

Physiology of Binaural Hearing

*David McAlpine*¹

¹Macquarie University, Sydney

Most sounds appear to originate from somewhere, and are usually attributed to the specific source, or sources, from which they originate. Nevertheless, unlike vision or touch, for example, the sensory end organs in the sense of hearing – the cochlea in the inner ear - contain no specialized receptors for determining the location of sound sources. To this end, cues to the location of a source must be computed from information that, of itself, is not spatial, including the use of interaural, or binaural, cues. Beyond this, our perception of the acoustic space in which we reside is also critical to our "connectedness" to that space, and also relies on binaural cues. Starting with the work of Lord Rayleigh who demonstrated the duplex theory of binaural hearing, I will demonstrate how our understanding of the biology of spatial hearing obtained from in vivo animal studies has developed alongside the emergence of techniques used to assess brain function in humans. With precision in the order of a few tens of microseconds, sensitivity to binaural spatial cues challenges our understanding of how technologies such as cochlear implants—devices that replace the function of the inner ear entirely—can be used to create a sense of space in individuals who may never have experienced the percept of sound.