

## Bacteria evoke alarm behaviour in zebrafish

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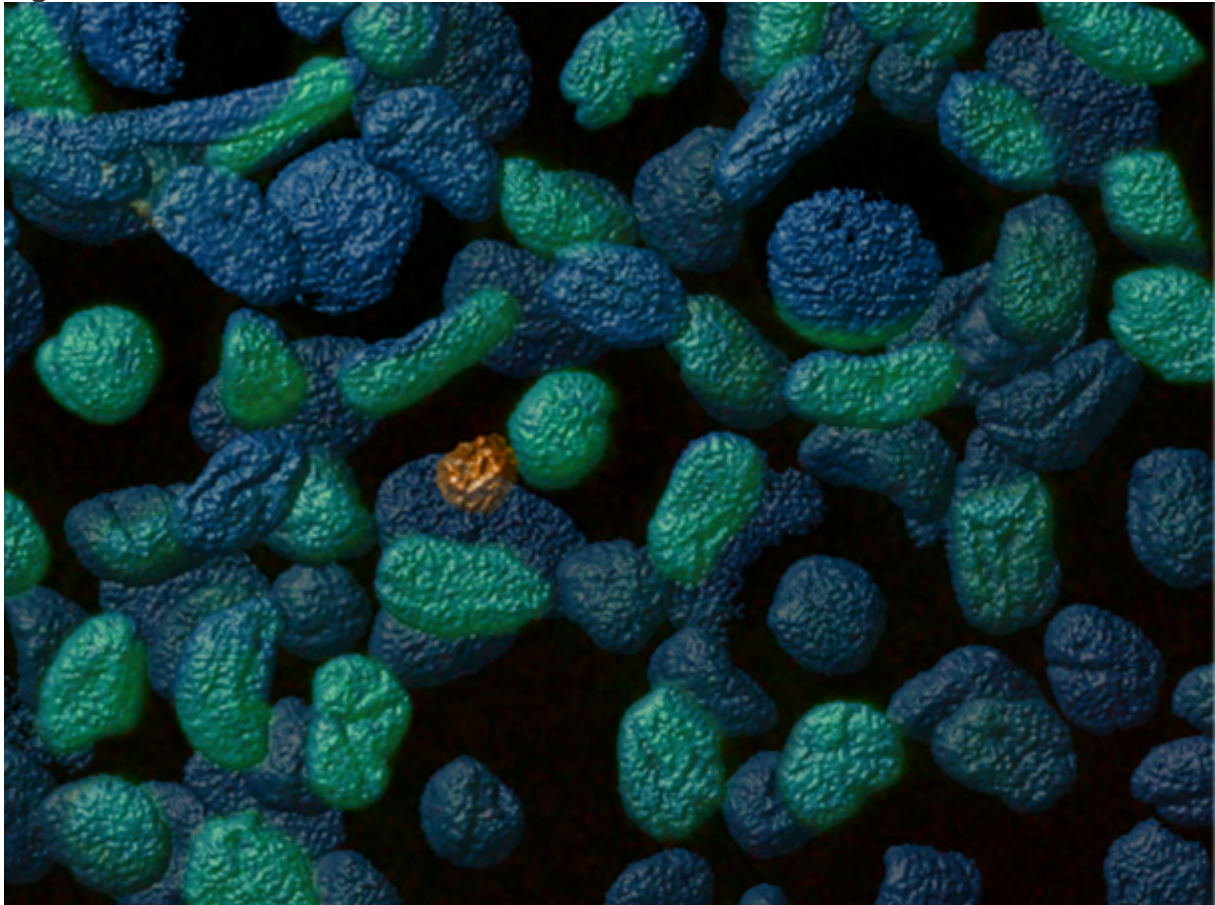
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**Abstract:**

When injured, fish release an alarm substance (Schreckstoff) that elicits fear in members of their shoal. Although Schreckstoff has been proposed to be produced by club cells in the skin, several observations indicate that these giant cells function primarily in immunity. Previous data indicate that the alarm substance can be isolated from mucus. Here we show that mucus, as well as bacteria, are transported from the external surface into club cells, by cytoplasmic transfer or invasion of cells, including neutrophils. The presence of bacteria inside club cells raises the possibility that the alarm substance may contain a bacterial component. Indeed, lysate from a zebrafish *Staphylococcus* isolate is sufficient to elicit alarm behaviour, acting in concert with a substance from fish. These results suggest that Schreckstoff, which allows one individual to unwittingly change the emotional state of the surrounding population, derives from two kingdoms and is associated with processes that protect the host from bacteria.

**Figure**

**Figure Legend: Discovery of a new aspect of mucosal immunity.** A cell full of bacteria (orange) after entry in a giant club cell (black cytoplasm) in the skin of zebrafish. Other skin cells are labeled in either green or blue.