

I. Navigating in a turbulent world

When organisms locomote and interact in nature, they must navigate through complex habitats that vary on many spatial scales, and they are buffeted by turbulent wind or water currents that also vary on a range of spatial and temporal scales. I will discuss a few examples from my ongoing research on behavioral and biophysical mechanisms that locomoting animals use to make their way through such dynamic, variable natural habitats. How do microscopic larvae of marine animals use odors to find coral reefs in turbulent, wave-driven water flow? How do flying frogs or horseshoe crabs navigate to breeding sites through forest canopies or the surf? These examples illustrate the importance of quantifying environmental variation on the spatial and temporal scales relevant to the organisms and biological processes being investigated.

II. Sniffing by hairy noses: Odor capture by crustacean antennules in turbulent environments

Odors are dispersed in the environment by turbulent wind or water currents. The first step in smelling is capture of odor molecules from the surrounding fluid. Many animals capture scents using olfactory antennae bearing arrays of chemosensory hairs. We studied the fluid mechanics of odor capture by the hairy olfactory antennules of a variety of marine animals (lobsters, crabs, mantis shrimp). They sniff (take discrete odor samples in space and time) by flicking, which alters the penetration of odor-bearing fluid into their arrays of chemosensory hairs. Antennules of various designs capture different snapshots of the fine-scale spatial and temporal patterns of concentration of odors dispersed by turbulent ambient water flow.

Some Useful References:

<http://ib.berkeley.edu/labs/koehl>

Koehl, M.A.R. and M. Hadfield, (2010) Hydrodynamics of larval settlement from a larva's point of view. *Integrative and Comparative Biology* 50: 539-551.

Koehl, M. A. R. (2011) Hydrodynamics of sniffing by crustaceans. *In: Chemical Communication in Crustaceans*. T. Breithaupt and M. Theil [eds], Springer Verlag, pp. 85-102.