Vertebrates aim their noses at regions of interest and sniff in order to acquire olfactory trace signals that carry information on food, reproduction, kinship, danger, etc. Invertebrates likewise position antennae in the surrounding fluid to acquire such signals. Some of the fluid dynamics of these natural sensing processes has been examined piecemeal, but the overall topic of sniffing is not well investigated or understood. It is, however, important for several human purposes, especially sampling schemes for sensors to detect chemical and biological traces in the environment. After establishing some background, a general appraisal is given of nature’s accomplishments in the fluid dynamics of sniffing. Opportunities are found for innovation through biomimicry. Since few artificial (“electronic”) noses can currently sniff in the natural sense, ways are considered to help them sniff effectively. Security issues such as explosive trace detection, landmine detection, chemical and biological sniffing, and people sampling are examined. Other sniffing applications including medical diagnosis and leak detection are also considered. Several research opportunities are identified in order to advance this topic of biofluid dynamics. Though written from a fluid dynamics perspective, this review is intended for a broad audience.

Keywords: aerodynamics, pneumodynamics, chemioception, reviews
Topics: Air flow, Explosives, Flow (Dynamics), Fluid dynamics, Fluids, Particulate matter, Plumes (Fluid dynamics), Sensors, Signals, Vapors, Jets, Land mines

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