Insect ear biomechanics : passive and active processes that can inspire acoustic sensors.

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Biological systems provide an incredible wealth of archetypes that have emerged through evolutionary processes. Hearing organs are a good example of how different solutions, and adaptions, across different animal taxa, can often converge to solve similar sensory problems. Hearing has evolved independently multiple times across the insects, and the diversity of these biological solutions therefore provides a wealth of inspiration for the creation of novel acoustic sensors. Some biological solutions can be considered as purely passive mechanical constructs that accomplish some processing of the incoming sound. This talk will consider examples of this, including the frequency discrimination of the locust ear, and the directionality and wideband response of different moth ears. Several insects also display active hearing processes, whereby energy is used to actively change the hearing response, bearing some similarity to the processes found in the mammalian inner ear. This talk will thus discuss how some moths actively tune their ear, and how the mosquito ear actively utilizes gain and compression. Finally, the talk will discuss some examples of different acoustic sensors from the University of Strathclyde that take inspiration from these passive and active biological processes.

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