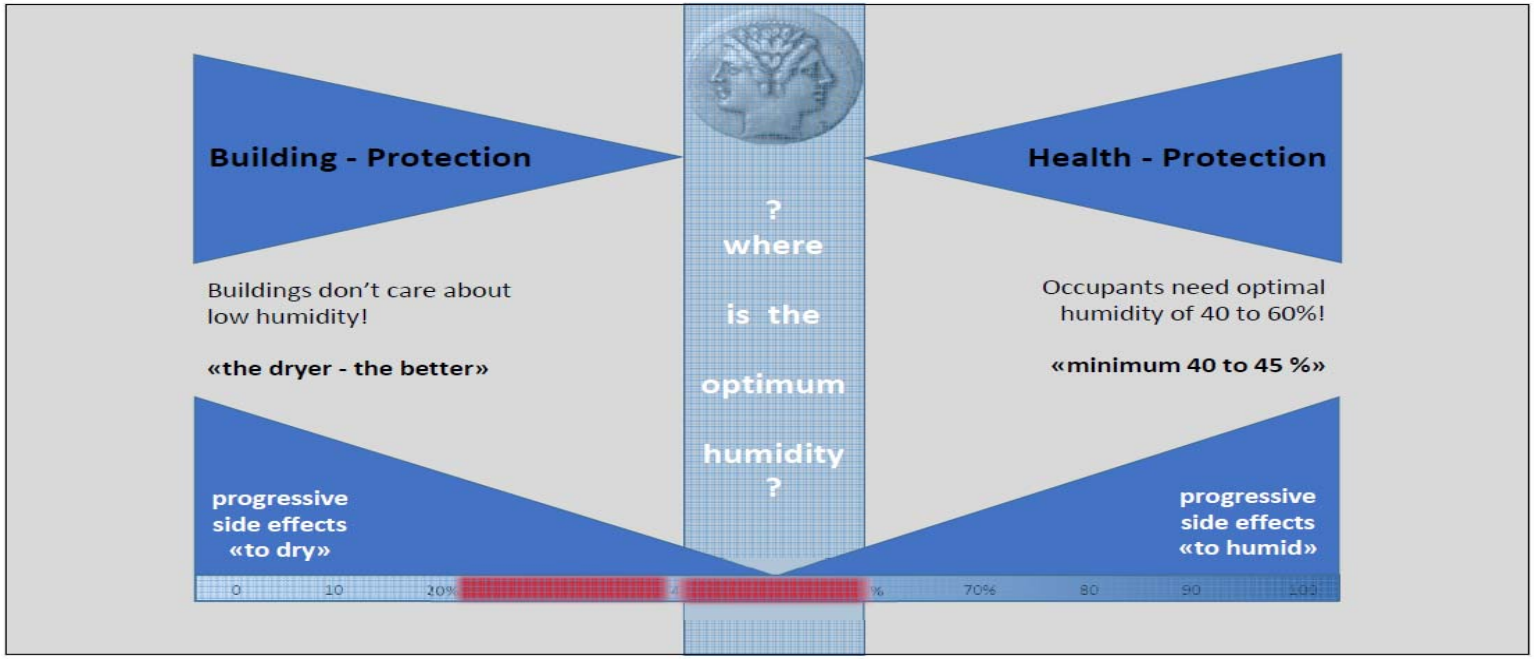
Optimal humidity ?



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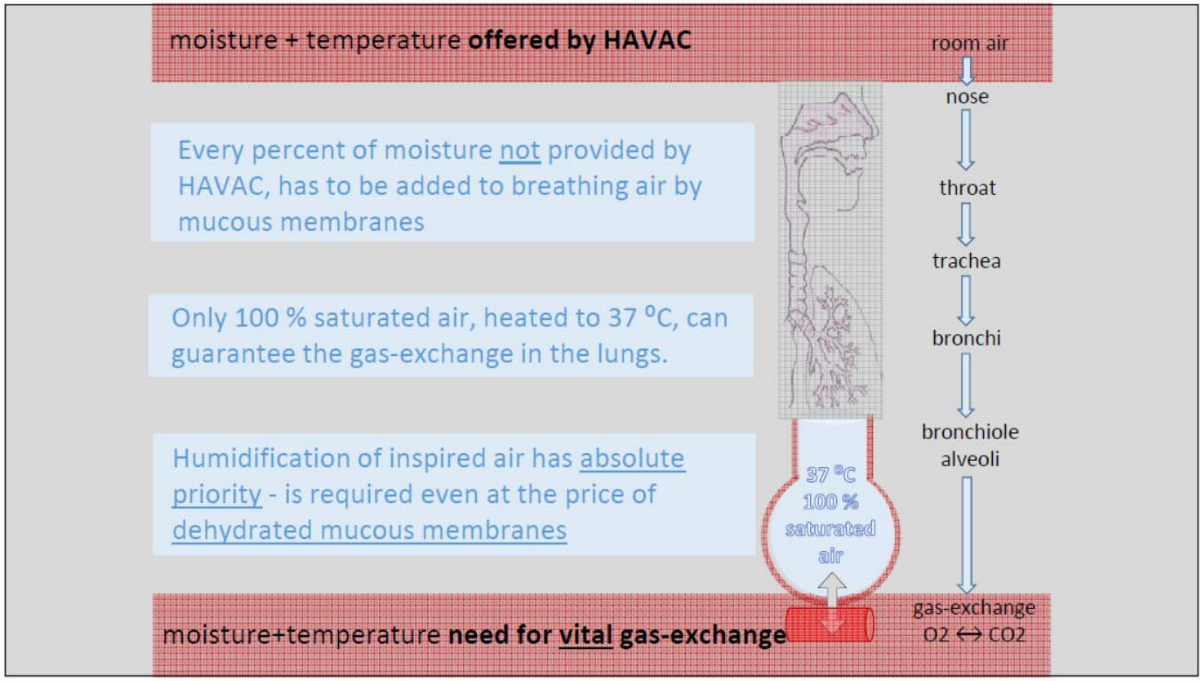
HVAC and humidity



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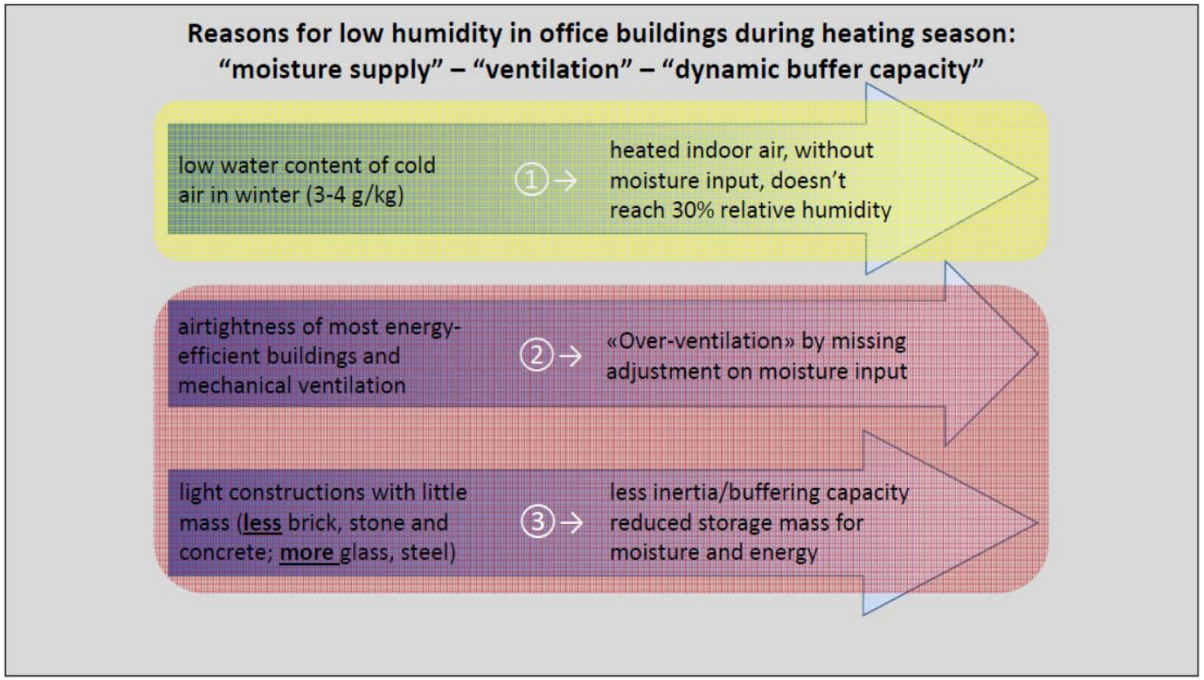
Humidity



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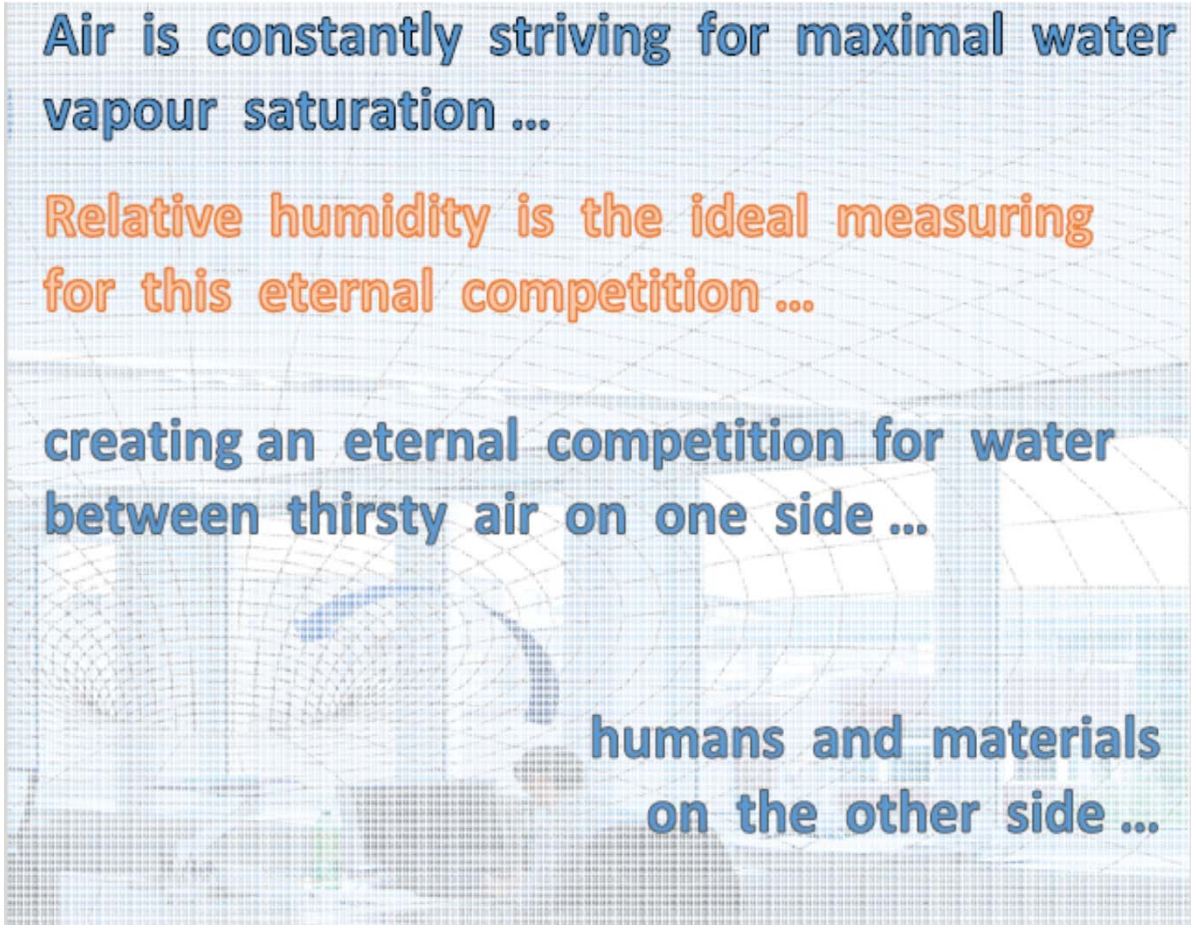
Water and humidity



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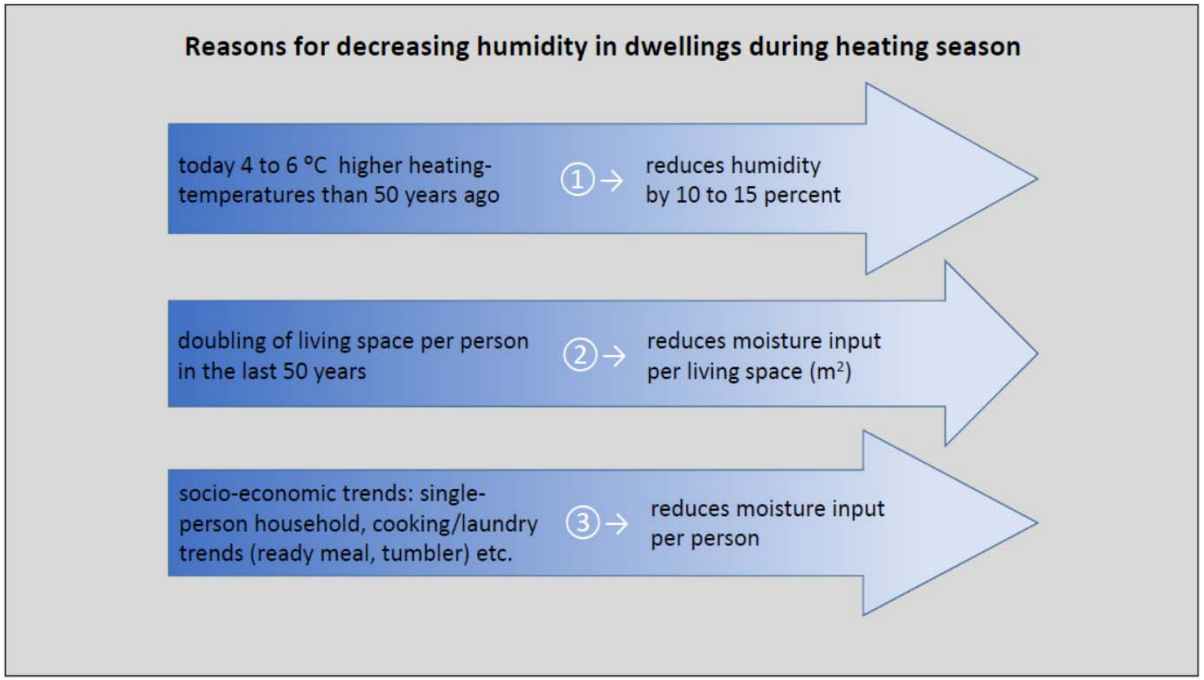
Humidity



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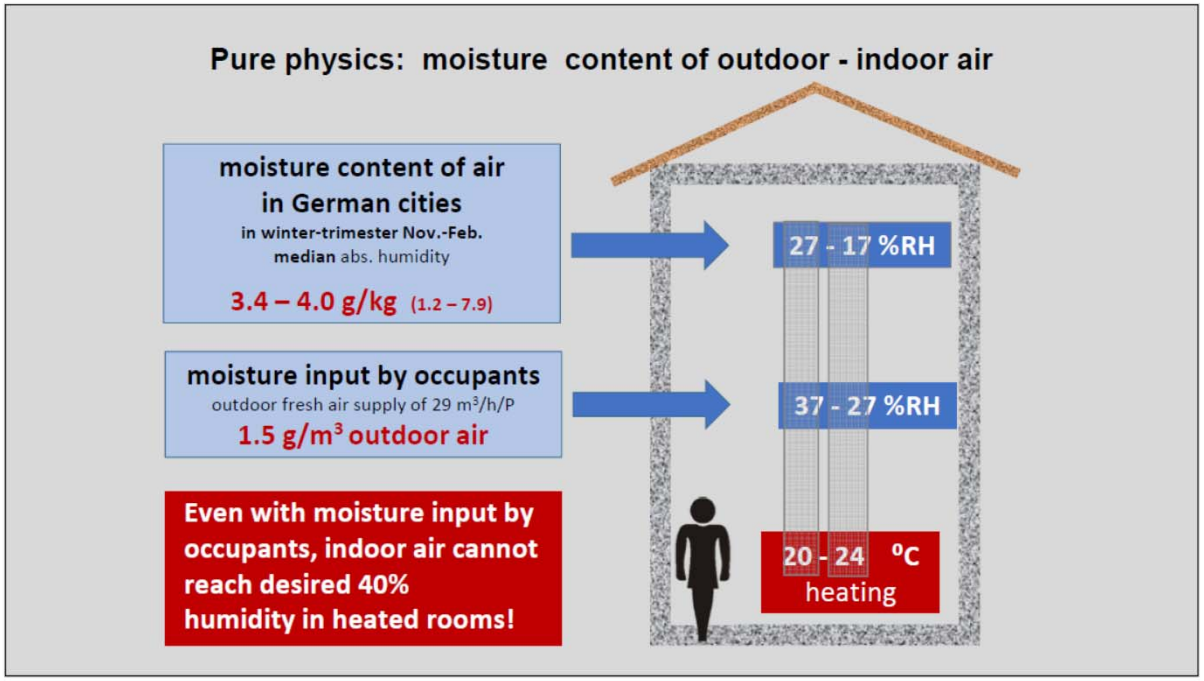
Moisture



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Humidification

Why humidify for people?	
Dry Air	① Turns off natural, humidity-based protection against winter-time viruses which cause flu and colds
below	② Dries out mucous membranes, preventing clearance of pathogens and increasing our risk of disease from infections and air pollution
40 % rh	③ Increases resuspension and spread of any kind of air pollutants

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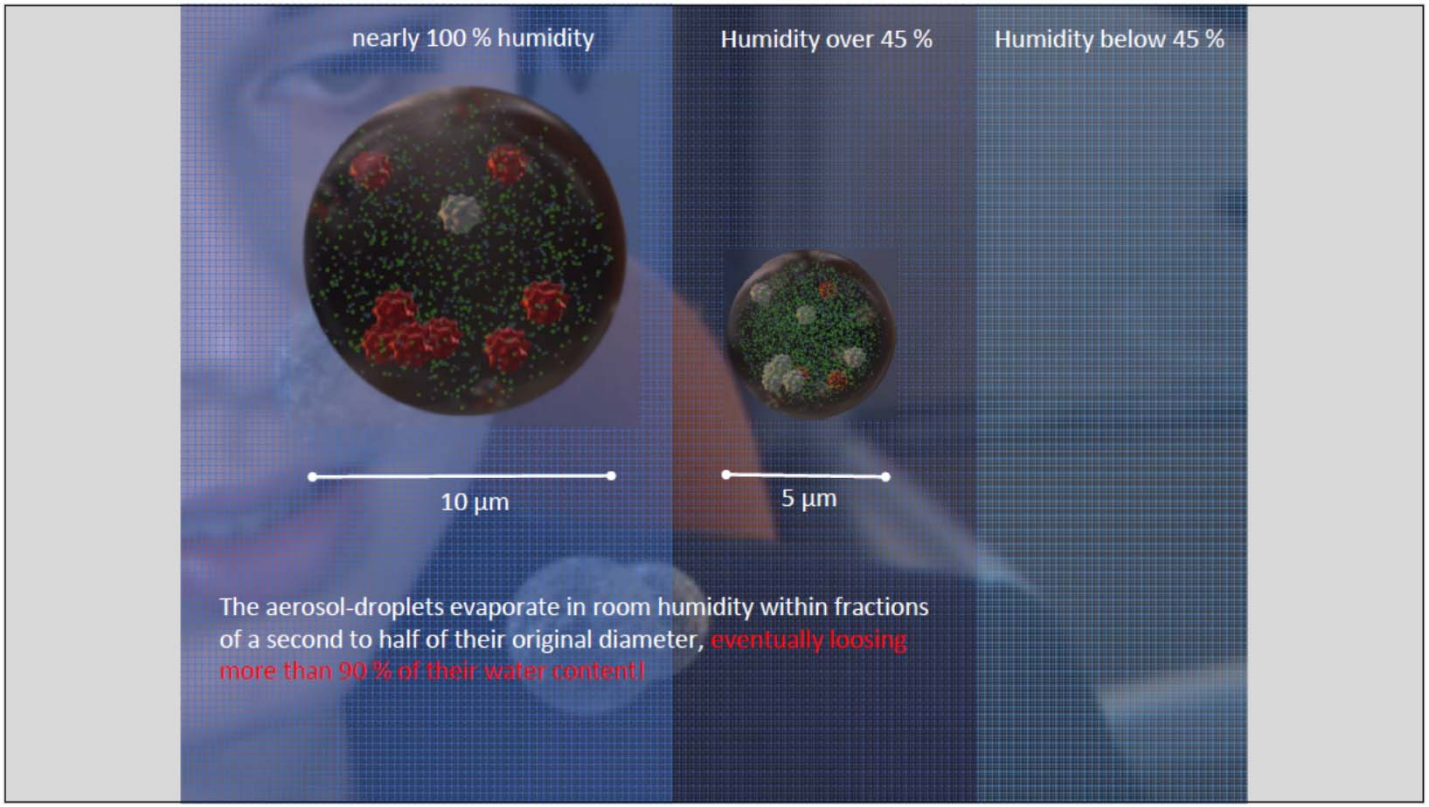
Aerosol droplets



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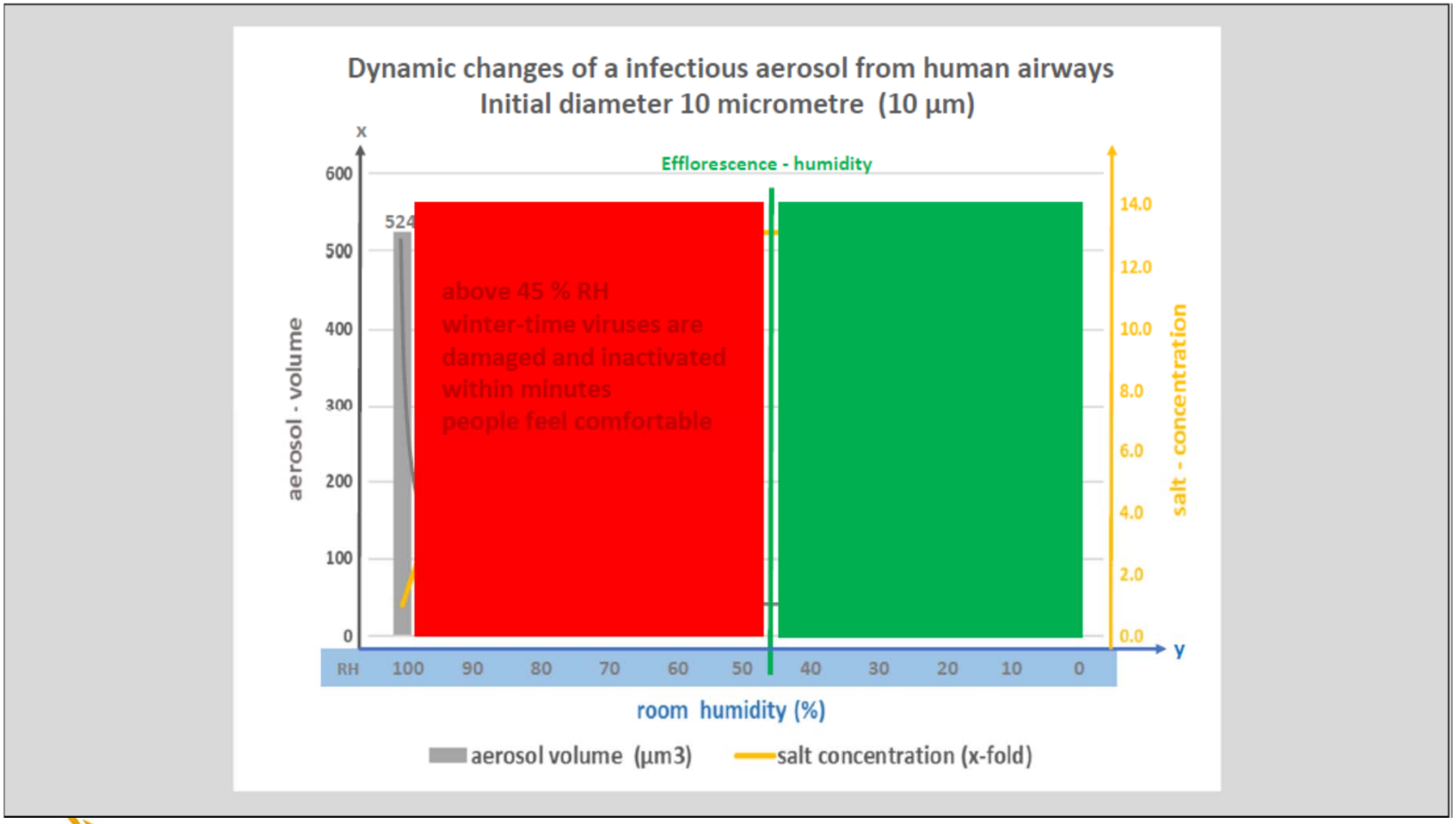
Aerosols in human airways



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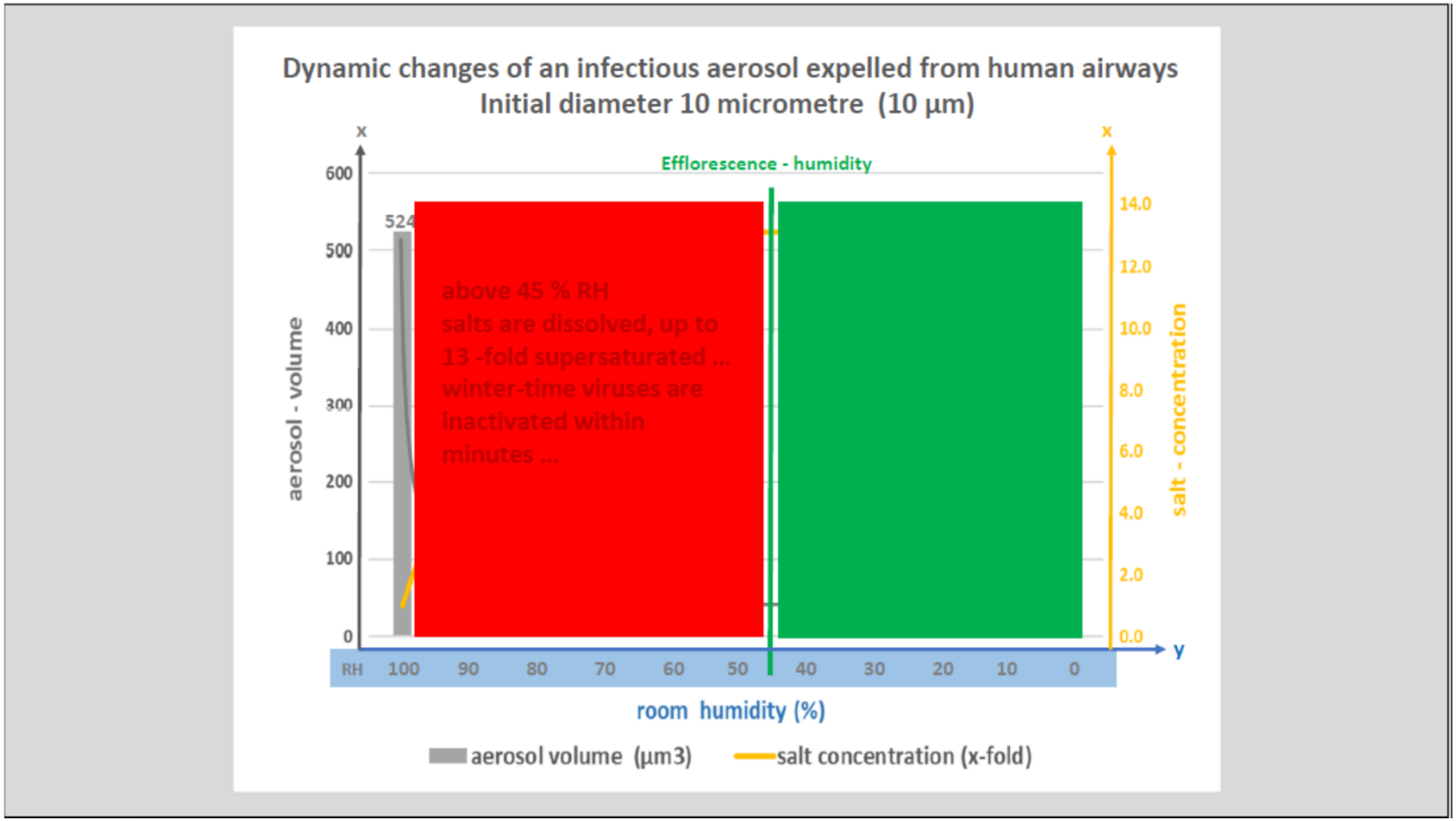

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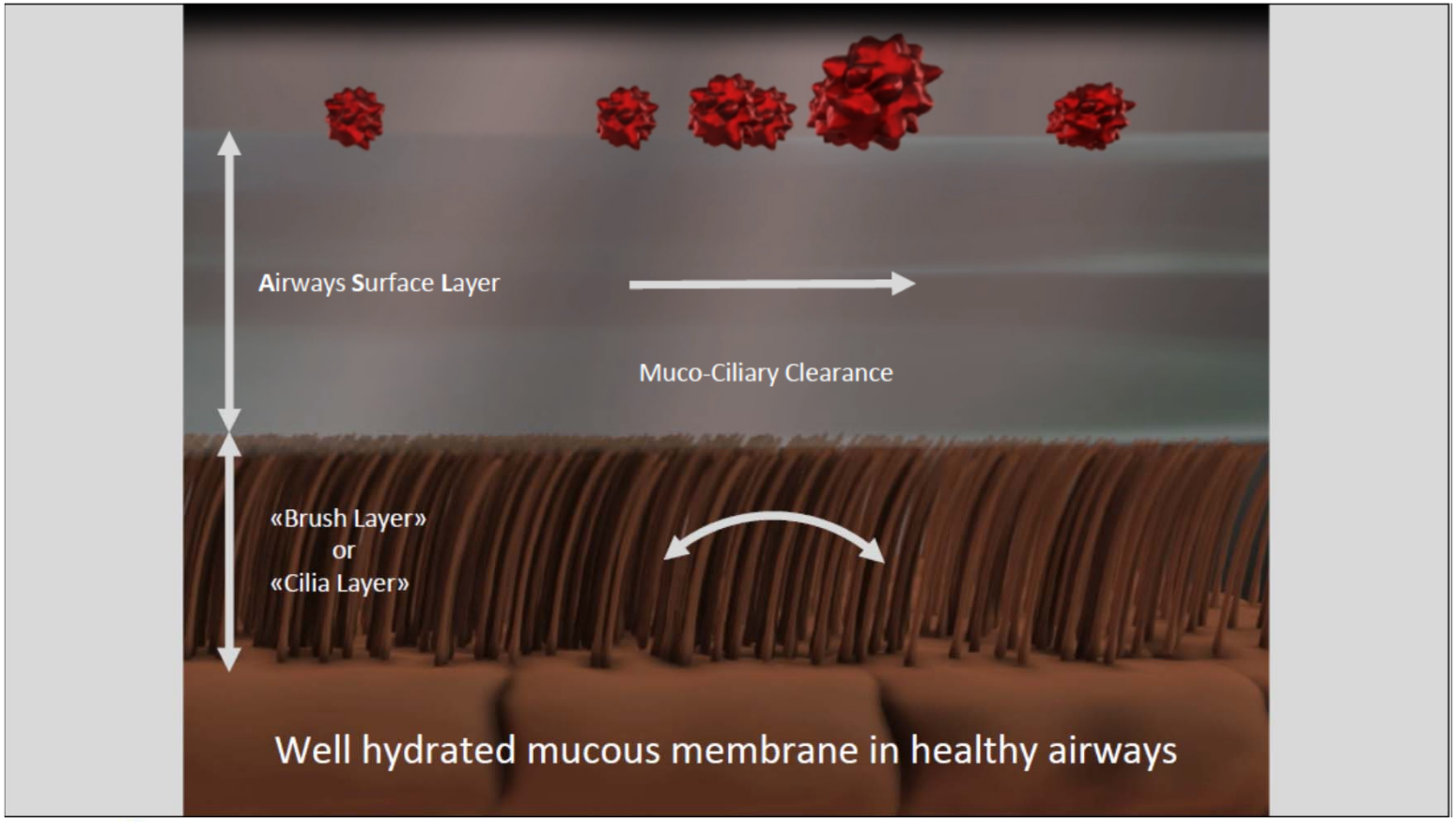
Mucous membrame



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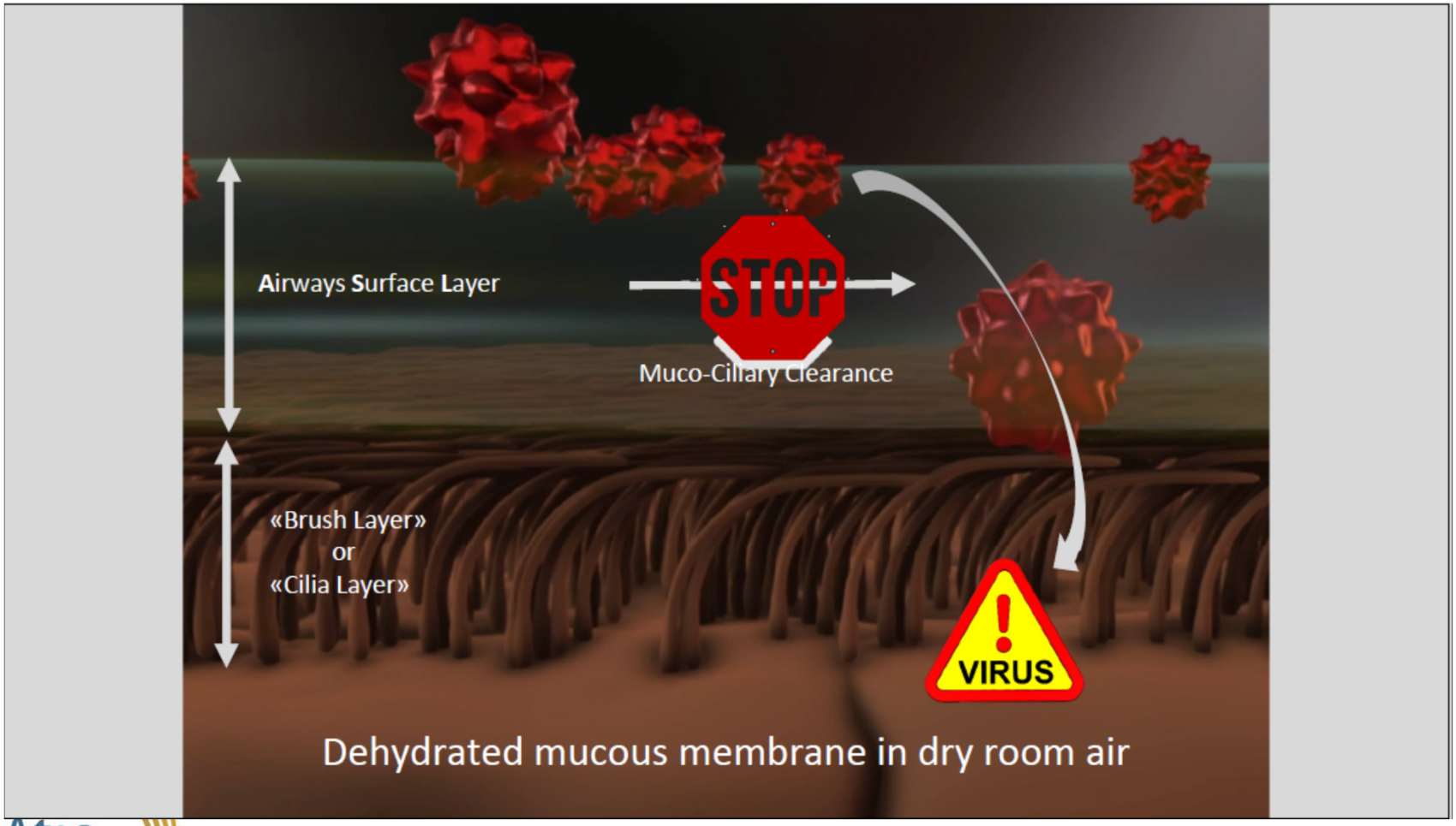
Mucous mebrame and humidity



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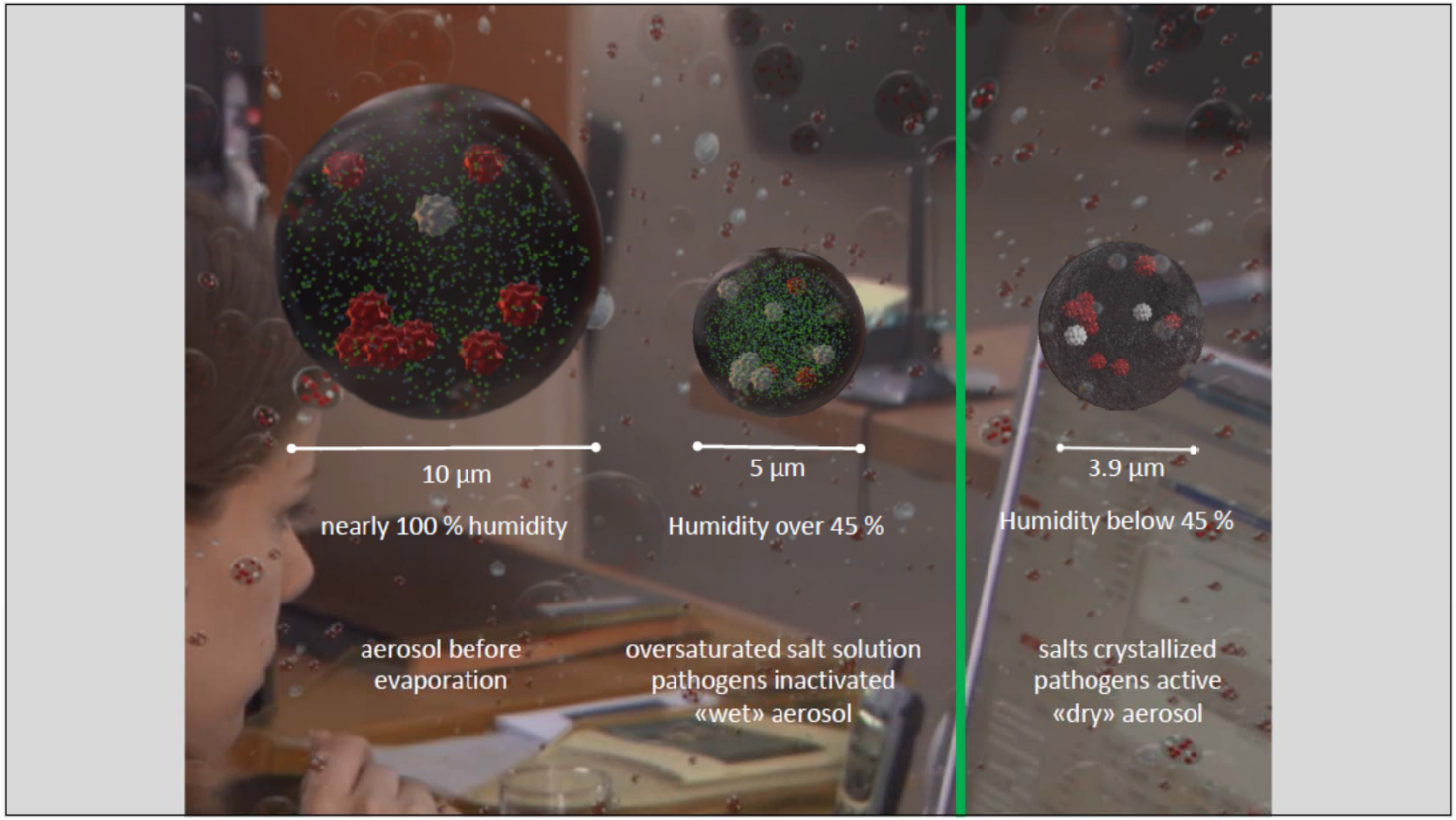
Aerosols and humidity



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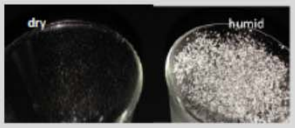
Moisture

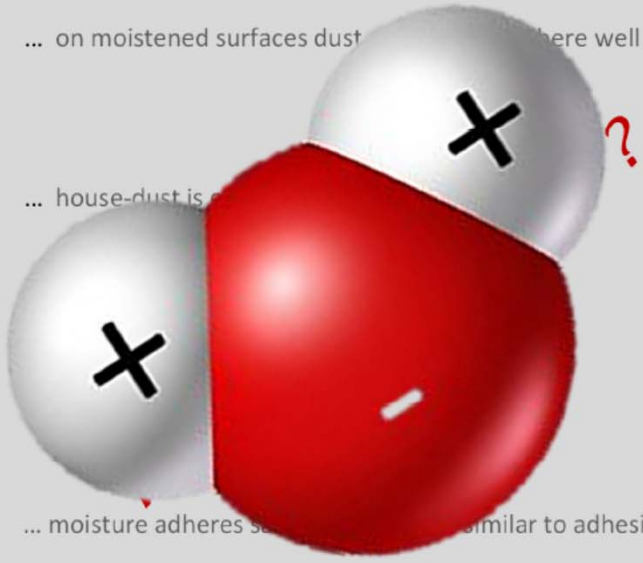
Moisture has a «sticking effect», that corresponds to our everyday perception of the adhesivity of water



... on moistened surfaces dust ... here well ...

... house-dust is ...

... moisture adheres ... similar to adhesive ...



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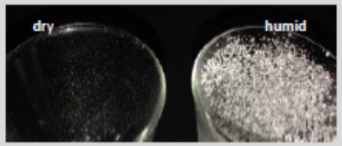
Humidity and moisture

Moisture has a «sticking effect», that corresponds with our everyday perception of the adhesivity of water

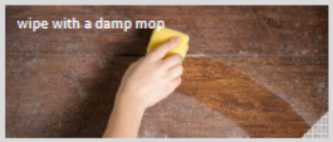


... on moistened surfaces dust and powder adhere well ...

Humidity dependent adhesive forces are the strongest forces between particles and surfaces!

... house-dust is easily raised when air is dry ...

«resuspension» is an important cause of increased particle numbers caused by windows and human activities



... dust is easily wiped with a damp mop ....

Humidity is the Adhesive of Particles

Water content, moistened particles adhere to each-other, clumping together to aggregates ....

... moisture adheres sand/powder, acts similar to adhesive ...

«wet particles» adhere better to each other and to surfaces than «dry particles» ....

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Humidity on the work floor

When humidity is between 40 -60% :

- People feels good, wellbeing , motivated
- People works more attentive, more safety
- People achieve better
- People are less sensitive for viruses (flu)
- People has less absenteeism
- People has less infuence for dust and static electricity
- Conclusion : A good humidity is NECCESARY on the workplace
- We advise MINIMUM 45% RH is needed !

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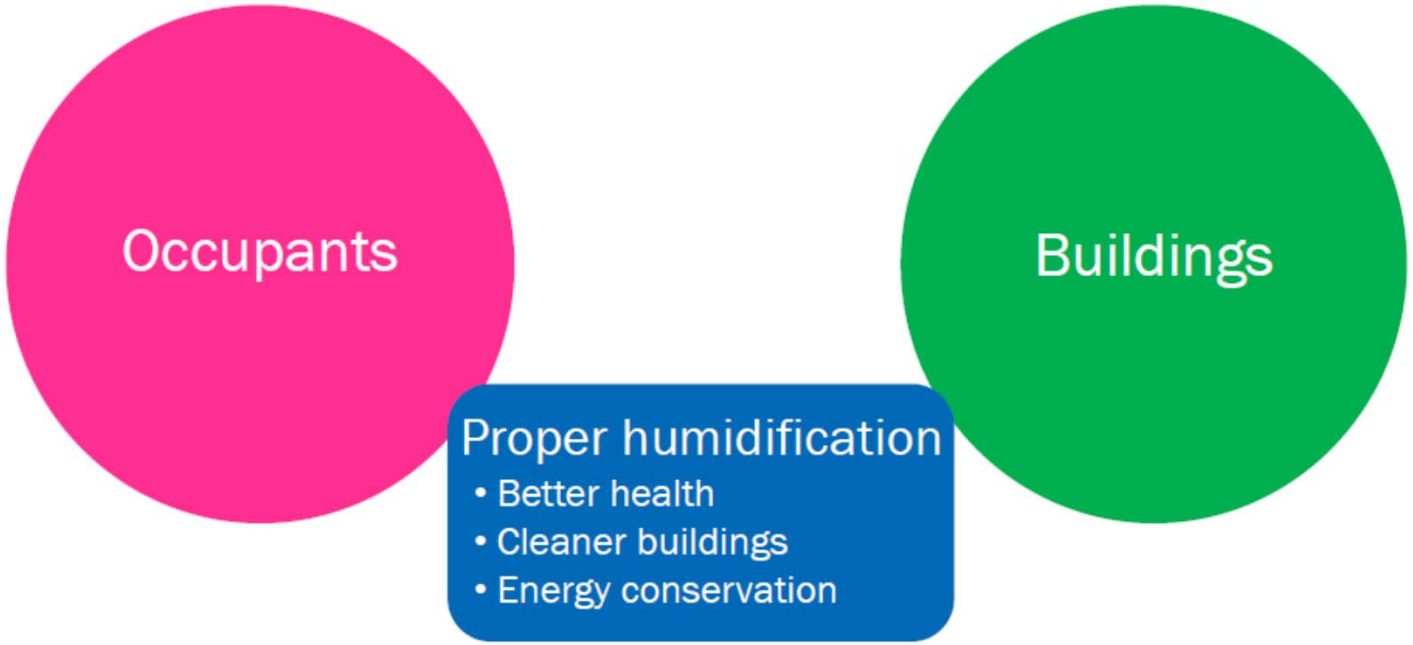
How you can help us ?

YOU hold the key



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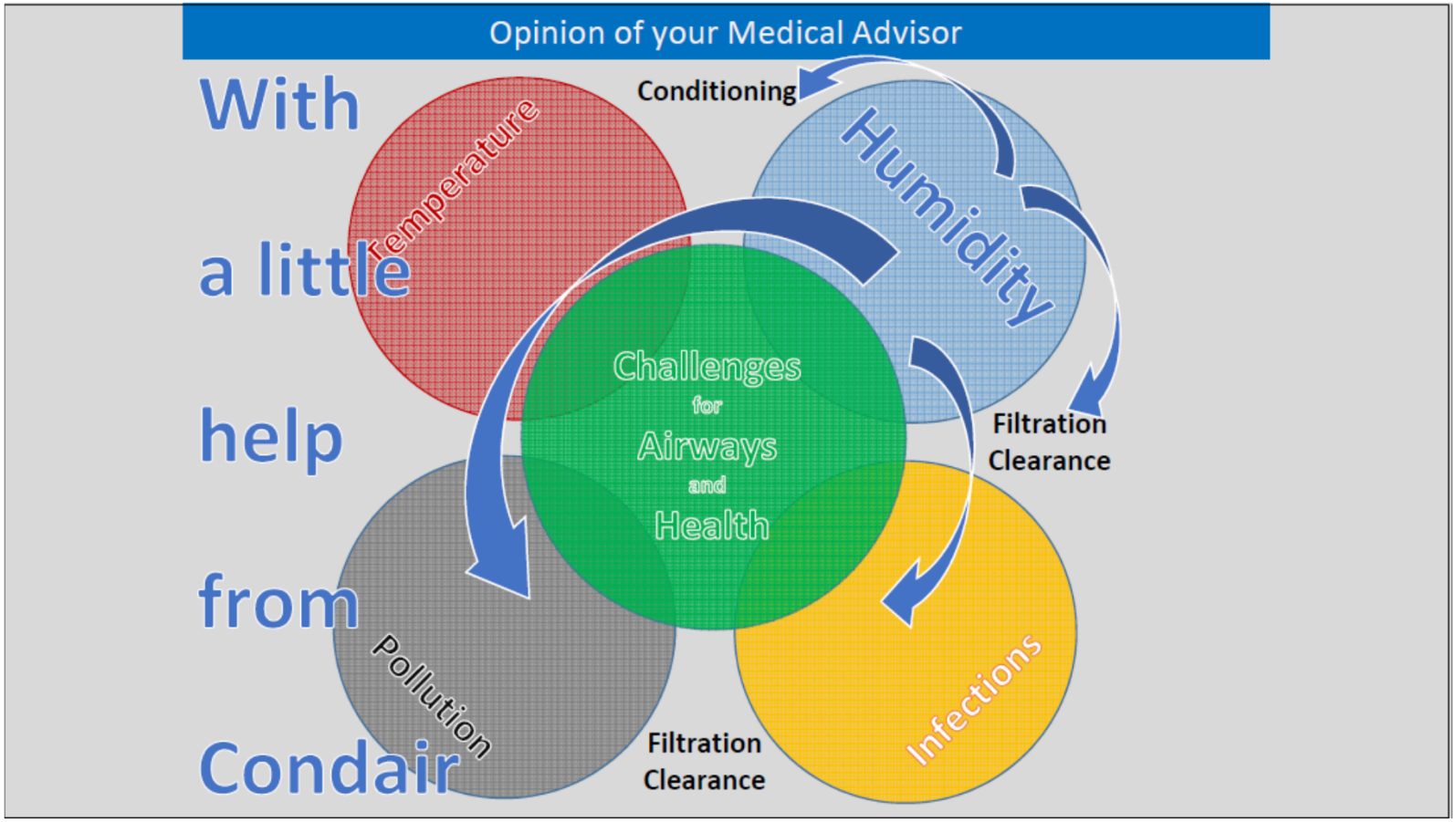
Conclusions: Need for humidification



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Thanks to our scientists

Special thanks for using the slides for this presentation

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The end…..

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