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①

Over the course of your professional career, you spent more than 25 years caring for people of all ages, and professions.

Where does your passion for indoor climate issues come from?

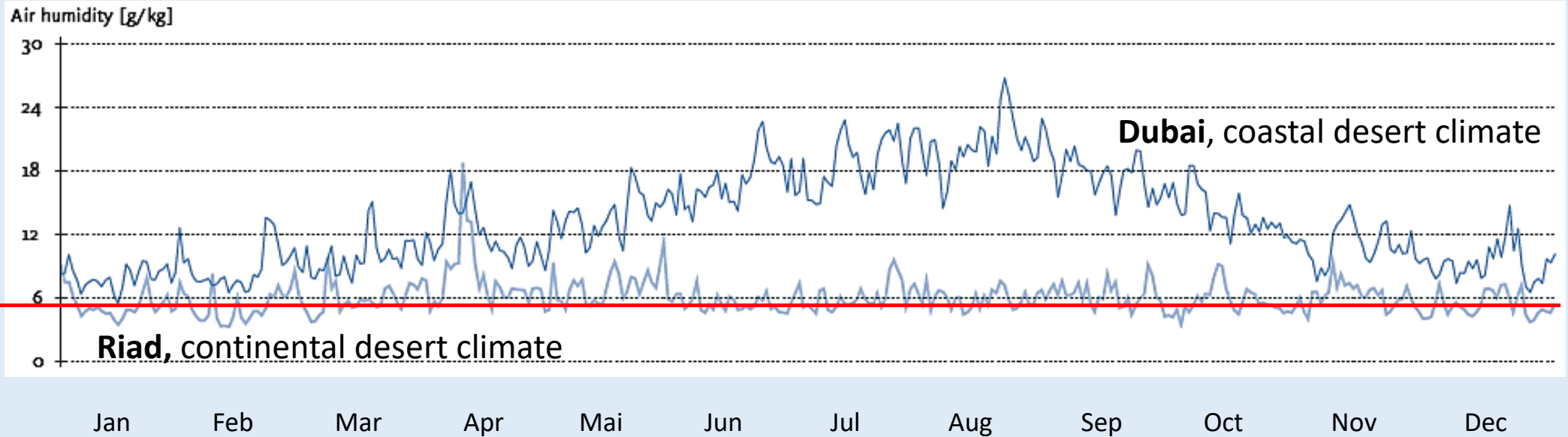


Dehydration Presents Unique Risks for Pilots

The effects of water loss can be pronounced for flight crewmembers operating in the dry environment of high altitudes; therefore, crewmembers should ensure that they drink adequate amounts of water and should try to avoid situations that deplete the body's supply of water.



desert-like humidity on long-haul flights – a systematically underestimated risk



3-4 g/kg

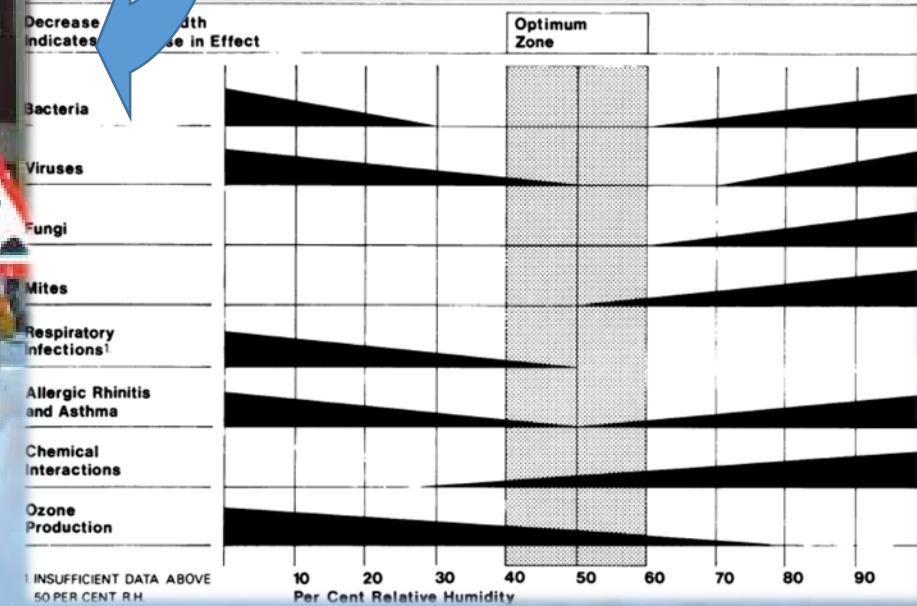
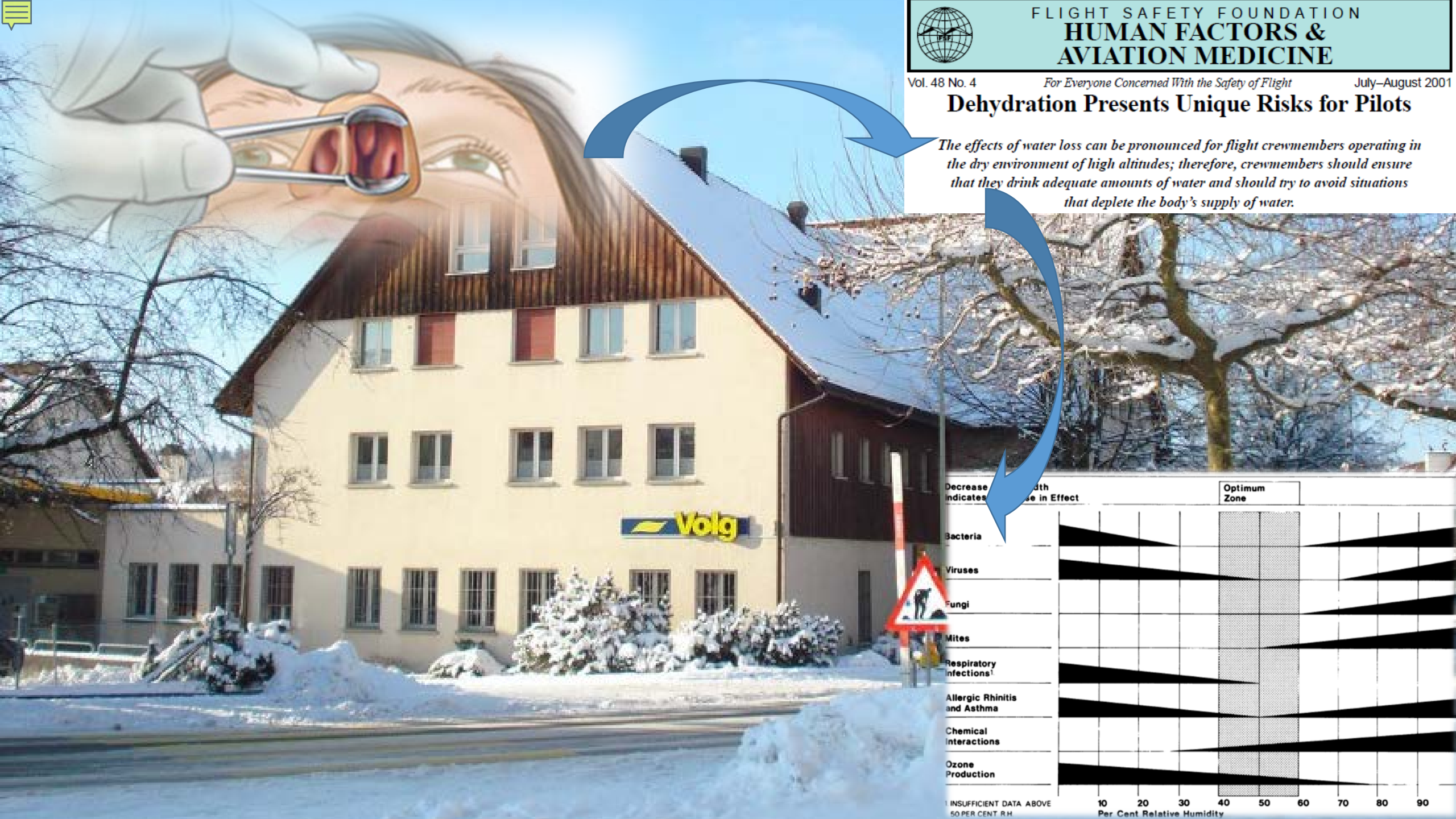


On board of aircrafts absolute air humidity is 3-4 g/kg, depending mainly on the seat load factor



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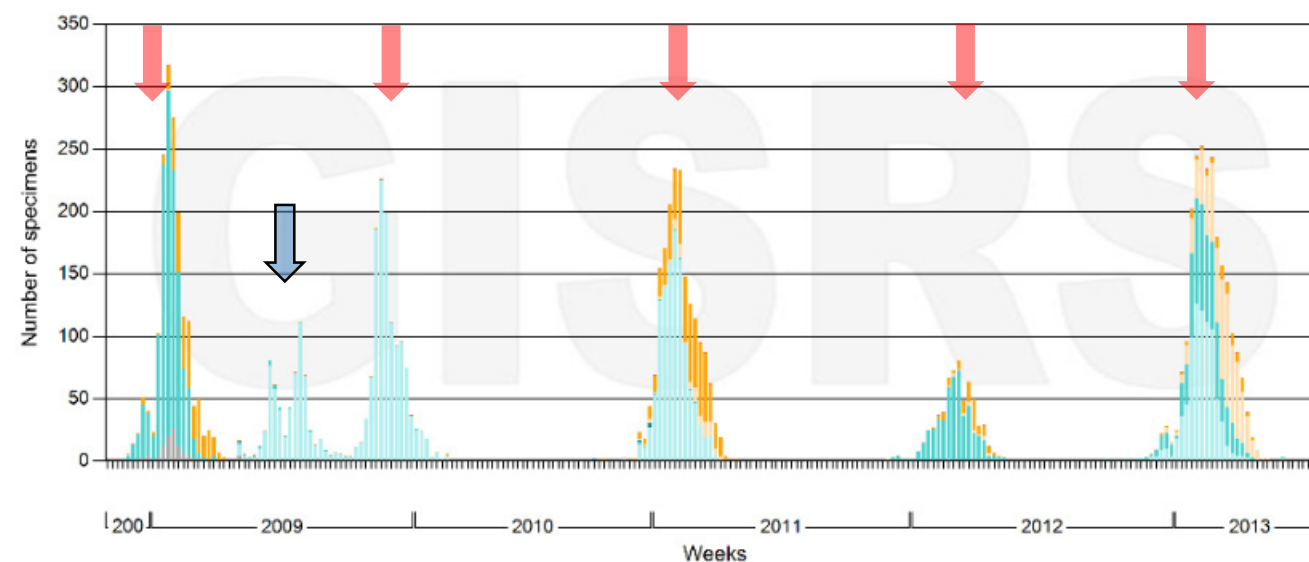


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Germany

Number of specimens positive for influenza by subtype



Conflict of interest “building – occupants”, in moderate climate

Building requirements

“The dryer - the better”

**Conflict
of
interests**

*“most human airways are
over-strained by longer-
term humidity below 40%”*

Occupants needs

gaps of skills and knowledge

insolation + ventilation
technology

dynamic interactions:
ventilation – aerosols -
“dust” – indoor climate

water treatment
hygienic aspects

dynamic interactions:
building material –
humidity - fungi

interactions flow
pattern – flow velocity
– sedimentation and
re-suspension of
aerosols

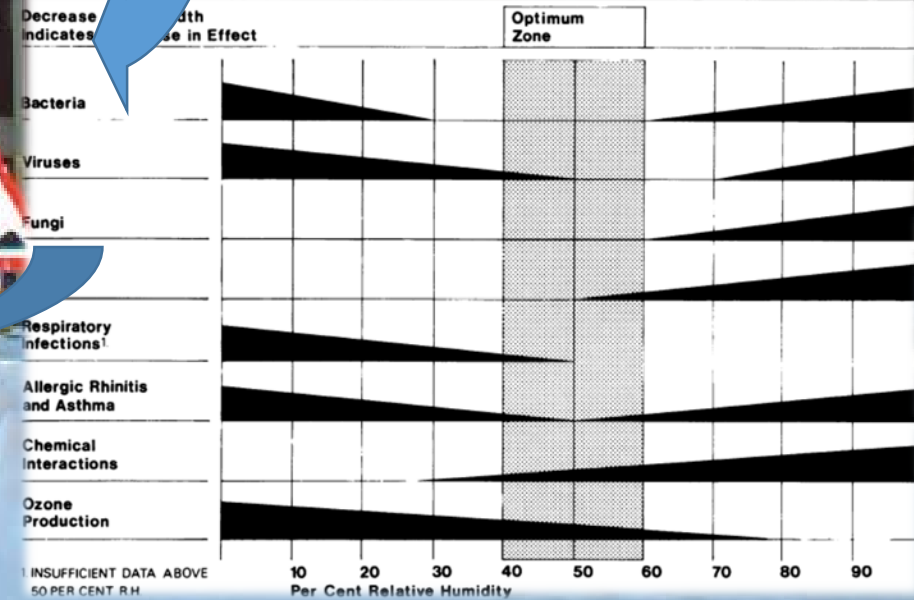
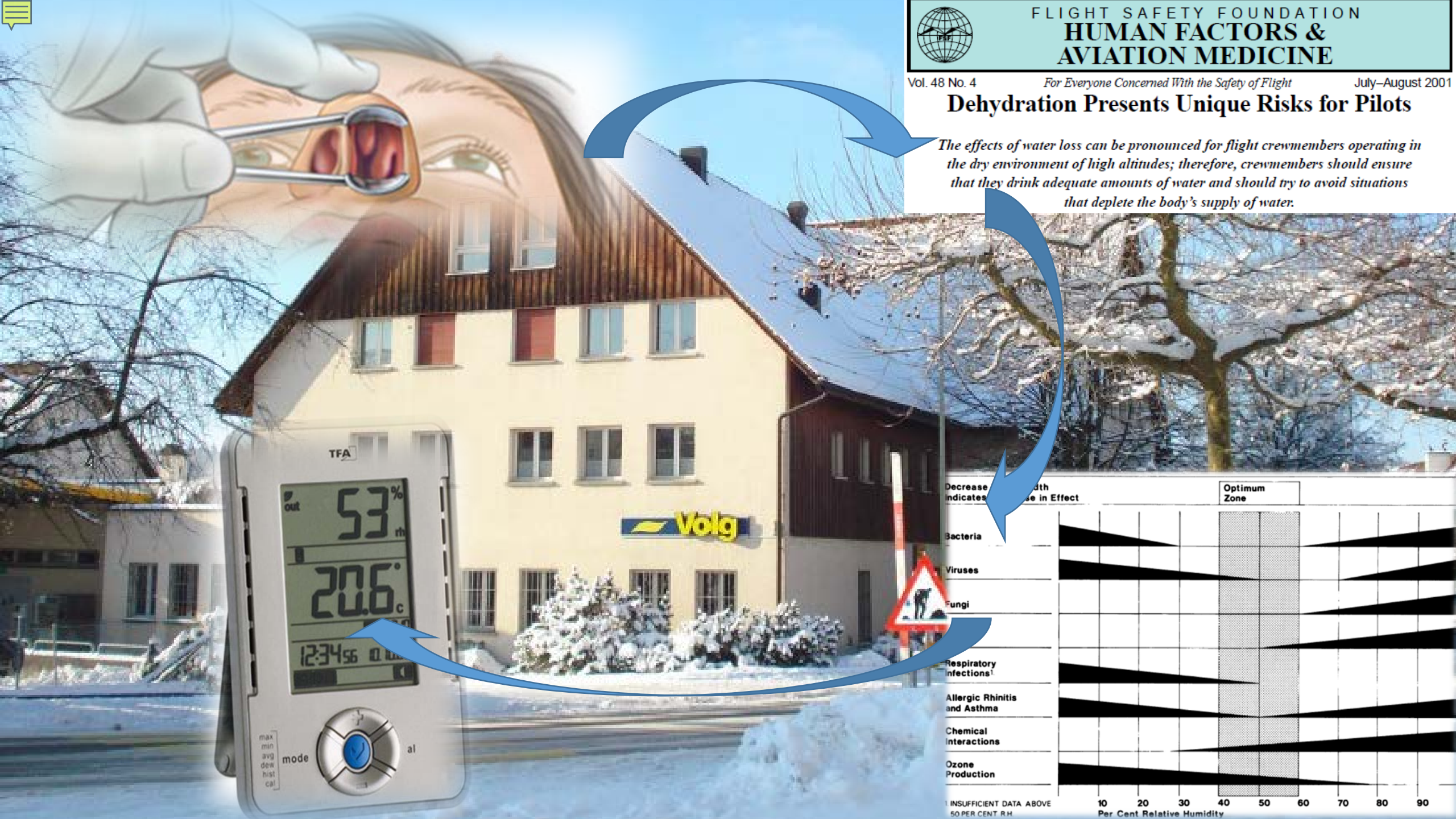
transmission ways of
pathogens

behavior of
infectious and allergic
bio-aerosols



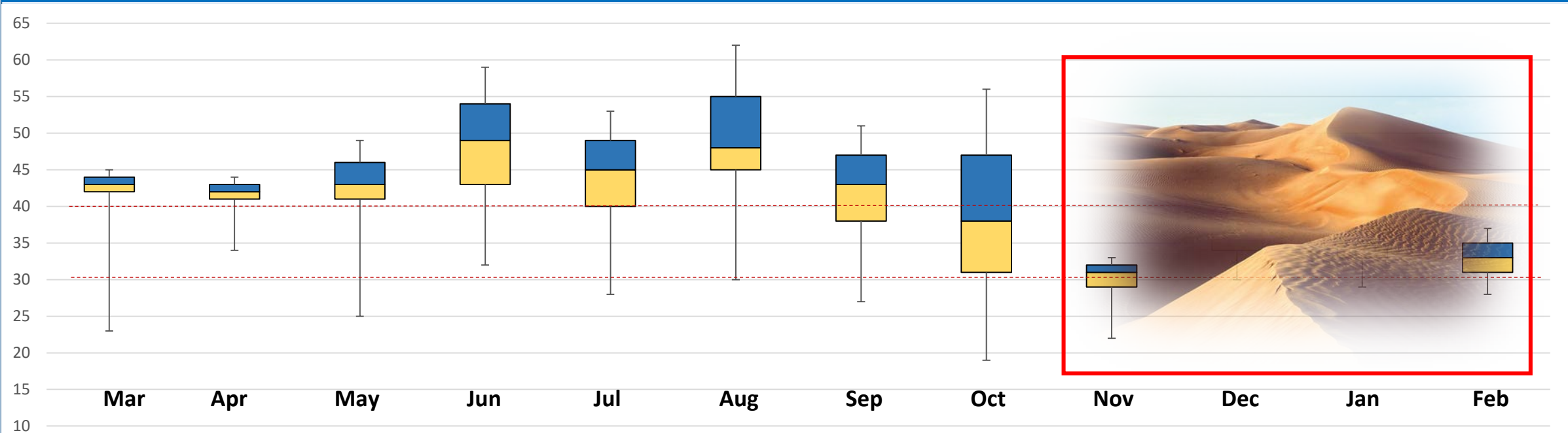
Dehydration Presents Unique Risks for Pilots

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Open space office in Zurich, Switzerland, annual data set on relative humidity, 2009/2010

(box plot's with median values, 25/75% quartile, min and max values)



Indoor climate values, hourly data on rel. humidity and temperature, °C

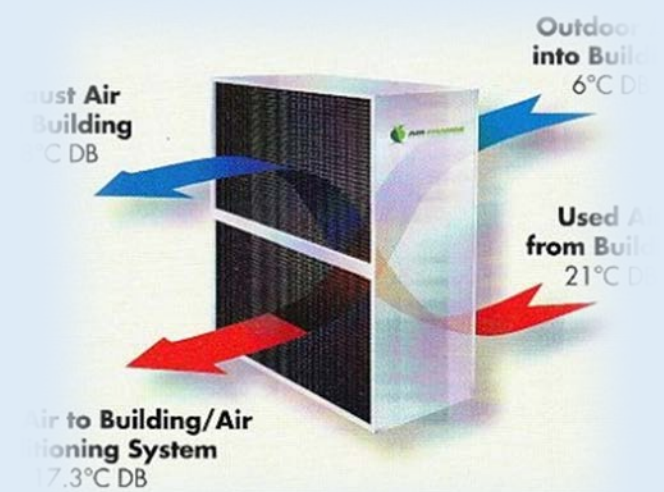
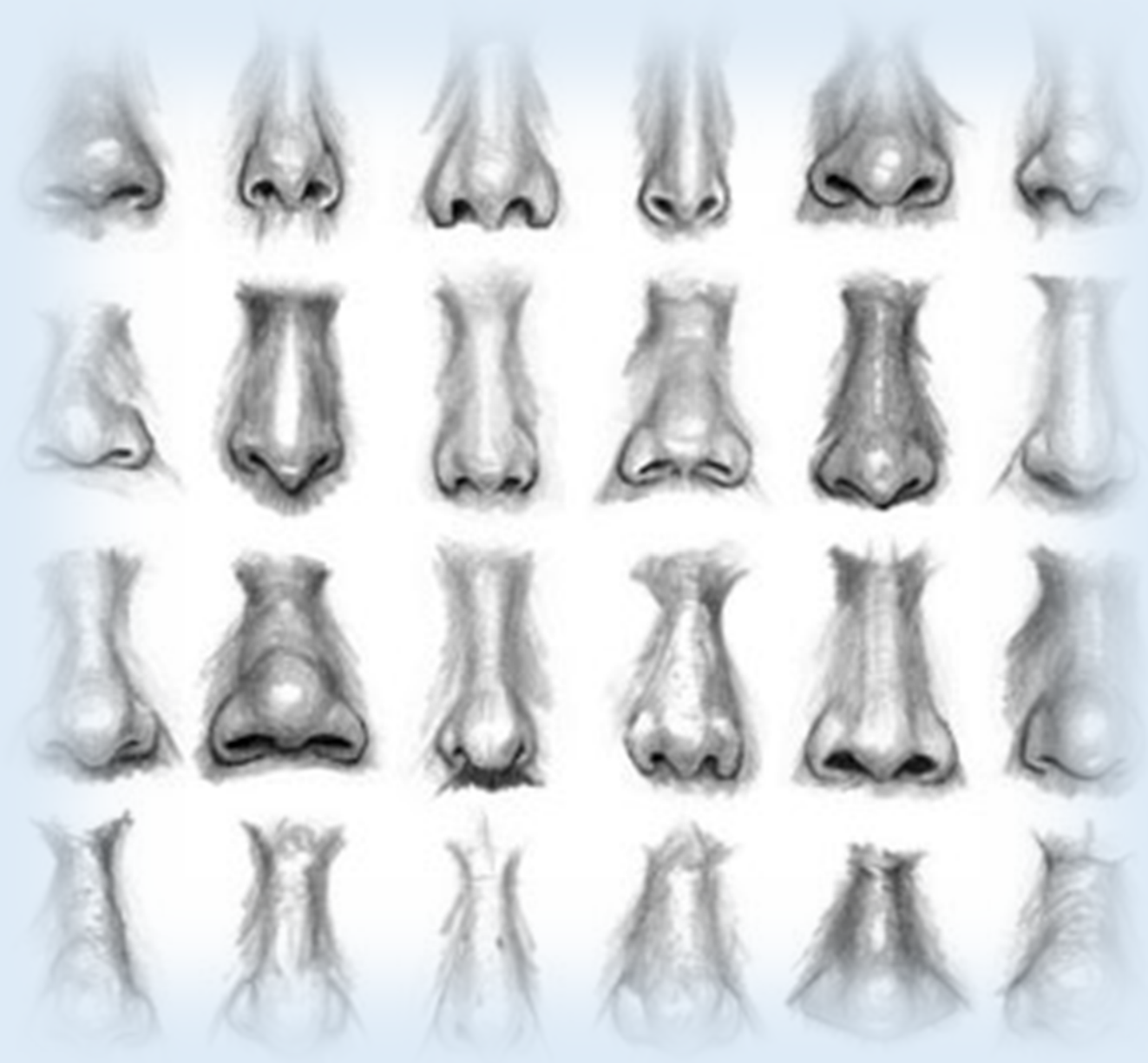
locality	open space office		shopping mall		hospital (new building)	
	Nov. 2007	Dec. 2007	Nov. 2008	Dec. 2008	Nov. 2010	Dec. 2010
median rh	31%	36%	32%	29%	29%	27%
median temp °C	22.9	22.2	23.2	22.6	22.3	22.0



Fv Gute Raumlufte Bern_Podium
Von Geschäftsstelle MINERGIE

②

So, Dr. Hugentobler you recently published an article in the biggest German speaking HVAC journal cci with the message “Our nose is our air handling unit”. Could you explain this to our audience?





High-Performance
Enthalpy exchanger

standard
nose breathing

50 %
10 mg/L
22 °C

task of heating
and humidifying
inhaled air

75-95% nose

5-25% throat area
+ trachea

Isothermic saturation
boundary (ISB)

Isothermic saturation
boundary (ISB)

100%
44 mg/L
37 °C

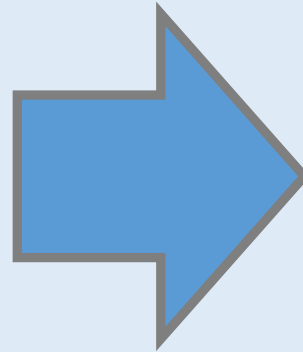
Source: **William R**, Relationship between the humidity and temperature of inspired gas and the function of the airway mucosa, Critical Care Medicine, 1996





Donald F. Proctor
Ib Andersen

60 ies and 70 ies



Basis message

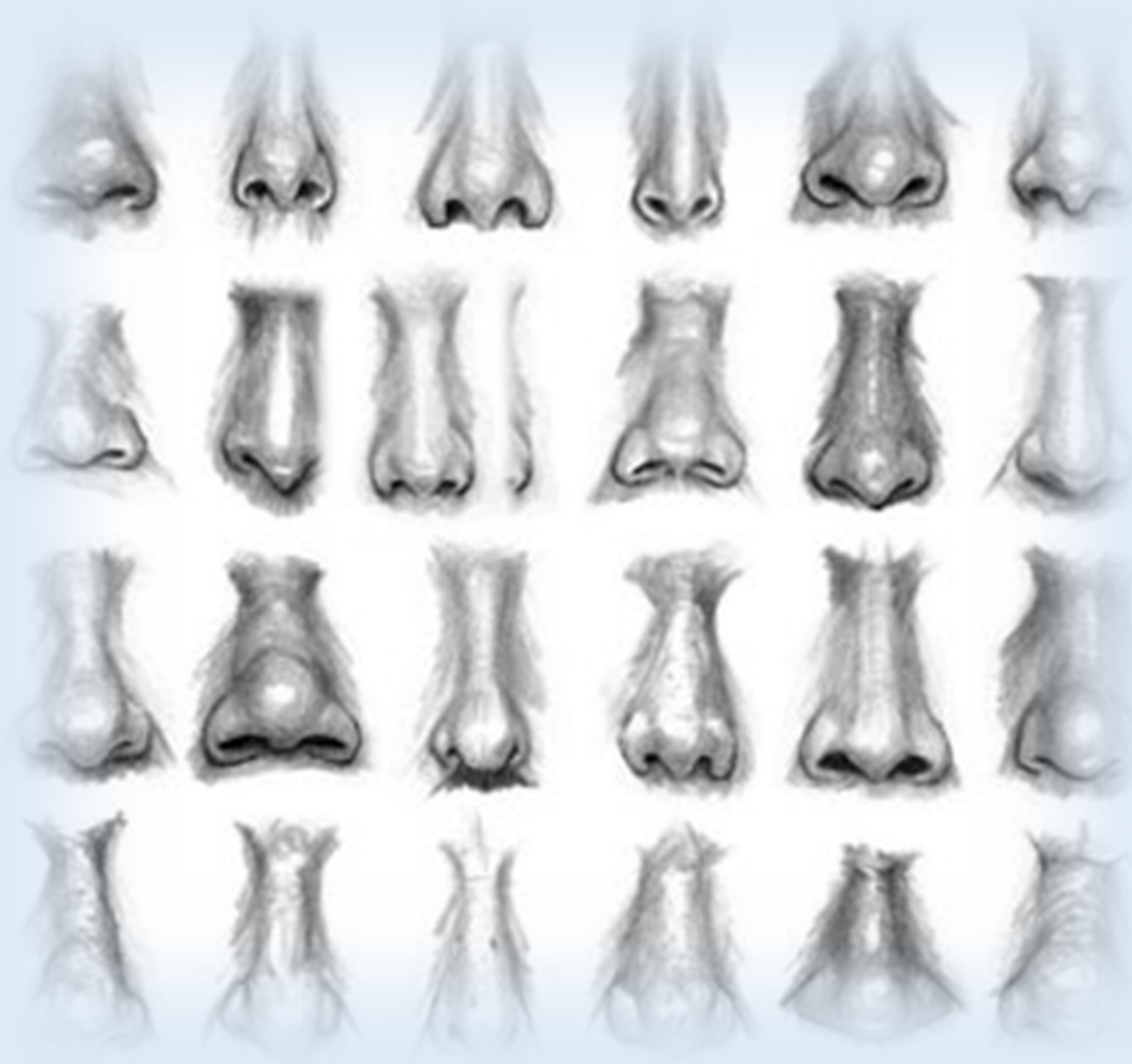
The human nose is able to
handle dry air

Quote

The study indicates that
there is no physiological
need for humidification of
the air

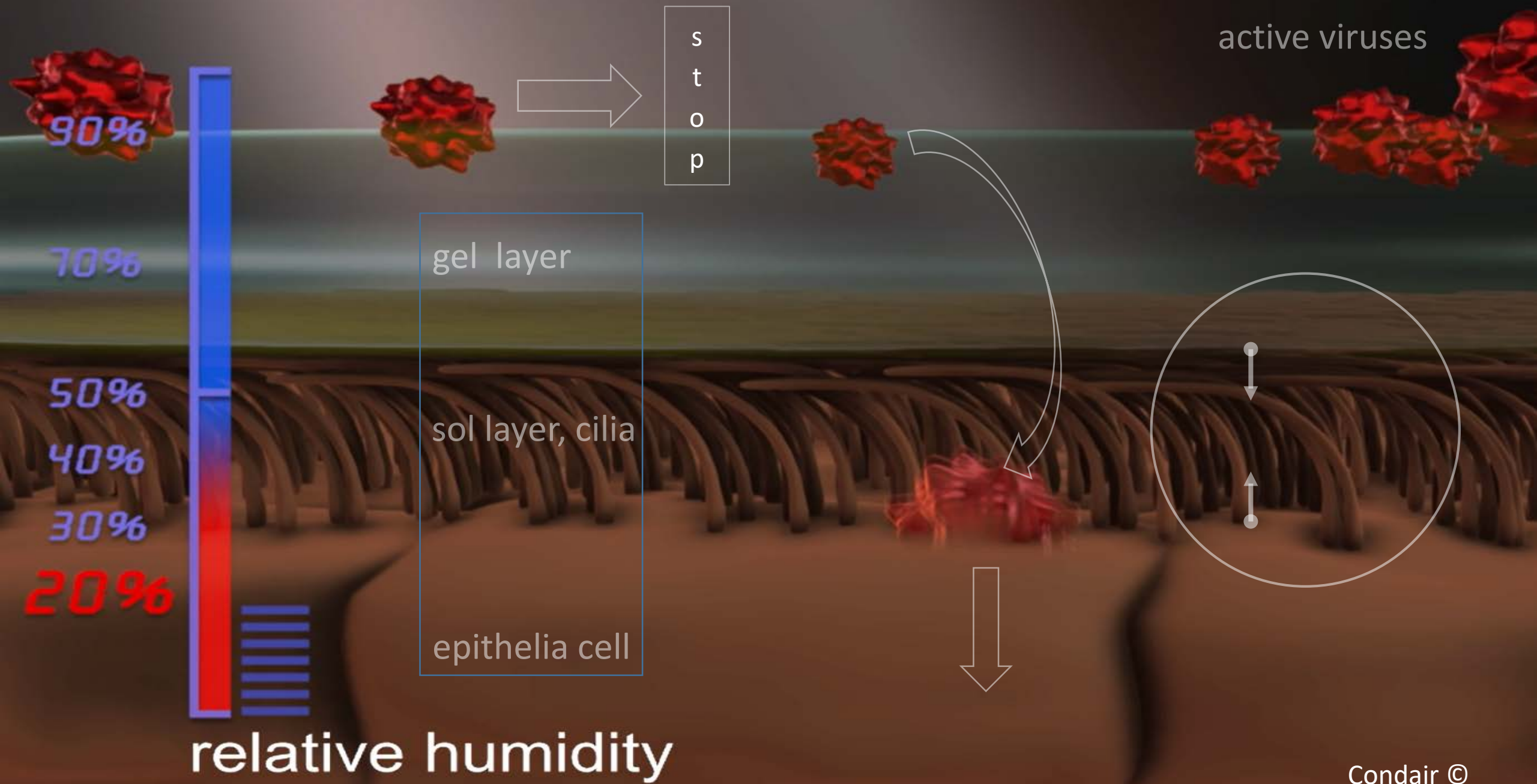
Quote «Human Response to 78-Hour
Exposure to Dry Air», Andersen Ib et al,
Arch Environ Health/Vol 29, Dec 1974

... . most physicians believe without questioning ... ever after



Noses are individually different as we are, differing in shape and function

Not all noses are healthy, standard size, without allergies, non-smoking and young ...



③

How many of us could avoid the flu or colds if our home and work places had proper humidity levels?



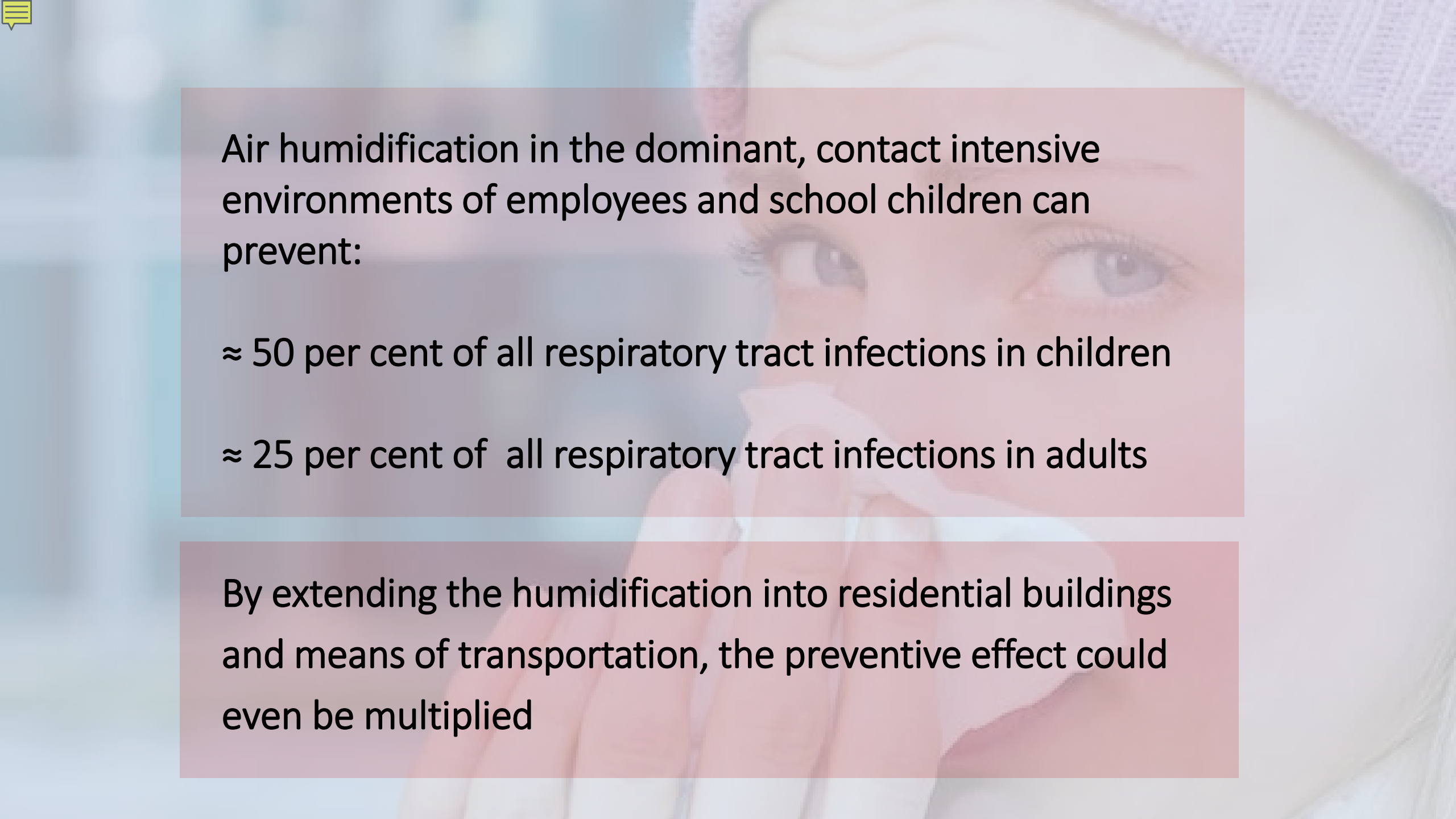
In the US approximately 500 million non-influenza related viral respiratory tract infections occur per year.

The total economic impact approaches 40 billion dollar annually (fig. for 2001)

Adults: 2 to 5 respiratory tract infections per year

Children: 7 to 10 respiratory tract infections per year

Fendrick M.A. et al, The Economic Burden of Non-Influenza-Related Viral Respiratory Tract Infections in the United States, Arch Intern Med. 2003



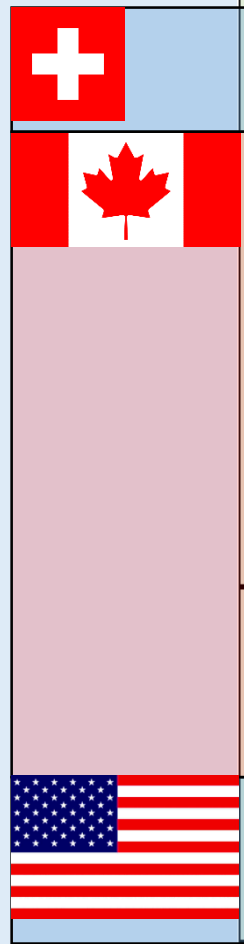
Air humidification in the dominant, contact intensive environments of employees and school children can prevent:

≈ 50 per cent of all respiratory tract infections in children

≈ 25 per cent of all respiratory tract infections in adults

By extending the humidification into residential buildings and means of transportation, the preventive effect could even be multiplied

Eight historic, successful prospective intervention studies on the preventive effect of humidification



Historic Studies* and Data			Rel. Humidity % (RH)		% Work Day Loss	Δ%	Ø Δ% (ARR**)	25 Winter Periods (inconsistent because of too small ΔRH)	Comment
	Author, Year, State, City	Building, Period, Population	RH (%)	Δ RH					
Children (Preschool) and Students	Ritzel ⁴ ,1966 CH, Basel	5 Double-Pavilions 9 Weeks, Jan-March 1965 232 Preschool Children	40 / 49	9 %	5.7 / 3	-2.7		1	% Days Missed due to RTI , RTI by Teachers Report
	Sale ⁵ , 1970 CA, Norfolk	3 School Buildings Nov 1969 – April 1970 516 Children, 4 Groups I (39), II (101), III (95), IV (281)	30 / 50	20 %	I H. Home + School 1.3 II H. at School 3.9 III H. at Home 5.1 IV no H. 7.1	I/II -2.6 II/IV -3.2 II/III -1.2 I/IV -5.8	Δ = 2.4 (41 %)	1	% Days Missed due to RTI, RTI diagnosed by Teachers, Parents, Doctors
	Green ⁶ ,1975 CA, Saskatoon	6 Schools, 3 with H. 1960-61, ~2400 Students	22 / 31 22 / 31 26 / 39	9% 9% 13%	5.30 / 3.99 4.79 / 4.20 4.46 / 3.63	-1.34 -0.59 -0.83	Δ = 0.92 (19 %)	3	% Days Misses lower in humidified Schools
		12 Schools, 6 with H. 1971-72 ~ 3600 Students	25 / 30 25 / 34 25 / 34	5% 9% 9%	4.25 / 5.10 5.77 / 4.53 5.03 / 4.50	+0.85 -1.24 -0.53	Δ = 0.9 (18 %)	3 (1)	ΔRH with 5-9% too small RTI diagnosed by Students or Parents
	Green ⁷ ,1985 CA, Saskatoon	11 Schools 7 no H. , 4 with H. Lost Days Record 1960-70 ~ 4400 Students	22-25 / 25-35	3-10%		0.97/0.56/0.87/0.04 0.17/0.35/0.63/1.04 0.38/0.36/0.1	Δ = 0.5 (9.8 %)	11	Days Misses constantly lower in Schools with Humidifier
Hospital Staff, Recruits	Green ⁷ ,1981 CA, Saskatoon	Hospital A, with H. 1973-74, 1974-75, 1975-76 185 Staff Hospital B/C, no H. 1973-74, 1974-75, 1975-76 650/1560 Staff	Years 1973-74 1974-75 1975-76	8/3.5 14/14 11/9	A B C 2.19 1.91 2.30 1.87 2.93 2.50 1.56 1.76 2.43	BA / CA +0.28/-0.11 -1.06/- 0.63 -0.20/-0.87	Δ = 0.48 (21%)	3 (1)	Winter 1973-74 ΔRH too small
	¹ Gelperin ⁸ , 1973 US Missouri	8 Barracks, 4 with H. 6 Month, 2 Periods of 3 Month ① Oct - Dec 1970 ② Jan-March 1971 800 Recruits	20 / 40	20%	① 378 Recruits 1.28 RTI/R. 365 Recruits 1.17 RTI/R. ② 418 Recruits 1.29 RTI/R. 400 Recruits 1.06 RTI/R.			1	Oct-Dec 1970 8% less RTI Jan-Mar 1971 18% less RTI Only RTI triggering Doctors Visit

*Three Studies (Sérati, Gubéran, Salstoff) are discussed in the Paper but not included in Table

Abbreviations: RH=Relative Humidity, no H./w. H.= no/ with Humidification RTI= Respiratory Tract Infection

Δ% = Percentage Difference of Days Missed, Adjustment for Working Days not possible (missing of detailed Information)

Text/Figures highlighted yellow=Figures consistent, significant Difference (p≤ 0.01) Text/Figures highlighted blue: Figures inconsistent, Difference not significant, ΔRH too small!

¹Gelperin, 1973, Results reported by Arundel and Green, no original data **ARR = Absolute Risk Reduction (%) for RTI

Average Reduction on % Work /School Days Missed and (ARR) : Children 2.4 % (41%) Students 0.5-0.92 % (9.8 -19%) Adults 0.48 % (21%)





1. **Arundel AV, Sterling EM et al**, Indirect Health Effects of Relative Humidity in Indoor Environment, Environmental Health Perspectives Vol. 65, 351-61, 1986



2. **Sterling EM, Arundel A, Sterling TD**, Criteria for Human Exposure to Humidity in Occupied Buildings, ASHRAE Transactions, 1985, Vol. 91, Part



3. **Scofield MC, Sterling EM**, Dry Climate Evaporative Cooling with Refrigeration Backup, ASHRAE Journal June 1992



4. **Ritzel G**, Sozialmedizinische Erhebung zur Pathogenese und Prophylaxe von Erkältungskrankheiten, Zeitschrift für Präventivmedizin 1966, 11. 9-16



5. **Sale Ch**, Humidification to Reduce Respiratory Illnesses in Nursery School Children, Southern Medical Journal, July 1972, Vol. 65, No 7



6. **Serati A, Wüthrich M**, Luftfeuchtigkeit und Saisonkrankheiten, Schweizerische Medizinische Wochenschrift, 99, 48-50, 1969



7. **Gubéran E, Dang VB., Sweetnam PM**, L'humidification de l'air des locaux préventielle les maladies respiratoires pendant l'hiver? Schweizerische Medizinische Wochenschrift, 108, Nr. 22, 1978



8. **Gelperin A**, Humidification and Upper Respiratory Infection Incidence. Heating, Piping and Air Conditioning, 45:3, 1973



9. **Green G**, The Effect of Indoor Relative Humidity on Absenteeism and Colds in Schools, ASRAE JOURNAL, January 1975

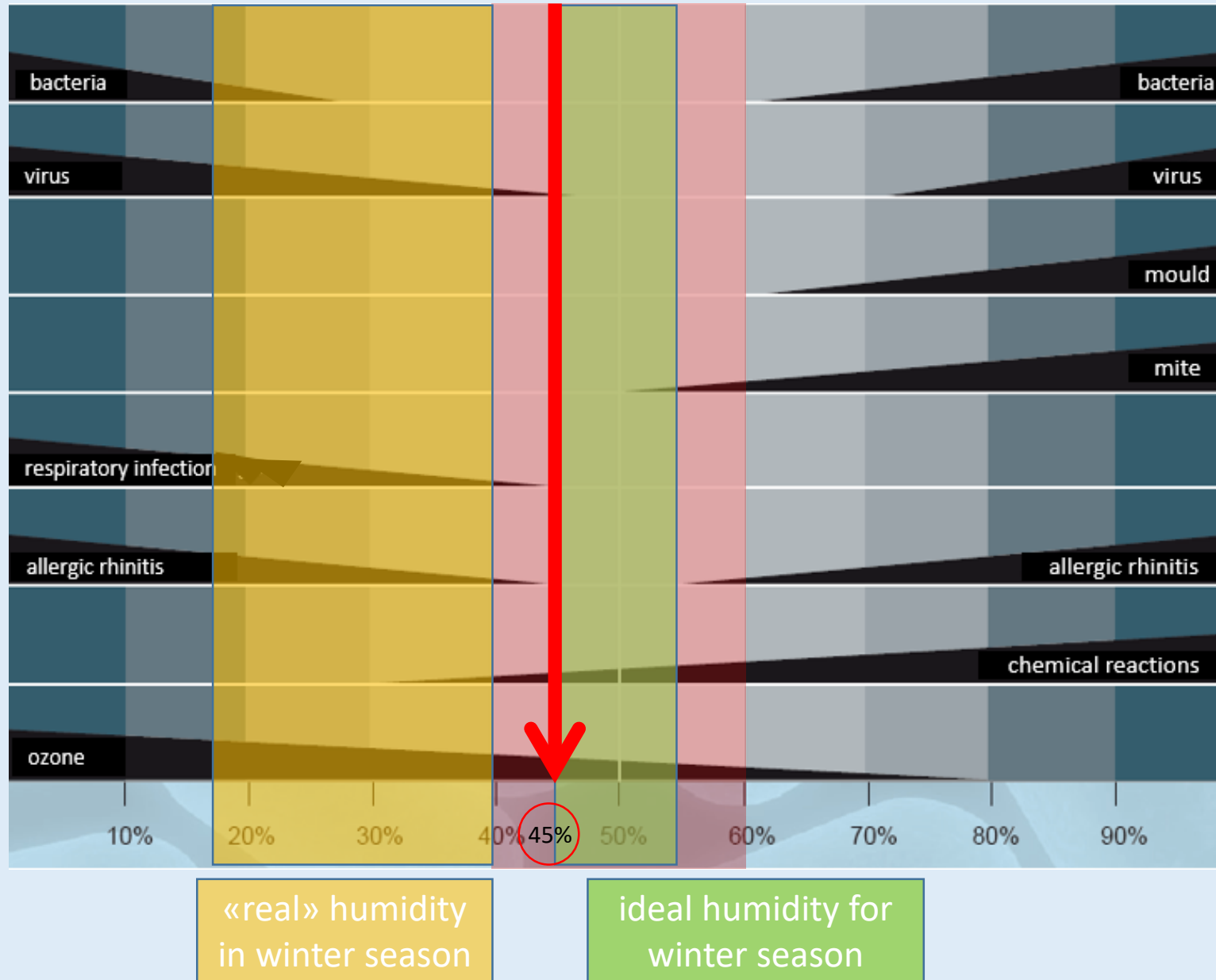
Five out of nine publications on the effect of humidification upon human health originated from Canada.

Most of us know the famous Scofield-Sterling diagram!





Scofield – Sterling diagram, published 1985
with **ideal** humidity level for winter season between 40% and 60% rh

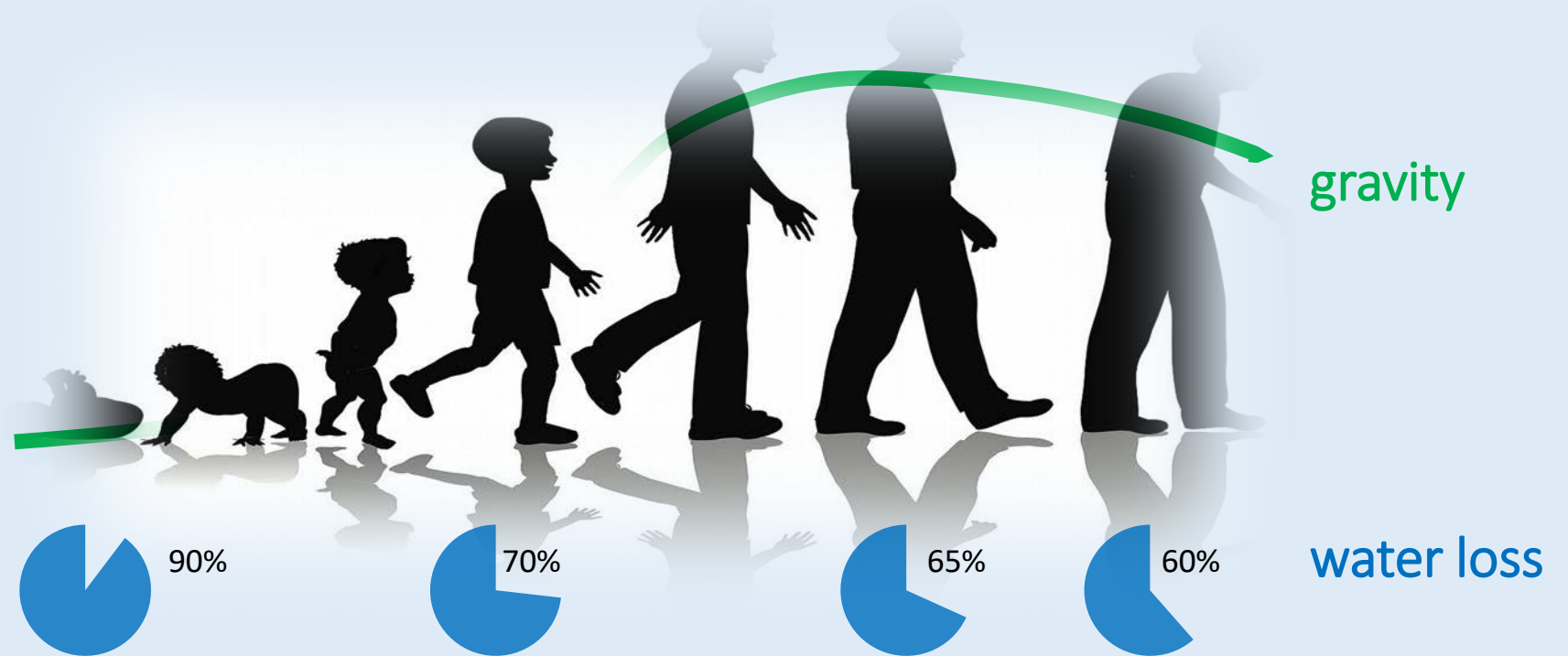


④

Surveys show that 30-40 per cent of people complain about dry indoor air in working and residential environments in winter time. What do you think we should be doing to change this?



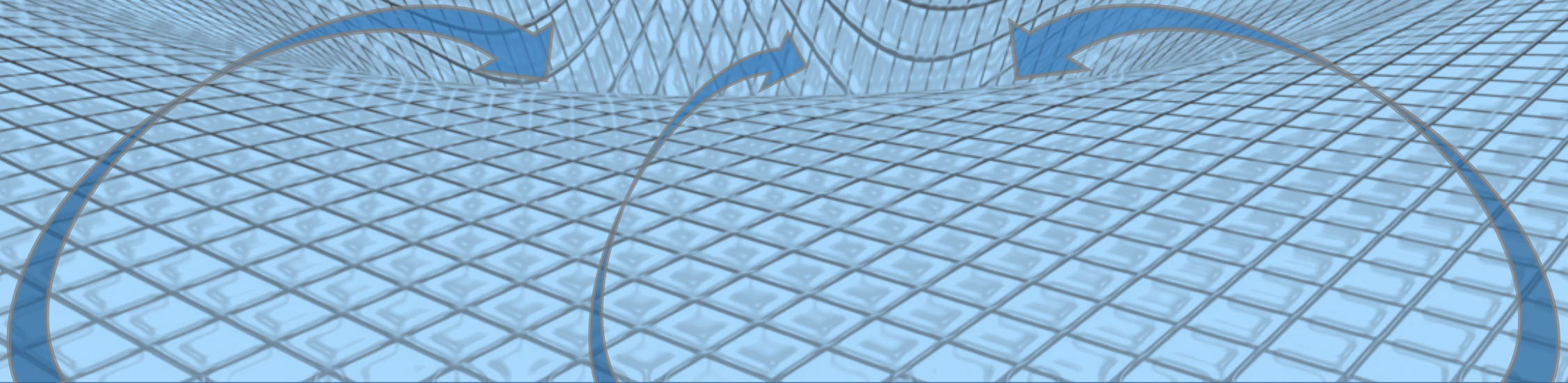
Human live is an ongoing struggle against gravitation and dehydration

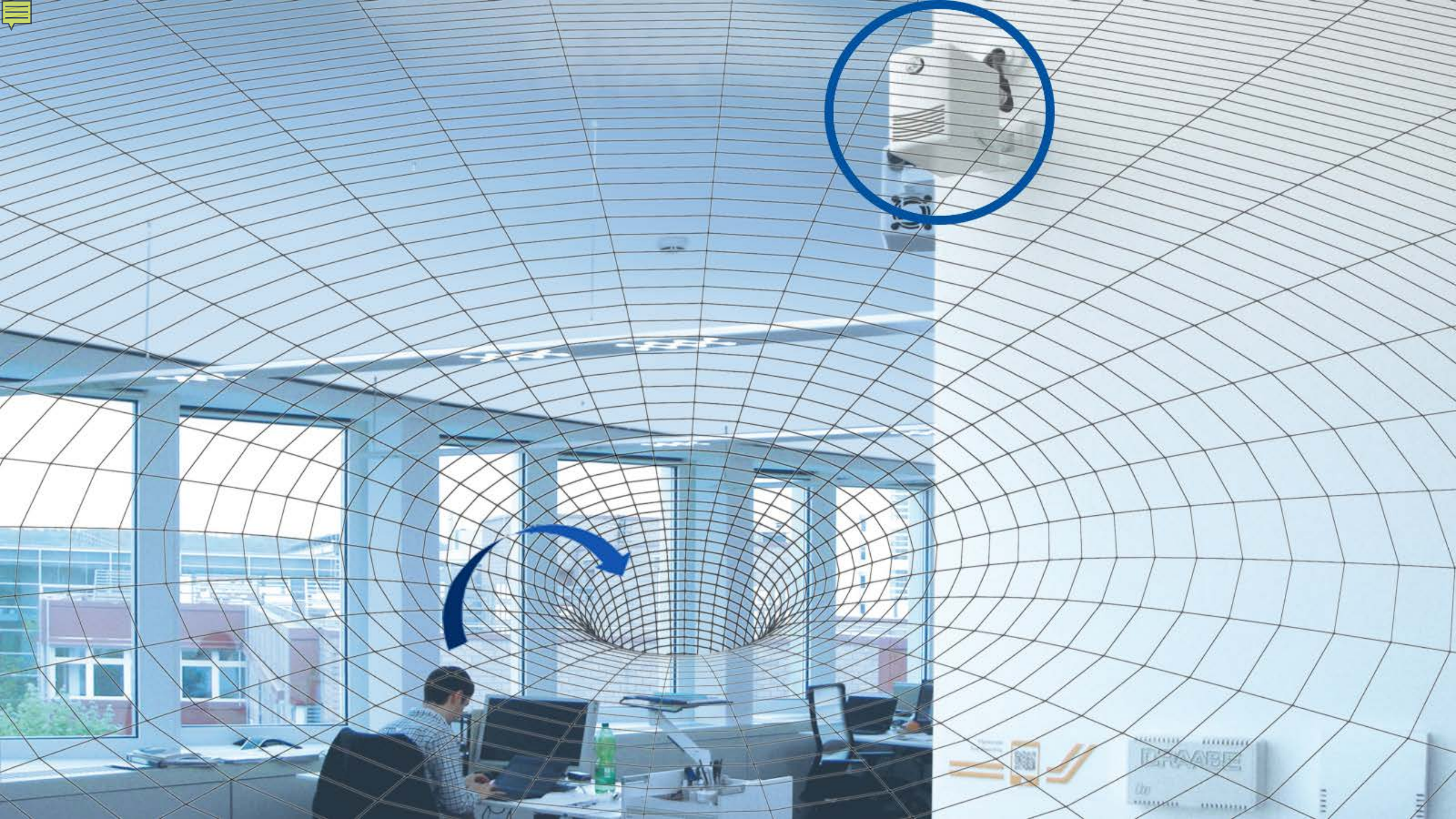


dehydration



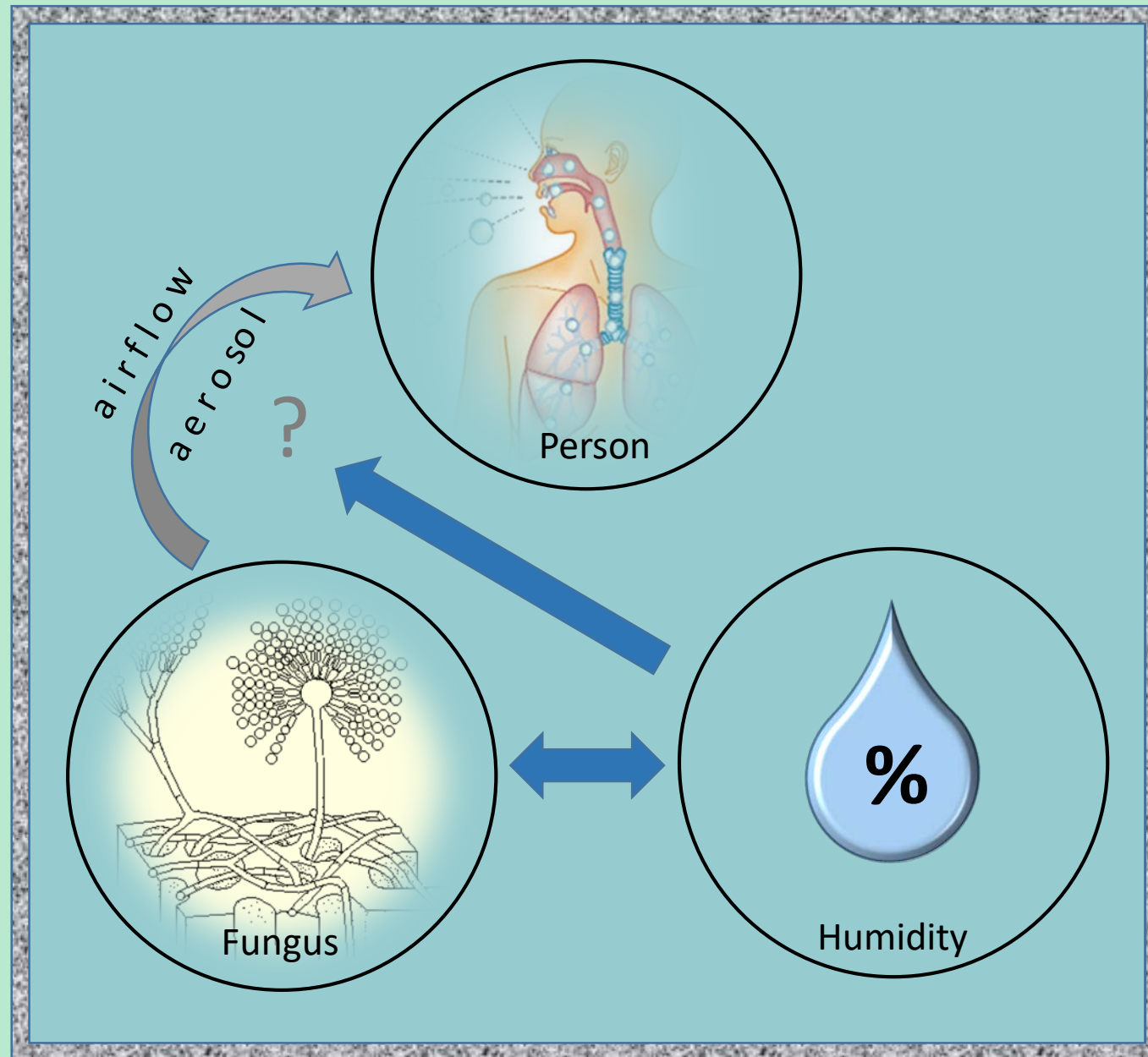
Nose, mouth, throat, skin and eyes must compete with the merciless, thirsty air that strives for saturation. Air picks up humidity wherever it is available and whatever it's manifestation





⑤

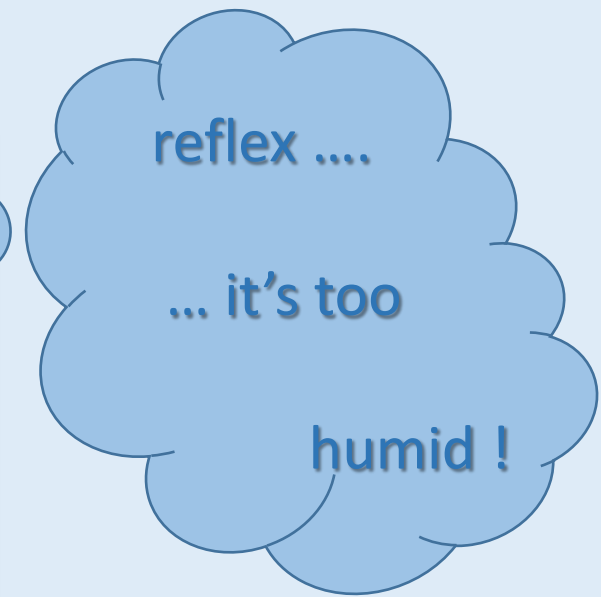
You frequently mention the fact that risk and exposure are two sides of the same coin but should be clearly distinguished. What do you mean by that?



Hazard?

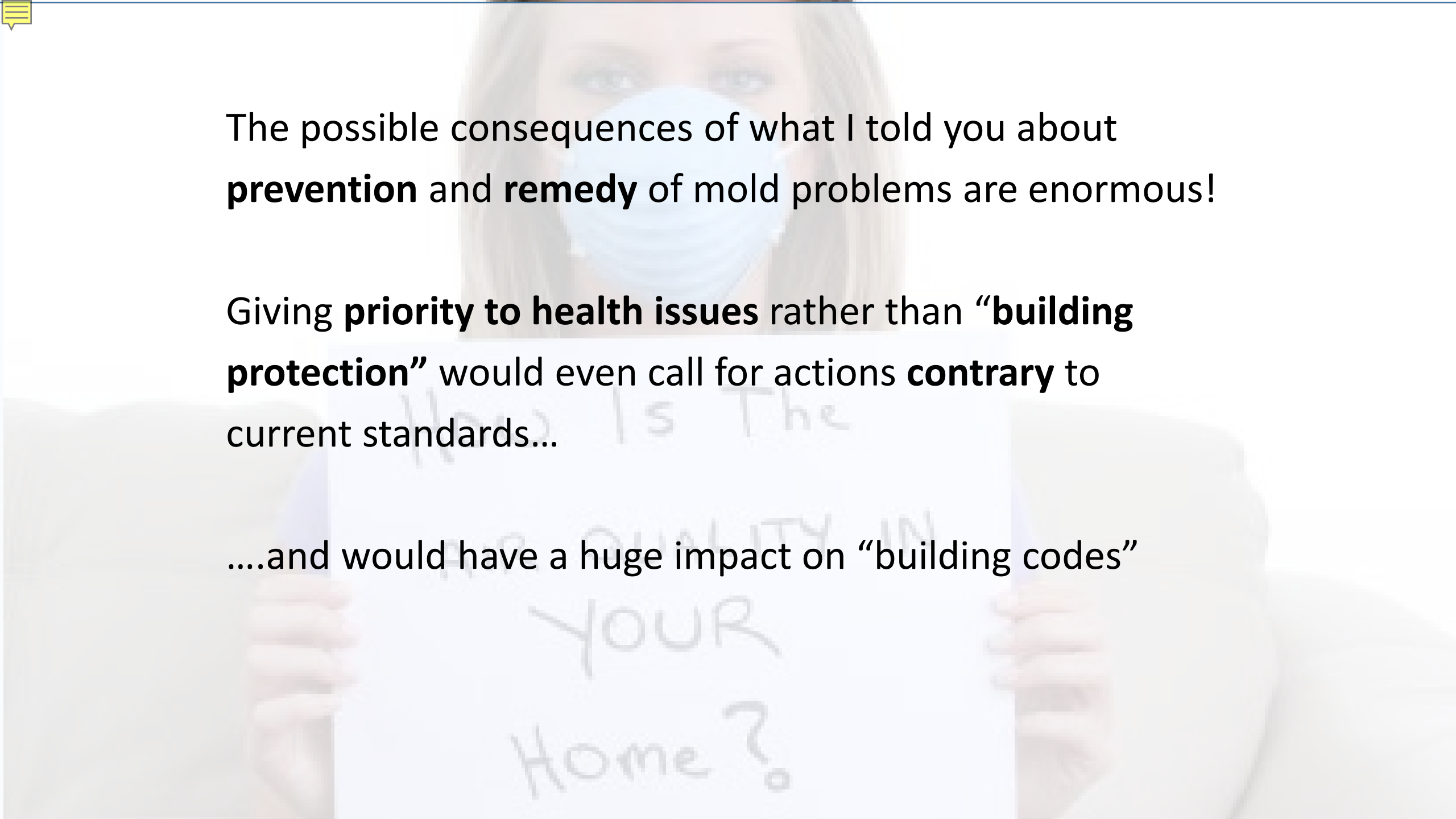
Risk?

Exposure?



The combination of “**structural dampness**” and “**dry air**” seems to be “**paradoxical**” to most of us. It’s not. It’s logic and common in our climate!

The above fact can only be understood by taking into account the **time sequence** and **time lap** between humidity and its impact on building structure and health.

A woman with blonde hair, wearing a blue surgical mask, is holding a white sign. The sign has handwritten text in blue ink that reads: "What Is The BEST QUALITY IN YOUR Home?".

The possible consequences of what I told you about **prevention** and **remedy** of mold problems are enormous!

Giving **priority to health issues** rather than “**building protection**” would even call for actions **contrary** to current standards...

....and would have a huge impact on “building codes”

⑥

Are children and seniors more vulnerable to the effects of low humidity?

• TheUpshot

No, You Do Not Have to Drink 8 Glasses of Water a Day

AUG. 24, 2015



Aaron E. Carroll

THE NEW HEALTH
CARE

If there is one health myth that will not die, it is this: You should drink eight glasses of water a day.

It's just not true. There is no science behind it.

And yet every summer we are inundated with [news media reports](#) warning that [dehydration is dangerous](#) and [also ubiquitous](#).

- delicate fluid balance
- higher water loss through the skin
- no self-control over fluid input
- no control on clothing



- there sense of thirst is clearly reduced (is thus unreliable as the sense for humidity)
- bedridden and unconscious persons have no autonomy
- seniors often limit drinking in order to reduce toilet visits
- mentally ill persons often forget to drink

resulting health implications
are underestimated and have
barely been investigated





THANK YOU FOR YOUR ATTENTION !