2. Basic Acoustics

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- Sounds have a double nature: pressure oscillations and oscillating flows of the medium. Textbook definitions of sound generally focus on the pressure component and ignore the flows. Both components are important in biology.

- For biologists without training in physics, it requires much hard work to become so acquainted with the physics of sounds that one can contribute in a professional manner to bioacoustics. Most textbooks on acoustics contain too many equations and too little text, and the physics departments are generally ignorant about the complexity of this area. The newcomer is advised to read the textbook by L. L. Beranek (Acoustics, McGrawHill 1954, reprinted 1993 by the Acoustical Society of America ISBN 0-88318-494-X) and then to seek help at schools of engineering.

- It is important to realise that, although textbooks are filled with equations, exact solutions are rare in bioacoustics, since the equations are generally approximations, and the anatomy and mechanics of animals tend to differ from the simple assumptions behind textbook equations. While calculations may thus lead to very misleading conclusions, experiments without a proper theoretical basis are not likely to lead to any real understanding. The ideal approach, then, is a combination of experiments and calculations.

- A dB value without a reference value is as meaningless as "you are 10%". dB is a logarithmic measure (scatter bars should be of unequal length!). In air, sound pressure levels expressed in dB often have the reference $2\ 10^{-5}$ N/m$^{2.}$ If the reference value for sound power is chosen to be 10^{-12} watt/m^2, then one may use the same dB scale for both pressure and power. Pressure or powers of complex sounds are calculated from the root mean square (r.m.s.) values. "dB peak" and similar expressions are nonsense!

- Most interactions between sounds and objects depend of the wavelength/size ratio. This is true for sound emission and for diffraction of sound by objects.
Important concepts in acoustics are monopoles and dipoles (in both sound emission and sound reception) and near fields and far fields.

- The number of pitfalls is large in acoustics, and some sound phenomena are counter-intuitive (example: the surplus pressure at the back of a sphere).

- Home-made instruments often suffer from a lack of understanding of the theory. Their use may save money, but lead to crazy results.