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Visualizing infections and immune mechanisms in zebrafish

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The zebrafish has become an important model to study a wide spectrum of vertebrate biological processes. It is used within all major biological sciences and has been especially valuable within developmental biology and genetics. Within the last 20 years the amount of papers describing zebrafish as a model has increased dramatically. It is a valuable model because of several characteristics: it is a vertebrate, it has external embryological development and is fully transparent for the first 24 h post hatching, development is fast; the vertebrate organs can be identified within 48 hours (ears, eyes, brain, internal organs), embryos are simple to genetically manipulate, the genome has been mapped, thousands of transgenic lines exist and a pair of breeders are able to produce up to 300 eggs per week making it a high-throughput but low-cost model organism. Unique tools for non-invasive *in vivo* imaging has been developed and high quality intravital microscopy can be conducted without comparison. A transparent line has also been developed where transparency is maintained throughout the lifespan of the fish facilitating *in vivo* visualization of e.g. the spread of fluorescence-tagged cancer cells, immunological reactions during e.g. transplant rejections or the spread and pathogenicity of pathogens. We have, in our laboratory, used the zebrafish as a model for aquacultured fish species and their pathogens. We have 1) visualized antigen uptake *in vivo* following a bath in a soup containing fluorescent inactivated bacteria, 2) visualized the spread of a bacterium after either a bath or an injection in the peritoneal cavity, and 3) visualized (images + videos) the behaviour of certain immune cells, called neutrophils during a parasite disease. Using adult fish of a transgenic line with GFP-tagged neutrophils, we got an unprecedented view into the interactions between the parasites and the neutrophils.