

Biofizika II.

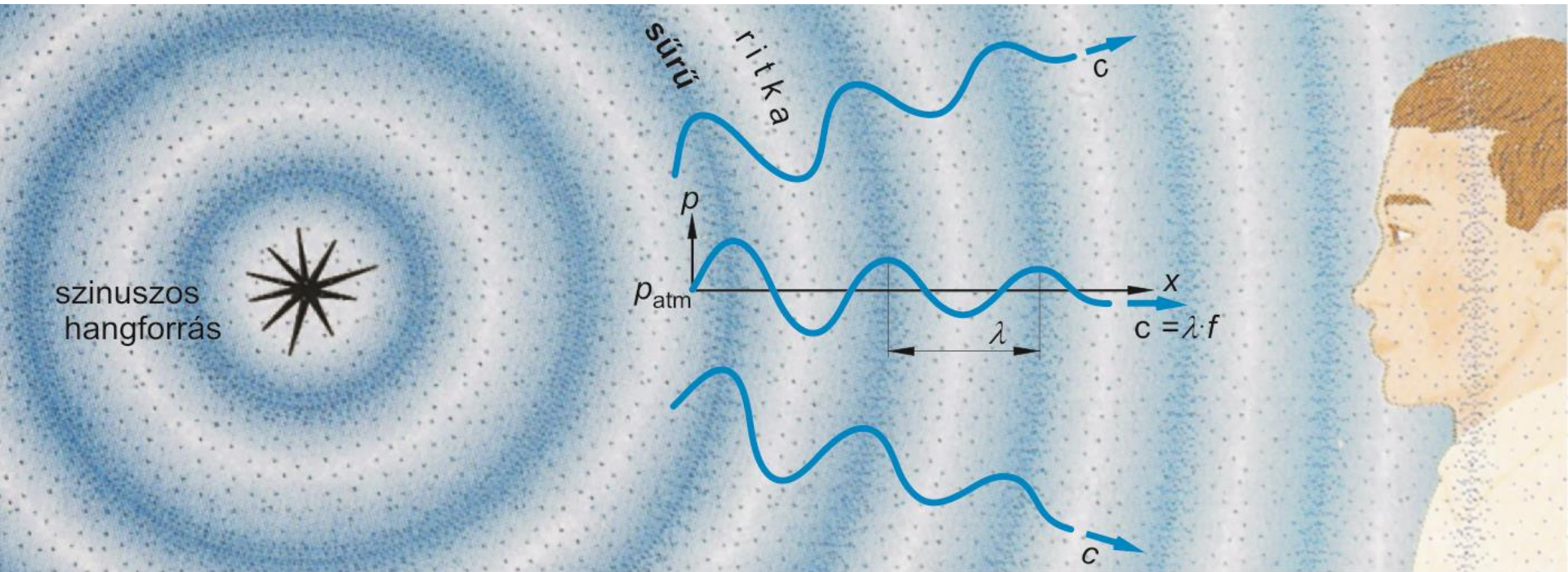
Hang

Orosz Ádám

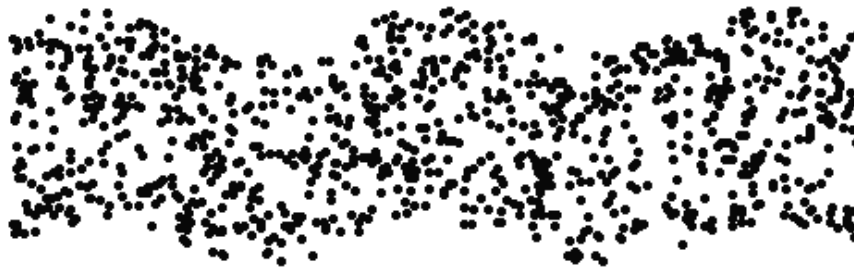
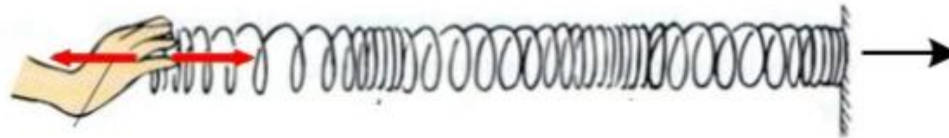
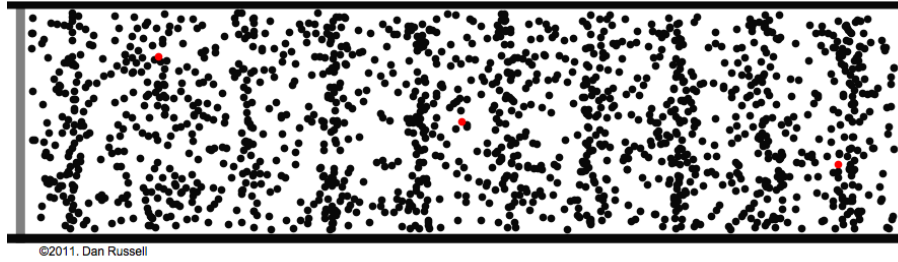
Semmelweis Egyetem

Biofizikai és Sugárbiológiai Intézet

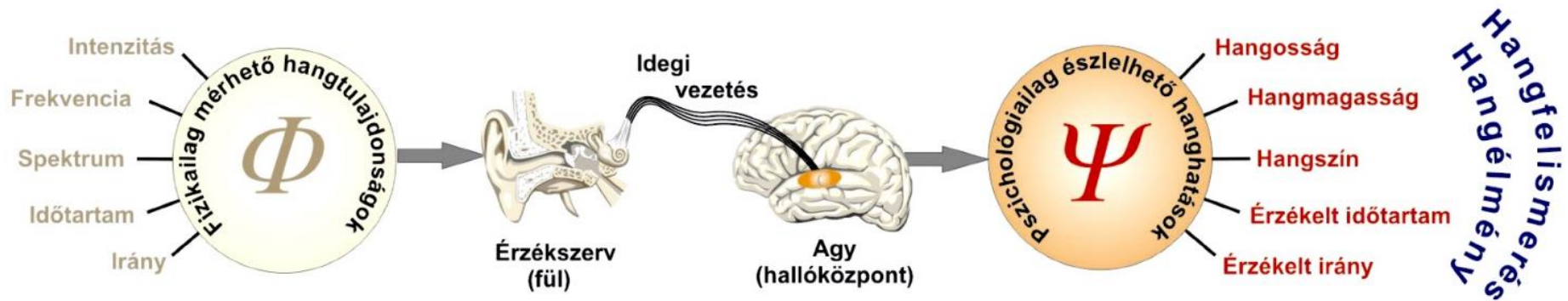
A hang – rezgési állapot terjedése időben és térben



A hang mint hullám



A hang fizikai jellemzői és az érzetek



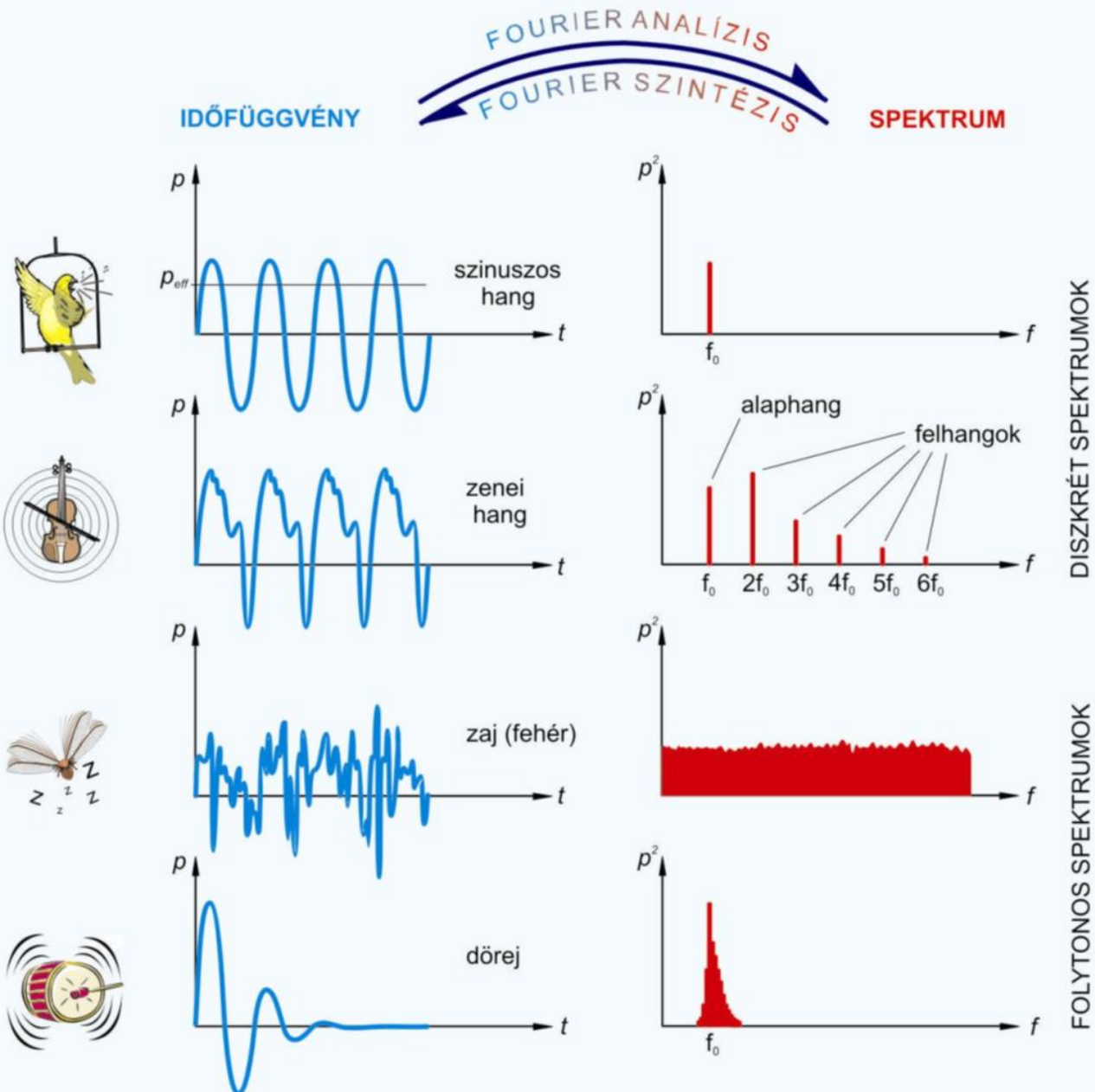
The diagram illustrates the relationship between sound waves in the time domain and their spectra in the frequency domain, using Fourier analysis and synthesis.

FOURIER ANALÍZIS (Fourier Analysis) is the process of decomposing a complex waveform into its constituent frequencies. **FOURIER SZINTÉZIS** (Fourier Synthesis) is the reverse process, combining individual frequencies to reconstruct the original waveform.

The four examples shown are:

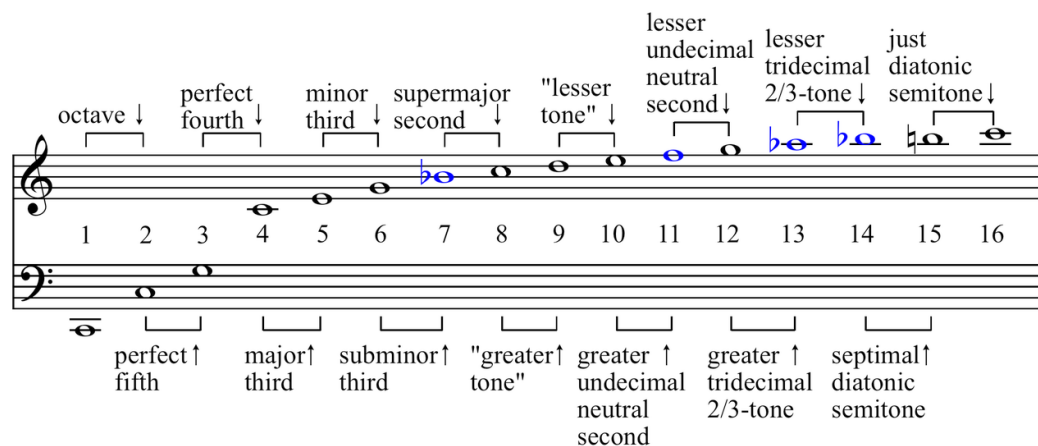
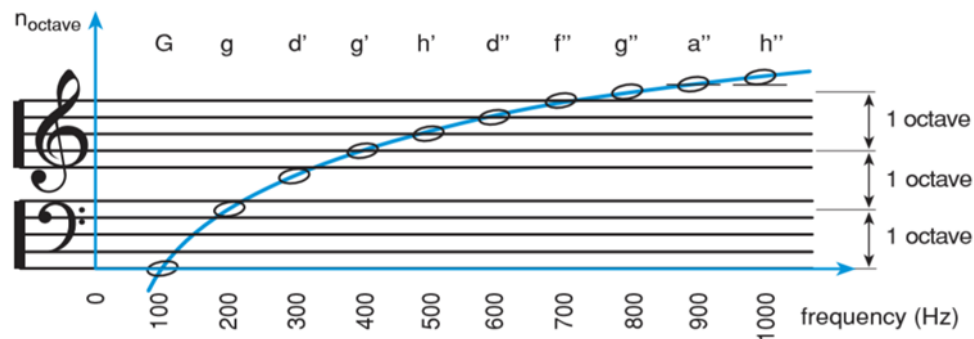
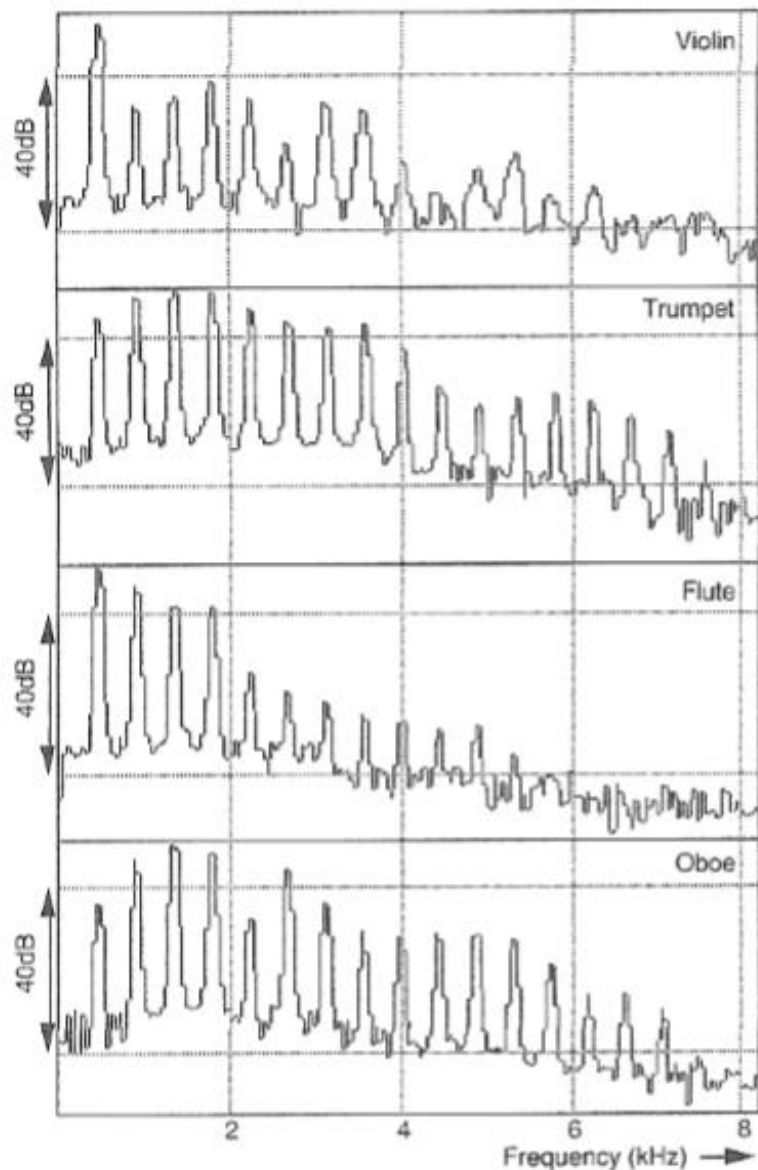
- sinuszos hang** (sine wave): A simple periodic wave. Its spectrum consists of a single peak at the fundamental frequency f_0 .
- zenei hang** (musical note): A complex periodic wave. Its spectrum shows a series of discrete peaks: the **alaphang** (fundamental) at f_0 and **felhangok** (harmonics) at $2f_0, 3f_0, 4f_0, 5f_0, 6f_0$.
- zaj (fehér)** (white noise): A complex aperiodic wave. Its spectrum is a continuous band of energy across a range of frequencies.
- dörej** (drum beat): A complex aperiodic wave. Its spectrum shows a sharp peak at the fundamental frequency f_0 and a continuous band of energy at higher frequencies.

The vertical axis for the time-domain plots is pressure p and time t . The vertical axis for the frequency-domain plots is power p^2 and frequency f .



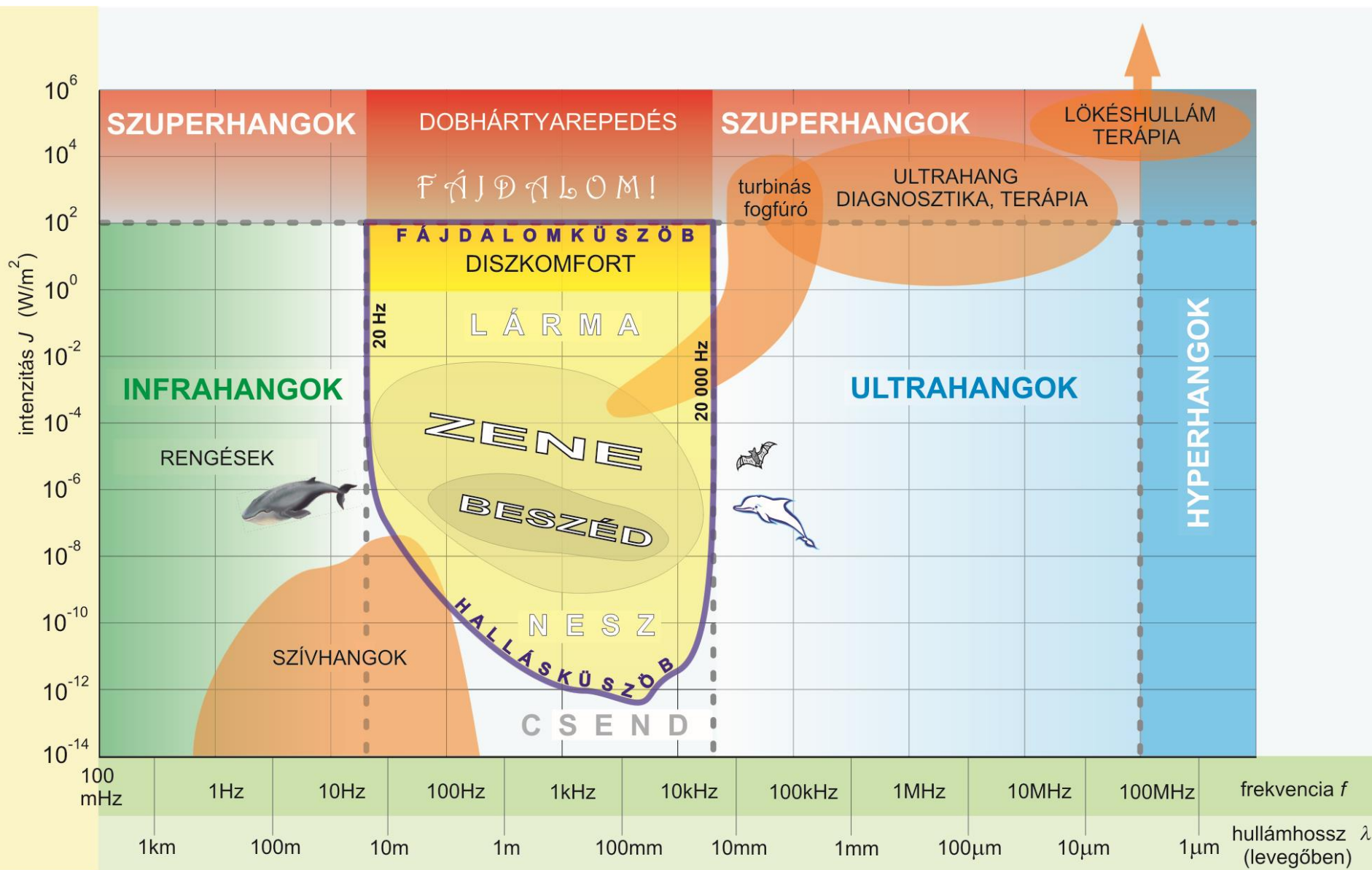
Harmonikus felhangspektrumok

négy hangszer a-hang (440 Hz) spektruma



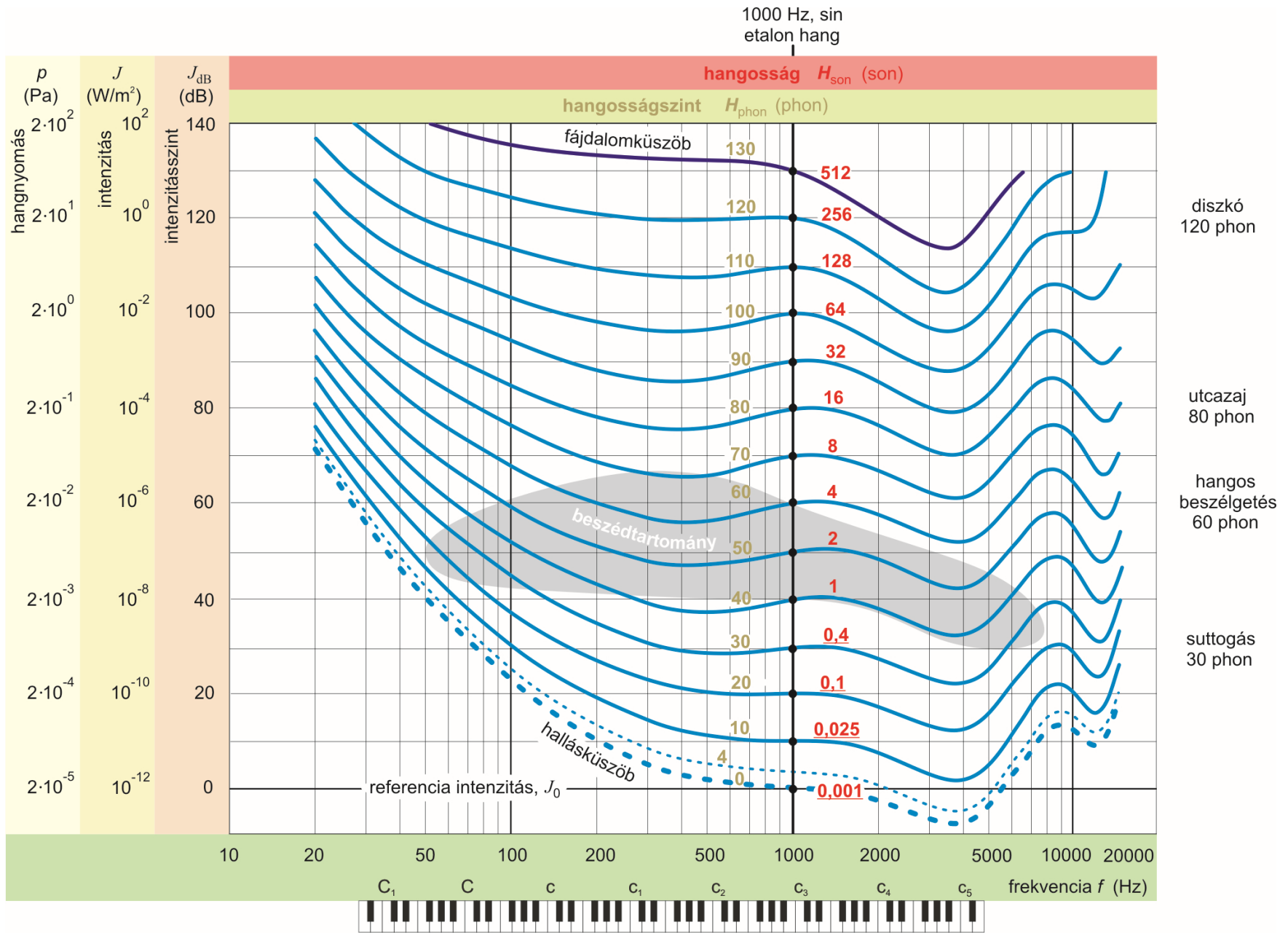
Mechanikai hullámok osztályozása

frekvencia és intenzitás



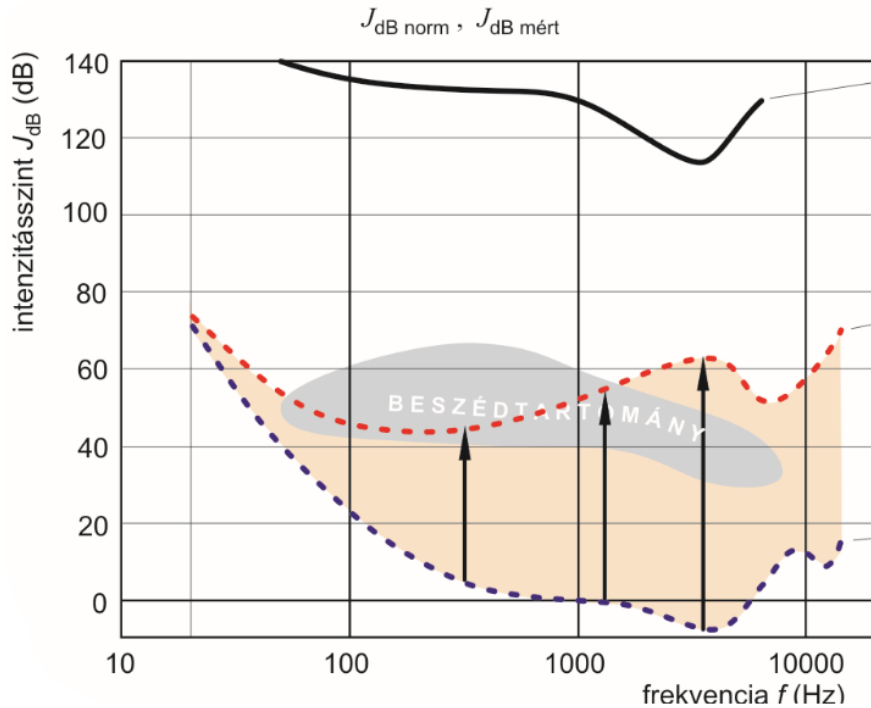
Egyenlő hangosságú görbék

az érzékelés fizikája - pszichofizika



Audiometria

EGYENLŐ HANGOSSÁGÚ GÖRBÉK



AUDIOGRAM

