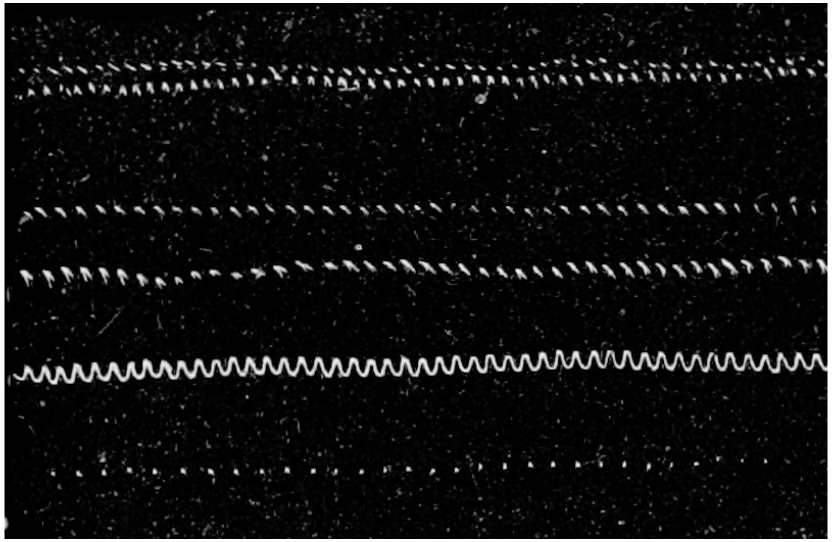
Bee Strings

Sitting in a neighbour's garden one afternoon in May, I listened to the comings and goings of bumblebees around her flowery borders. I was interested the hum they made as they flew, and how the pitch and character of the drone varied as they hovered to and fro. I wanted to get closer to the vibration of the wings, and wondered how to get into to the detail of these tiny, fleeting tremors.

As a kid in the 70s, my brother admitted to 'taking a fly for a walk' by stunning it with a rolled up newspaper, looping cotton thread around it, tying the other end around his finger, and willing it back to action. Remembering his anecdote, I was curious about whether the vibrations of the wings would travel through the body of the fly, and be conveyed via the tensioned thread to his finger, but the method always seemed too barbaric to replicate.

As part of investigations into the flight of insects in the 1870s, Etienne-Jules Marey held his subjects in forceps and used their wings as cutting styluses, using a writing mechanism employed by phonautographs and other early sound recording devices. Held lightly against rotating cylinders of lamp black coated paper, each wing left a delicate line tracing its beats. By arming the teen of a tuning fork with a needle and referencing its vibrations across the same paper, Marey was able to calculate the wingbeat frequency of his bee as 190 double vibrations per second. The intriguing overlap between the apparatus of acoustics and physiology in this scene evokes the earlier work of Robert Hooke.



Above: a segment of Marey's wing writing. The three upper lines were made by a drone fly, the lower dotted line by a bee. The fourth line was a tuning fork calibrated to 250Hz. *Below:* a league table listing the stroke frequency rate of Marey's winged subjects.

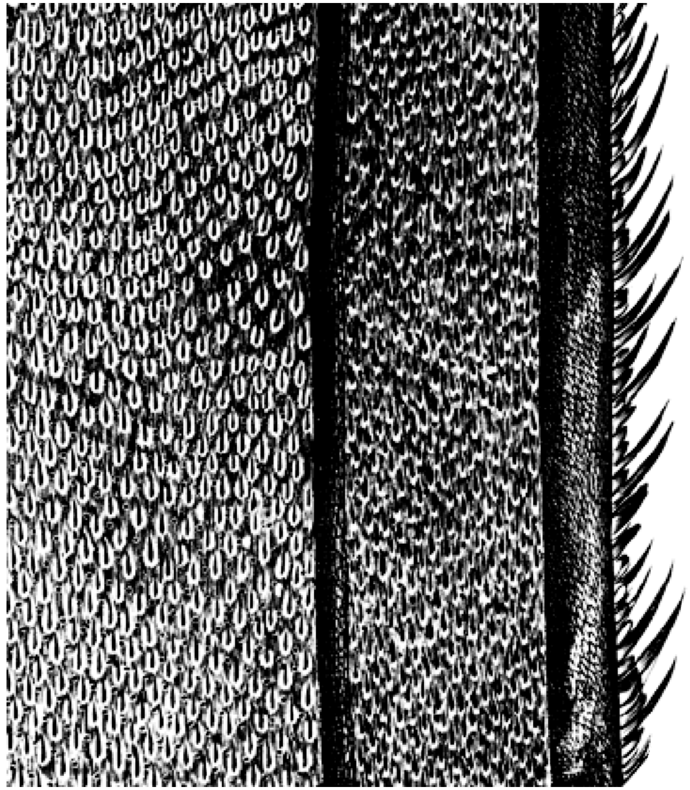
Common fly	330
Drone-fly	240
Bee	190
Wasp	110
Humming-bird moth (Macroglossa) .	72
Dragon-fly	28
Butterfly (Pontia Rapæ) . . .	9

Hooke is best known for his pioneering use of the microscope to 'quietly peep in at the windows' of minute creatures like the flea, and record them at a level of detail invisible to the naked eye. He was also interested in insect flight, and glued a fly to the quill of a feather to observe it's 'glassy' wings in motion. Having previously employed a 136 foot long monochord to count the rate of vibration of tensioned string, he figured he could quantify the stroke rate of a bee's wing by listening for 'the note that it answers to in Musique'.

His notion of tuning strings to wings is based on the understanding that things sounding the same pitch have the same 'pulse'. It follows from His insights into the springiness of air, and the transference of sound across different mediums, bodies and distances. Tracking the vibration from wing to string invokes thinking across scales and contexts, a defining feature of Hooke's vivid imagination.

Inspired by Hooke's approach, I tuned a violin to a bumbling bee, and stroked the bow up and down over the string, lingering on the note. Small tremors in the string, amplified by wooden body, simultaneously transferred to points of contact on my body: fingers, thumb, collarbone, jaw, throat and teeth. I enjoyed feeling airy bee drone up close through wood and skin and bone.

I recently heard about 'phytoacoustics' research by a team at Tel Aviv University. They reported that beach evening primrose flowers respond to sound in the frequency range of bees by temporarily increasing the sugar concentration in their nectar. No extra sweetening occurred when the flowers were kept in a silent chamber, played sounds in a higher frequency range, or stripped of one or more of their petals. The resonant frequency response of the flower was confirmed by a laser Doppler vibrometer to be 100-500 Hz.



Above: a segment of Hooke's drawing of a fly's wing viewed through a microscope.

http://www.dawnscarfe.co.uk/project_bees