

# **The Uniformitarian Theory of the Origin of Insect Flight**

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**Proposed:** The source of insect wing motion (but not of wings) is a mechanism for sound production.

## **1. Uniformitarianism**

This proposal has a uniformitarian basis: it demonstrates that the source of insect flight motion may still be an observable and active part of insect behavior.

## **2. The inherent mechano-acoustic properties of the insect cuticle**

Insect cuticle, a stiff, elastic lamina has ample capabilities for generating sound. Insects universally use elements of the cuticle for this purpose. Numerous examples of this process can be found in the literature.

## **3. The flight motor**

Wing vibration rates differ among insect types, but the alternating upstroke-down stroke wing motion is in all cases driven by a vibrating resonator. Importantly, if the wings are disregarded, a fully functional oscillating mechanism remains extant within the thorax. The flight motor without wings is a vibrator! A bee with wings immobilized still buzzes.

## **4. Selective advantages of sound making combined with display**

Would pre-flight insects need a vibrator? Very likely. Insect communicate visually, pheromally and sonically, and for all of these there is a plethora of examples. But before acquiring flight insects would especially rely on sound communication since their visual depth is rather limited (having short focal length lenses), and, except in swarming, would have a degree of difficulty finding each other in the substratum of stones and plants, and at a distance, etc. The wings of today's insects are in themselves sonifiers: mosquitoes, for instance, can distinguish between wing vibration rates of different species and genders. Primitive sounds could have been no more than single clicks, but under selective pressure would evolve into rhythmic pulses and phrases of suitable volume.

## **5. An inevitable conclusion**

The origin of the wing surfaces was most likely bound up with display, and could have derived from sources such as movable gills of an aquatic insect, as in the epicoxal theory proposed by Kukalova-Peck, or from appendages growing from the insects legs, according to the epicoxal-exite theory. If we suppose that the base of such a wing surface is connected to, i.e., arises from the pleural outer surface of a thoracic sound vibrator of an insect, then we can see a possible origin of the mobile wing. Through selection the relevant insects would evolve aerodynamic wing behavior and attain lift and later controlled flight. Thus, the present theory offers a uniformitarian explanation: the sources and actions that originated insect flight still exist in the present day: flying insects are equipped with a unified mechanism consisting of a resonator and display appendages.