

Infrasound Impacts at the Cellular Level - Introduction & History

Initial Low Frequency Noise (LFN) Research (1950s to 1970s)

- Key discovery of this period: chronic low frequency noise (LFN) causes cumulative harm to body systems (military & aerospace contexts)
- Workers exposed in aviation and heavy industries experienced nausea, fatigue, sleep disturbances, disorientation, thickening of cardiovascular structures, mood disorders, and neurological dysfunction
- References: [Vladimir Gavreau \(Wikipedia\)](#), [NASA: Apollo Space Program](#)

Vibroacoustic Disease Studies (1980s and 1990s)

- Portuguese researchers formalize the concept of Vibroacoustic Disease (VAD)
- Initially discovered in aircraft technicians; linked to fibrosis of cardiac tissue, memory issues, and neurological effects (later included train operators & shipyard workers)
- Effects extended to : cognitive dysfunction, balance disorders, tinnitus, autonomic nervous system dysregulation, irritability, arrhythmias, hypertension, emotional instability, and neurological symptoms
- Early studies found that LFN could cause health effects even when people couldn't hear it - pointing to infrasound below the frequency of 20Hz as the cause.
- References: [Mariana Alves-Pereira & her You Tube interview on VibroAcoustic Disease](#)

Wind Turbine Syndrome (2000 to 2010)

- Installations grow across Europe, Australia, and North America; first complaints registered from 2003-2004 included sleep disturbance, headaches, pressure in chest, anxiety, ear pressure, and cognitive fog
- A U.S. Princeton & Harvard trained doctor coins the term: Wind Turbine Syndrome, published a self-funded case series of 10 families living near turbines in 2009. Her work was attacked by pro-wind industry groups but embraced by affected communities and several independent researchers.
- [Nina Pierpont, MD PhD book Wind Turbine Syndrome: A report on a natural experiment](#)

From 2010 to Present in Ontario & Alberta

- In both provinces, wind generation grew significantly between 2008 and 2024 resulting in each province having an installed generation capacity of 5500+ MW by mid-2025
- In Ontario, affected people can call the Ministry of Environment's Spill Action Line to report issues related to living near wind turbines; in Alberta, people must try to report and resolve noise issues directly with the corporation operating the wind power plant (WPP).
- In Ontario, reports have been made on numerous symptoms experienced after the WPP began operation. In Alberta, landowners only have the ability to file complaints regarding audible noise.
- Wind project operators are not required to measure inaudible infrasound (below 20Hz) that causes health impacts before gaining project approval.
- By the end of 2018, over 5800 complaints were registered in Ontario with the vast majority left unaddressed after being recorded; Wind Concerns Ontario collected this data through FOIA requests and compiled the results in the report linked below.
- As turbines grow in generation capacity and blade length, the infrasound generated increases exponentially, creating a further need to determine minimum setbacks from people and homes.
- Most electricity-generating equipment can generate infrasound below the level of human hearing. Batteries, inverters, transformers, and substations all require adequate assessment.
- [Wind Concerns Ontario report: Response to Wind Turbine Noise Complaints \(April 2021\)](#)

Infrasound Impacts at the Cellular Level - The Science In Plain-English

Nobel Prize Research on Sensory Receptors (2000 - 2021)

- David Julius & Ardem Patapoutian discovered the molecular sensors (mechanosensors) responsible for temperature and touch – TRP ion channels (for heat/cold) and PIEZO ion channels (for mechanical force/touch).
- This work solved a centuries-old question: how physical stimuli like heat, cold, and pressure are turned into electrical nerve signals.
- Genetic studies began in the early 2000's and PIEZO1&2 were identified in 2010.
- PIEZO2 channels were found primarily related to sensing touch in 2014 and PIEZO2's role in proprioception (sense of body position) was shown in 2015.
- Between 2016 and 2021, much research was completed to confirm, characterize, and expand the importance of these channels across multiple tissues and systems: hematology, ocular physiology, bone biology, immunology, and chronic disease.
- Typically, the Nobel Prize is awarded only after the key findings have been repeated by others, have shown biological and medical significance across fields, and have received various forms of peer recognition. This is why the Nobel Prize was not awarded until 2021.
- [Nobel Prize Research Article published in 2021](https://www.nobelprize.org/prizes/medicine/2021/advanced-information/)
<https://www.nobelprize.org/prizes/medicine/2021/advanced-information/>

Blood Circulation & Endothelial Cells

- Blood delivers oxygen & nutrients to every cell in the body & moves harmful waste out
- Endothelial cells form an ultra-thin (nanoscopic) protective lining along the inner walls of every artery in your heart and blood vessels of all sizes including capillary microcirculation.
- When blood flows, endothelial cells absorb information through PIEZO ion channels that can, for example, regulate nitric oxide (NO) release to help control how & when arteries dilate.
- The **endothelium** (network of endothelial cells) form a barrier controlling the passage of materials into and out of the bloodstream and it is the foundation to regulate body systems and processes
- Dr. Bellut-Staack's research: [Impairment to the Endothelium & Disorder to Microcirculation..... \(2023\)](#)

Mechanotransduction & Infrasound

- **mechano**= force **transduction**= converting electrical energy into biochemical signals
- **mechanotransduction**: how forces of physical energy transfer will impact the biochemical activities of cells or individual molecules
- The endothelial lining of blood vessels contains **mechanosensors** (sensors that can register a mechanical force), namely the PIEZO1 & PIEZO2 ion channels.
- Living bodies react differently to natural external forces (wind) than man-made mechanical forces (noise from a turbine); all organisms “feel” and “hear” with these mechanosensor inner receptors.
- When a mechanical force in the low frequency range (below 10Hz) is received, it causes PIEZO ion channels to open or close in response, which can disrupt endothelial cell functions triggering dysfunction & illness.
- Endothelial cell functions include: exchange of nutrients & oxygen, growth & embryology, auto-regulation of blood vessel width & balance of nitric oxide, transport of hormones & medications, homeostasis of fluids, and regulation of the immune system, chronic inflammation & cancer.
- The impulsive, repetitive sound pressure waves of infrasound (above and below ground) are “felt” by mechanosensors in the endothelial cells resulting in **direct & serious** health impacts.
- Dr. Bellut-Staack's 2025 research in SCIREA's Journal of Clinical Medicine as: [A fundamental basis for all living creatures, mechanotransduction, is significantly endangered by periodic exposure to impulsive infrasound and vibration from technical emitters - in particular cardiovascular and embryological functions](#)