Critical Significance of Microcirculation and Endothelial Functions- State of the Art- 15 years of Emerging Endothelial Research

1. All organisms “feel“ and “hear“ with inner receptors in the circulatory system and organs, including the skin, called mechano-sensors. This discovery of this new level of perception by all organisms by Ardem Patapoutian was awarded the Nobel Prize in Medicine in 2021.

2. Ardem Patapoutian classified PIEZO channels as currently the most important group of mechano-sensors, a crucially newly recognized level of perception of physical forces and sound in all living things.

3. Vital functions are ruled by coordinated forces in the bloodstream of the capillary system. This causes thrust forces to act on the endothelial membrane, which moves sideways and opens the wings of the PIEZO I channel. This movement is perceived by different receptors for forces. One of the most important is the PIEZO I channel, embedded in the membrane of the endothelial cell.

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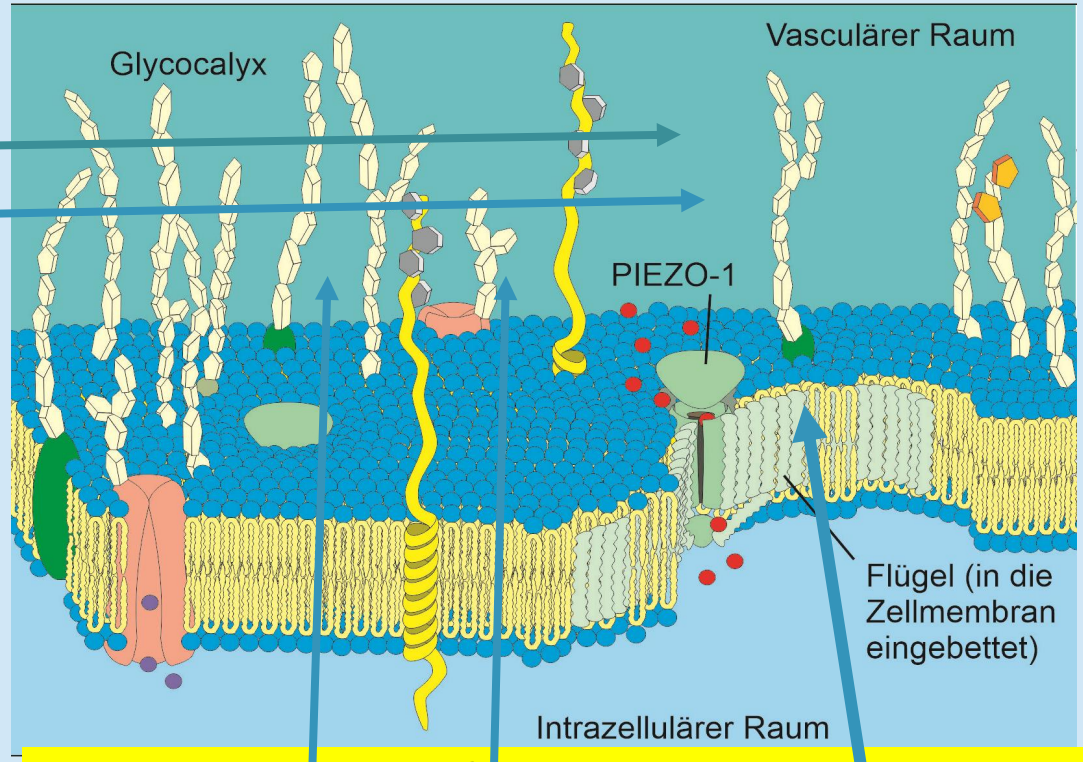
Surface of the Endothelial Membrane Towards the Bloodstream

Main driving forces in the bloodstream



Bilayer membrane of the Endothelial Cell with PIEZO-channel,

Vital functions of all organisms are dependent from laminar forces in the bloodstream and a healthy endothelium and without interruption of the laminar flow

External Forces are perceived such as proprioception, air pressure

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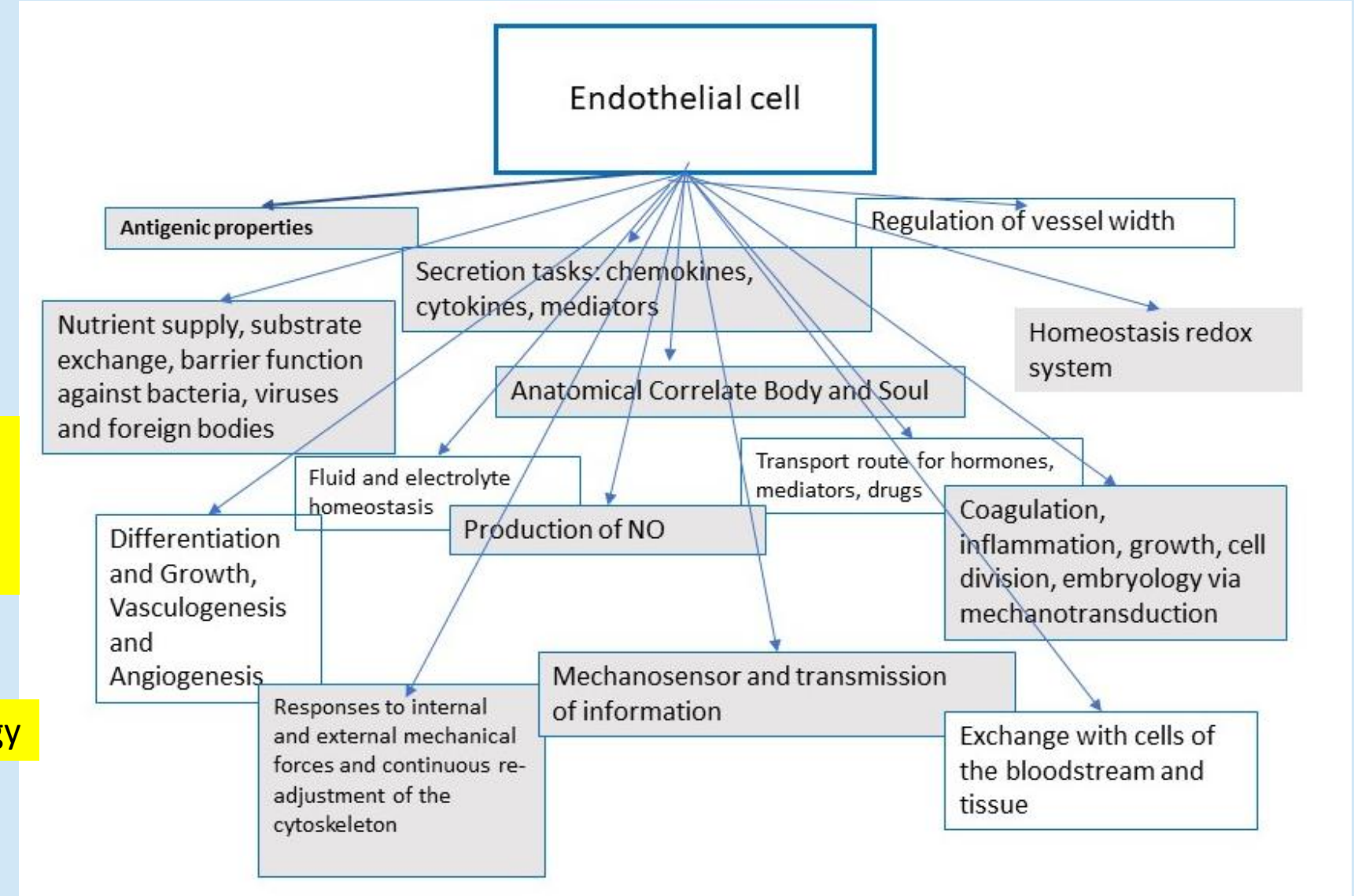
Grafik 07/24 Dr. Ursula Bellut-Staeck

Advance in Research: KNOWN Endothelial Functions

Exchange of nutrients and oxygen

Autotune Regulation of the Vessel Width-Homeostasis of NO

Growth, Embryology



Transport of hormones, medications

Homeostasis of fluids

Immunosystem, chronic inflammation and cancer

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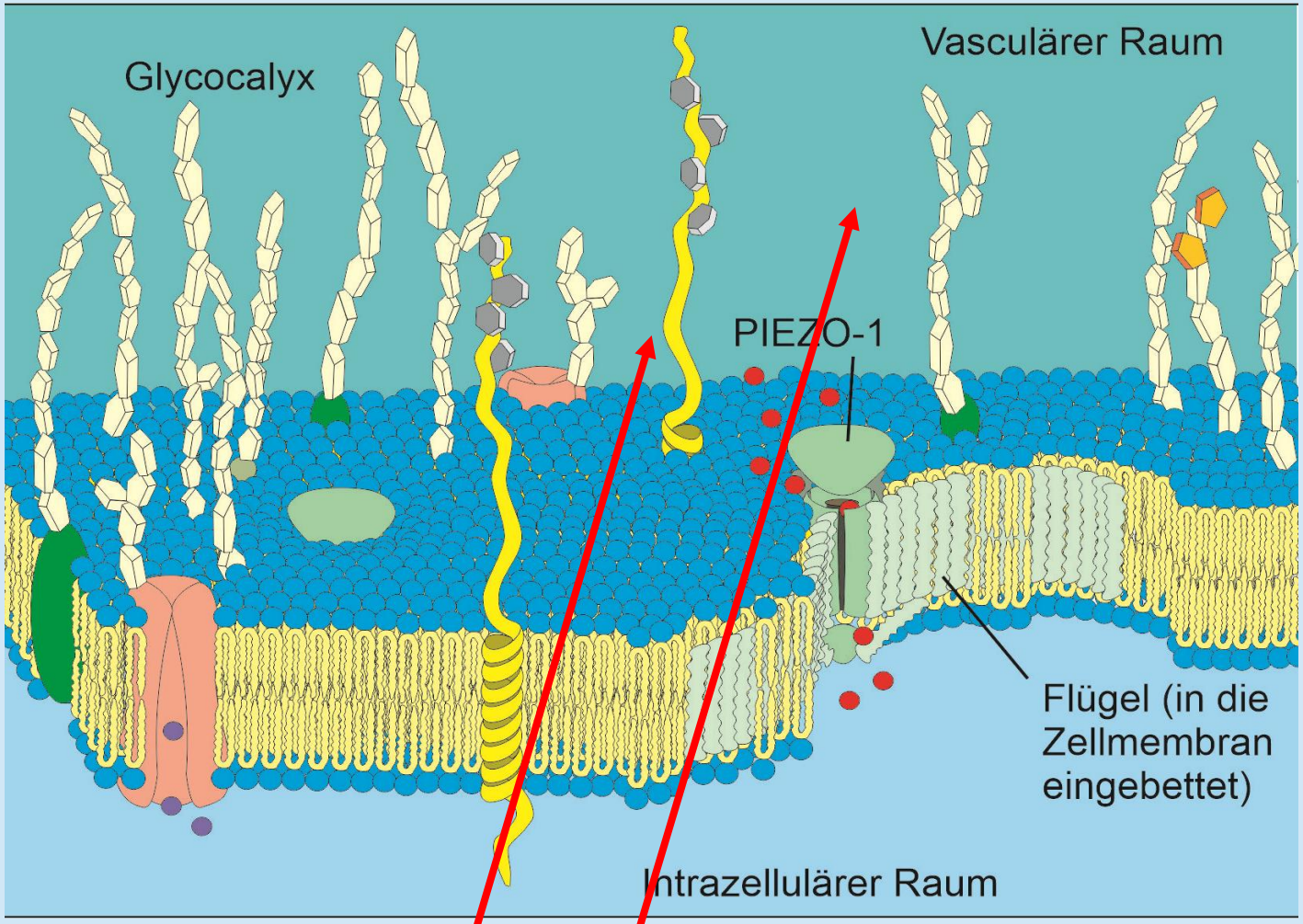
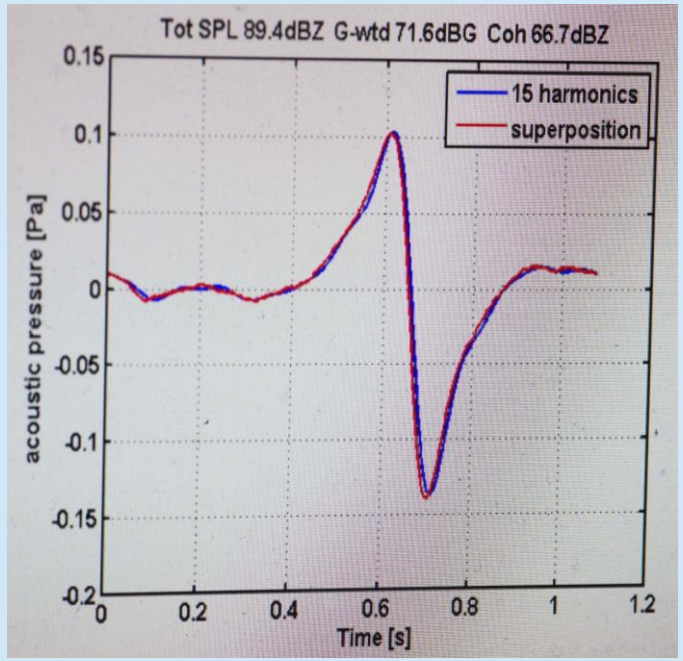


The properties of infrasound are transmittable forces sensed by the viscoelastic tissues in the body which supports the evidence that it is reaching the mechanosensor level and could lead to irregular information.

Infrasound with periodic and impulsive waves- this could lead to irregular information AND triggering of receptors causing imbalances.



Impulsive repetitive signals

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IT HAS BEEN LONG-ESTABLISHED THAT in the auto-regulated system, nitric oxide (NO) is emitted adequately for cellular function. If it is not emitted at the right time, in the right place, and in the correct amount, **oxidative stress increases**.

Table 1. The different possible effects of Nitric Oxide as protective, regulatory, and deleterious

***Protective effects*:**
• Antioxidant
• Inhibits leucocytes and platelet adhesion
• Protects against toxicity and peroxidation
Regulatory effects:
• Vascular tone
• Cell adhesion
• Vascular permeability
• Neurotransmission
• Bronchodilation
• Inflammation regulation
• Regulation of renal function
Deleterious effects
• Inhibits enzymatic function
• Induces DNA damage
• Induces lipid peroxidation
• Increases susceptibility to radiation, alkylating substances, toxic metals
• Depletes reservations of antioxidants

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Consequences:

1. In the beginning, functional disorders of the microcirculation. Symptoms of disorder can include: dizziness, headaches, tinnitus, thoracic pressure, weak muscles.

2. A long-term impact with increased oxidative & oscillatory stress can lead to an endothelium in an inflammatory state, which is also the basis for artherosclerosis and decreased endothelial functions.

3. Inflammation of the endothelium tend to lead to high blood pressure, vascular diseases, heart attacks, strokes.

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Conclusion

1. All organisms are equipped with mechano-sensors, in particular with PIEZO channels. For this reason, all organisms could be impacted by man-made infrasound.

2. Therefore, the impacts of infrasound frequencies and vibrations on people residing in close proximity to industrial wind turbines cannot be simply dismissed based on old studies that were previously valid. Findings from new studies must be considered.

3. A cautionary approach to establishing the setback for an industrial wind turbine project should be adopted. The distance at which serious health disturbances may be avoided is to be determined scientifically and not based on old studies. Factors such as the descending fundamental frequencies due to the increasing size of the rotor diameter, the main wind direction and wind speeds, the interaction of emissions from several wind turbines, the possible interferences between different wind farms and the topography must be considered.

4. Before establishing safe distances, various low-frequency forces need to be re-evaluated in terms of their effects before establishing safe distances could occur.

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