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Abstracts

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rone supplementation improved lung function, hemodynamic measurements, reduced fibrosis, reduced inflammation and immune response, and decreased vascular remodeling in the lungs. Interestingly, such phenotypic enhancement was absent in ovariectomized Fra-2 Tg mice following testosterone replacement. We are further investigating the role of testosterone in fibroblast activation and collagen deposition and the underlying cellular mechanisms.

Conclusions: These findings suggest a potential protective effect of testosterone and an association between testosterone levels and disease severity in male Fra-2 tg mice, highlighting the importance of sex hormones in SSc pathology.

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The lungs from an evolutionary perspective

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Background: If individuals vary their genetic makeup and, as a result, their characteristics as a result of a mutation, selection will result in different reproductive success. The postulate „**Evolution pushes physiology in the most economical direction possible**“ is therefore very likely from this point of view, because a living being that achieves the same performance with less food inevitably has a selective advantage.

Methods: Applied to the lungs, this extremum principle [see: The (human) respiratory rate at rest. J. Math. Biol. 85, 60, 2022] with only few boundary conditions leads to:

Results: The pressure in all alveoli is the same (=alveolar pressure).

- The static compliance C of the lungs including the thorax reaches its maximum value within the FRC and is largely constant within this area, since a maximum value of C corresponds to an inflection point of the static pressure/volume curve.
- The resting respiratory rate can be calculated from the following 6 parameters: C, airway-resistance R, dead space volume, CO₂-production rate of the organism, end-tidal-CO₂ fraction, ratio I:E of inspiration to expiration time.
- Each subsection of the lung as well as the entire lung itself can be regarded as an RC-element and each has a fixed time constant R·C. From a physiological point of view, the lung is therefore self-similar up to just before the alveoli. The two lungs therefore work synchronously and a lung lobe can therefore be transplanted into a child.
- The volume flow during quiet spontaneous inspiration is largely constant.
- Quiet expiration follows an exponential function with regard to expiratory volume and volume flow.

Conclusions: Analogous to the extremum principle of stationary action in natural sciences, the above postulate could therefore be used as an example for using extremum principles in (lung)physiology for fundamental cognitive processes with as few prerequisites as possible, so to say as an „ab initio method“.

ÖGP ABSTRACTS CLINICAL SCIENCES

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Associations between long-term exposure to air pollution and lung function in the LEAD general population study

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Background: Exposure to air pollution has been linked to an increased risk of abnormal lung development and impaired lung function. This study investigates cross-sectional associations of long-term exposure to particulate matter (PM₁₀) and nitrogen dioxide (NO₂) with lung function.

Methods: We used repeated measurements of lung function in the Austrian LEAD (Lung, hEart, social, boDy) study, a general population cohort of children and adults (6–80 years). FEV₁ and FVC were measured at the baseline (t₀; 2011–2022) and follow-up (t₁; 2017–ongoing). Annual concentrations of PM₁₀ and NO₂ from a chemical transport model (2015–2021) were assigned to individual's home addresses. Linear mixed-effects models with random participant intercepts were used, stratified by two age groups, and adjusted for lifestyle, sociodemographic, time-trend, and noise exposure.

Results: A total of 18,824 observations (n₀ = 13,712, n₁ = 5112) from participants aged 6–86 years (mean age at t₀: 41.0 years; 52.9 % female; mean PM₁₀ = 21 µg/m³) were analysed. Among adults (≥ 25 years), higher PM₁₀ exposure was associated with a reduced FVC of -25.7 ml (95 % confidence interval (CI): -44.0, -7.3) and FEV₁ of -16.4 ml (95 % CI: -31.0, -1.7) per interquartile range (1.8 µg/m³) increase. Effect estimates for NO₂ were also negative but weaker and borderline-significant. Among children/young adults (< 25 years), higher PM₁₀ exposure was associated with a reduced FVC of -31.7 ml (95 % CI: -55.9, -7.5).

Conclusions: Long-term exposure to PM₁₀ impacts lung function in both children/young adults and middle-aged and elderly.