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Imaging the Population Dynamics of Bacterial Communities in the Zebrafish Gut MATTHEW JEMIELITA, MICHAEL TAORMINA, Department of Physics, University of Oregon, ADAM BURNS, Institute of Ecology and Evolution, University of Oregon, W. ZAC STEPHENS, JENNIFER HAMPTON, KAREN GUILLEMIN, Institute of Molecular Biology, University of Oregon, RAGHUVEER PARTHASARATHY, Department of Physics, Institute of Molecular Biology, and Material Science Institute; University of Oregon — The vertebrate gut is home to a diverse microbial ecosystem whose composition has a strong influence on the development and health of the host organism. While researchers are increasingly able to identify the constituent members of the microbiome, very little is known about the spatial and temporal dynamics of commensal microbial communities, including the mechanisms by which communities nucleate, grow, and interact. We address these issues using a model organism: the larval zebrafish (Danio rerio) prepared microbe-free and inoculated with controlled compositions of fluorophore-expressing bacteria. Live imaging with light sheet fluorescence microscopy enables visualization of individual bacterial cells as well as growing colonies over the entire volume of the gut over periods up to 24 hours. We analyze the structure and dynamics of imaged bacterial communities, uncovering correlations between population size, growth rates, and the timing of inoculations that suggest the existence of active changes in the host environment induced by early bacterial exposure. Our data provide the first visualizations of gut microbiota development over an extended period of time in a vertebrate.

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