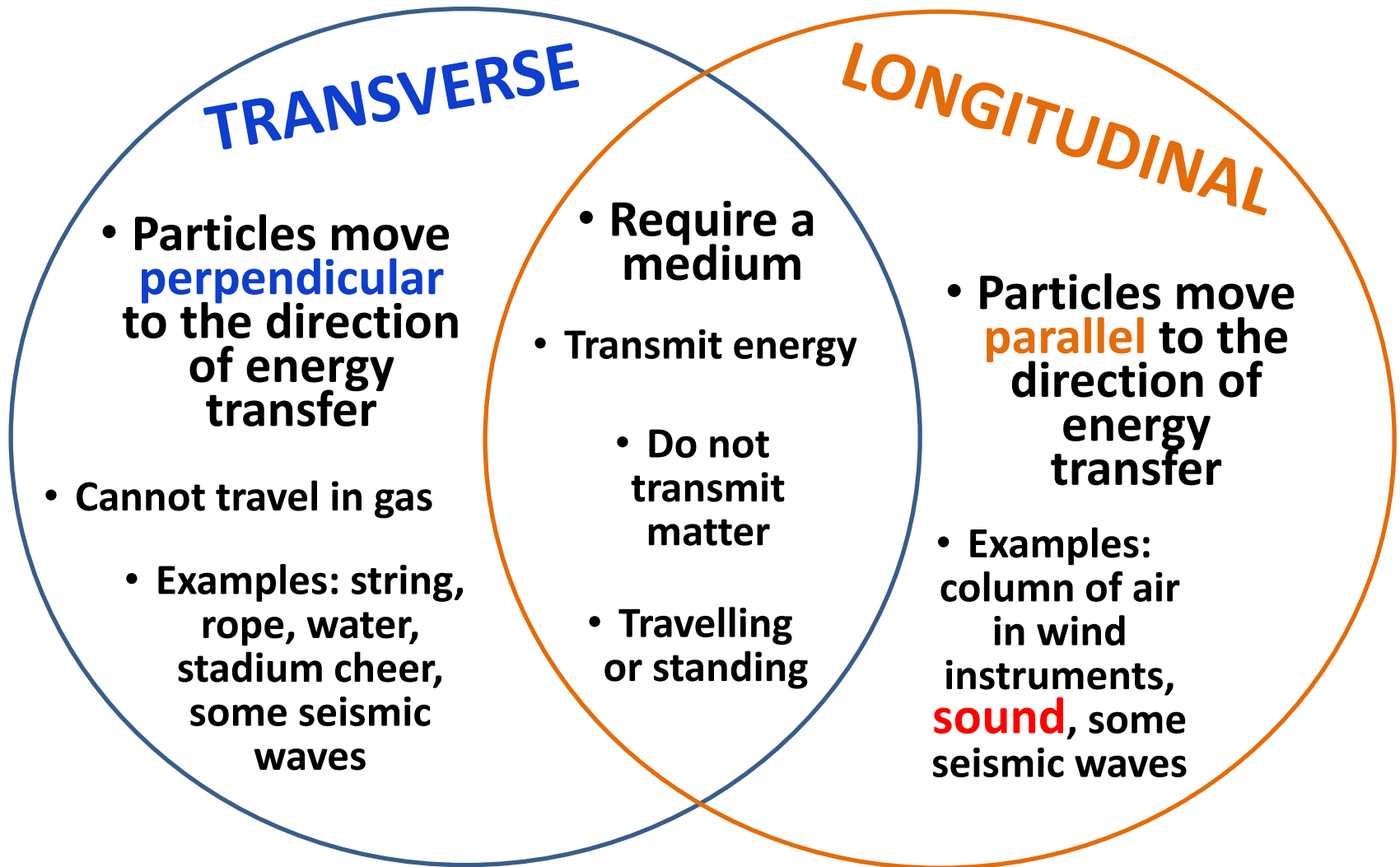


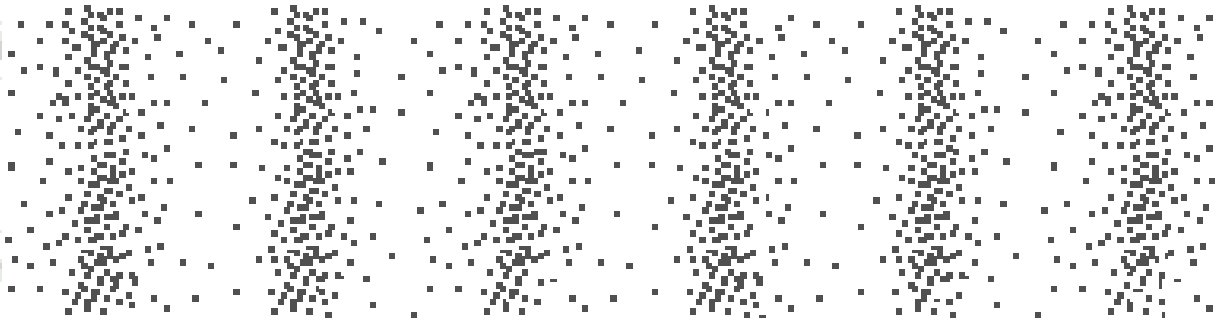
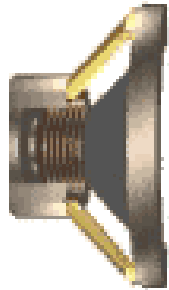
Mechanical Waves Summary



What is SOUND?

- Sound is a travelling longitudinal mechanical wave, that results from the back-and-forth vibration of the particles of the medium.

vibration
created



vibration
picked up

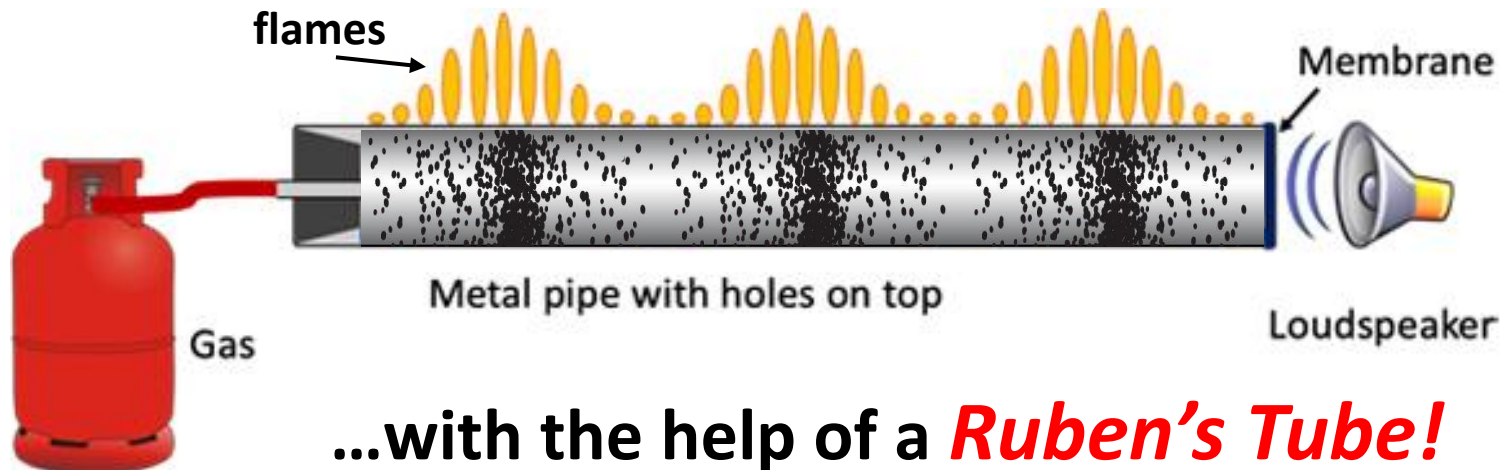


- Sound waves consist of areas of high and low pressure and therefore can be regarded as **pressure waves**:
 - “*compressions*” correspond to *higher pressure*
 - “*expansions*” or “*rarefactions*” correspond to *lower pressure*

How to describe sound?

Loud/Soft
Amplitude
High/Low
Speed
Frequency

We *hear* sound, but we also can *visualize* sound waves...

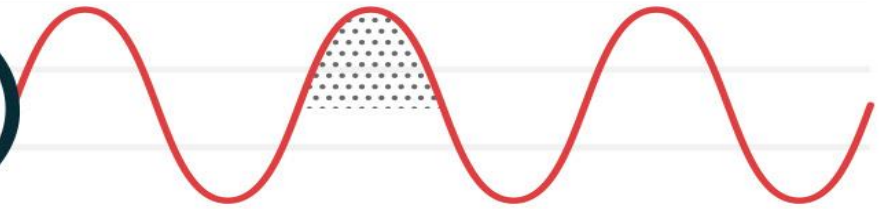


...with the help of a *Ruben's Tube!*

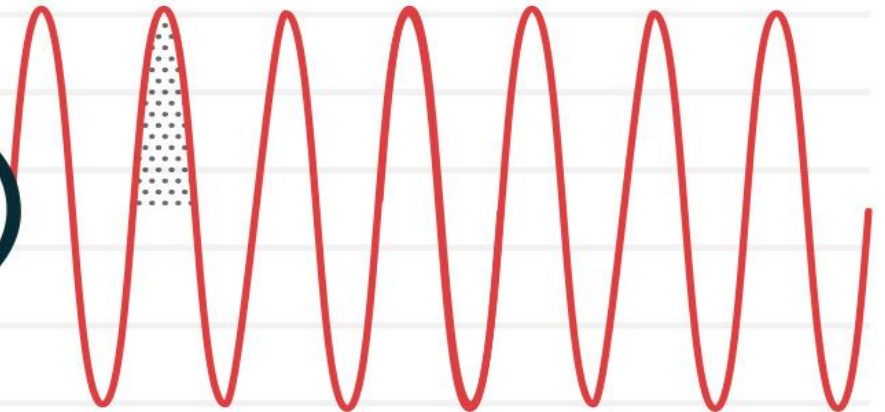
Sound waves: Pitch



Low Frequency = Low Pitch

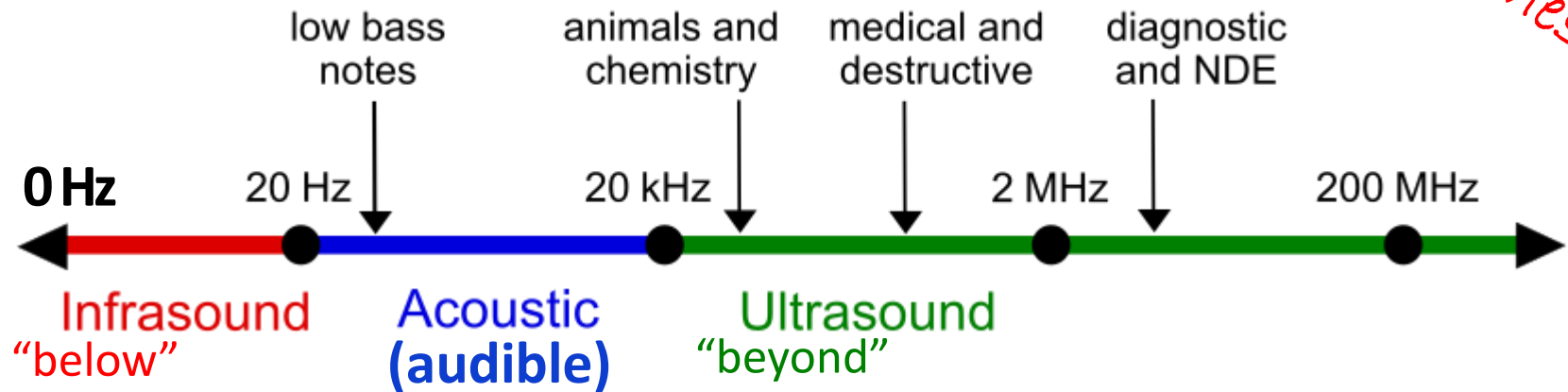


High Frequency = High Pitch

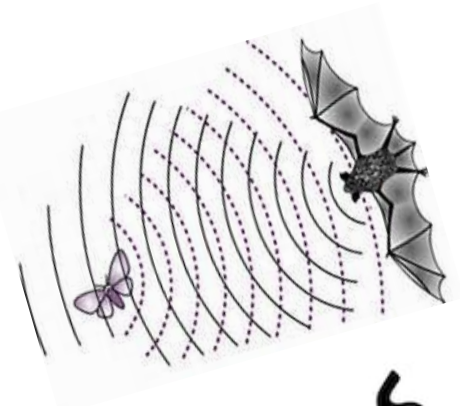


Sound waves spectrum

all possible pitches



- Humans can **hear** sound waves that have **frequencies between about 20 Hz and 20 kHz**.
- Sound waves **above 20 kHz** are known as **ultrasound**. Animals such as bats and porpoises use ultrasound for locating prey and obstacles.
- Sound waves **below 20 Hz** are known as **infrasound**. Whales, elephants and other animals can detect infrasound and use it to communicate.



Natural sounds: fun facts

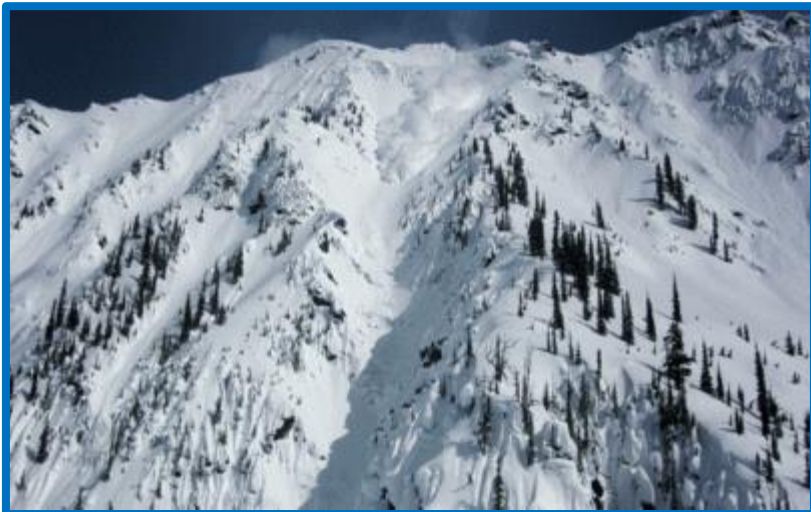
- ❖ Bats use **ultrasound** for hunting purposes...so many nocturnal insects have good ultrasonic hearing to help them escape being caught.
- ❖ *Tiger moth* can even produce ultrasound “clicks” itself!
- ❖ Hearing range of many medium-sized mammals, including dogs, cats and deer, extends into the **ultrasound** range; however they are not able to produce ultrasound themselves.



- ❖ Among all animals, the lowest **infrasound** frequencies (~3 Hz) are produced by *Sumatran rhinos*.

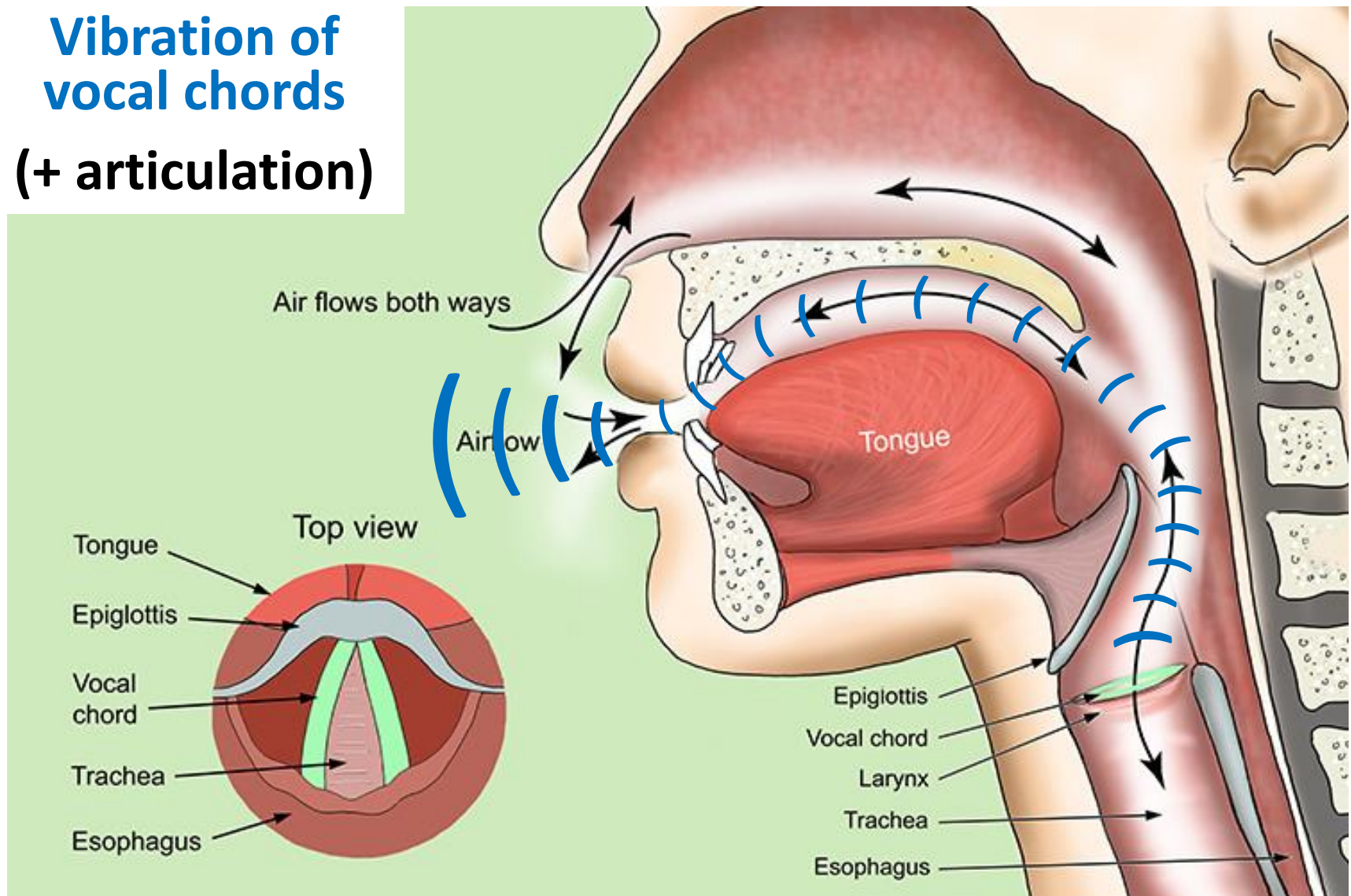
Natural sounds: more facts

- ❖ The rumbling vocalizations of *elephants* extend well into **infrasound** range and, being extremely loud, are used for long-distance (up to 10 km or over 6 miles!) communication.
- ❖ Sources of **infrasound** in nature include volcanoes, avalanches, earthquakes, hurricanes, and meteorites.



How do humans create sound?

Vibration of
vocal chords
(+ articulation)



How do we hear?

