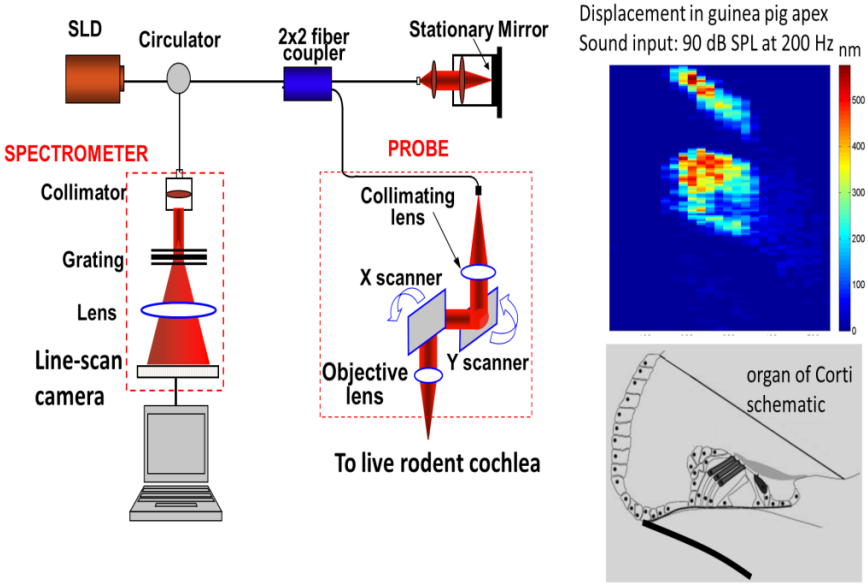
Identifying the mechanisms of origin and backward propagation of oto-acoustic emissions



Deafness is the most prevalent sensory disability across nations. Unlike other senses, hearing has been least understood owing to the challenge in accessing the deeply positioned inner ear. The long term goal of our Auditory Biomechanics Lab at IIT Bombay is to develop a better understanding and effective diagnosis of hearing loss by investigating active vibroacoustics in the inner ear using novel instrumentation as well as computational modeling.

Non-invasive identification of the source and local region in the inner ear responsible for sensorineural hearing loss could lead to better diagnosis and targeted therapies. Such a diagnosis is possible using otoacoustic emissions, which are sounds originating inside the cochlea and emitted out the ear, but their clinical scope has been limited due to a lack of understanding of their origin inside the inner ear.

Working towards addressing this issue, we are developing a new type of optical sensor that will enable intricate intracochlear measurements of otoacoustic emissions near their site of origin in rodents. This instrumentation is built upon a technology called 'optical coherence tomography' (OCT) which is an optical analogue of ultrasound.

While an OCT device to investigate the human inner ear is still in the future, few groups have been successful in using this device in other mammals such as guinea pigs whose hearing mimics ours. Recently in collaboration with researchers at the Oregon Health and Science University, we measured the *in vivo* cochlear vibration response to speech-frequency sounds without having to open the surrounding bone structures in live guinea pigs (refer image) thus minimising disturbance to hearing sensitivity. These measurements showed that the inner ear processes speech-frequency sounds differently as compared to sounds of high-frequency.

Our program of research will help determine how the otoacoustic emissions originate in the inner ear and propagate outward which will help improve the clinical diagnosis of sensorineural hearing loss.

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