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Bacteria sensing mechanisms in *Drosophila* gut : local and systemic consequences

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Corresponding author : (julien.royet@univ-amu.fr)**Keywords** : intestinal immunity, bacteria, *Drosophila*, NF- κ B, PGRPs, Peptidoglycan**Abstract**

All insects are colonized by microorganisms on their exoskeleton, their gut and even in some cases within their own somatic and germ line cells. This microbiota that can represent up to a few percent of the insect biomass may have a pervasive impact on many aspects of insect biology including physiology, nutrient acquisition, aging, behaviour and resistance to infection. Mainly through ingestion of contaminated food, the mouth-gut axis represents the first and principal access of external bacteria to the host. Soon after ingestion, the feeding insect needs to rapidly and accurately identify the ingested microbes and decide whether to preserve them if beneficial or neutral, or to eliminate them if potentially harmful. We will review here the recent data acquired in *Drosophila* on the mechanisms that invertebrate enterocytes rely on to detect the presence of bacteria in the gut. We will compare these modes of bacteria sensing to those in other immune competent tissues and try to rationalize differences that may exist. We will also analyse the physiological consequences of bacteria detection not only locally for the gut itself but also for remote tissues. Finally, we will describe the physiological disorders that can occur due to inaccurate bacteria identification by the gut epithelium.

1. *Drosophila* gut microbiota is simpler than that of Mammals

As expected for animals that mainly feed on food contaminated with microorganisms, *Drosophila* is hosting numerous microbes in its digestive tract, among which the bacterial populations are the best characterized (Broderick and Lemaitre, 2012; Douglas, 2015; Hoang et al., 2015; Wong et al., 2015). The presence of bacteria in the *Drosophila* intestinal tract was first appreciated in the 60s, through studies which initiated the characterization of gut associated bacterial communities (Bakula, 1969). Since then, recent works conducted in laboratory-reared and wild-caught flies, have allowed a better description of the gut bacterial population and began to provide some answers, yet incomplete, to important questions such as "Is there a core microbiota community in flies? What are the endogenous and exogenous factors that shape microbiota composition and allow its residence in the gut?" (Chandler et al., 2014; Chandler et al., 2011; Cox and Gilmore, 2007; Ren et al., 2007). Although other reviews of this issue will describe *Drosophila* microbiota composition and properties in detail, here

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