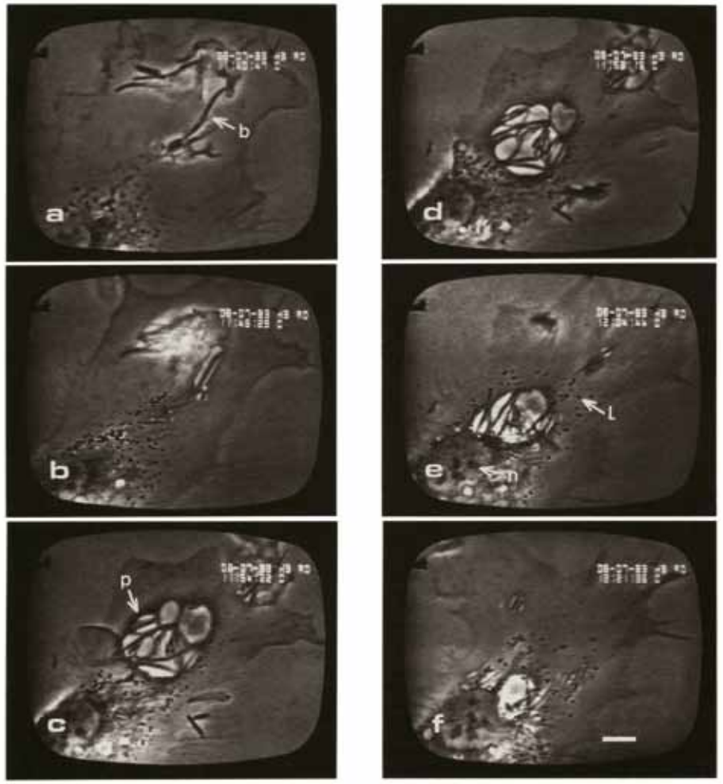


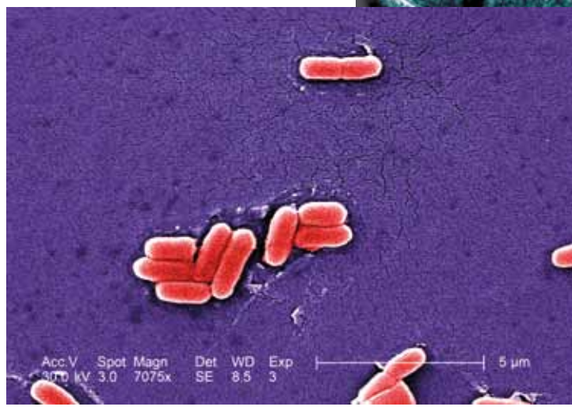
Salmonella orchestrates its uptake by host cells. Video time-lapse phase-contrast microscopy of phagocytosis of *Salmonellae* by cultured mouse white blood cells (macrophages). Attachment (a) of bacteria is followed by membrane ruffling (b) and uptake of bacteria and formation of wide phagocytic vacuoles (c), followed (d-f) by transport of the bacteria to the nuclear area. In pictures, b depicts bacteria, p the phagocytic vacuole and l the lysosomal vacuoles which contain enzymes that can break down almost any biomolecule. (calibration bar 10 microns)

Need for "farm to fork" hygiene

Non-typhoidal *Salmonella* infections occur worldwide, and control is complex as humans and animals can all act as reservoirs. Chickens and pigs are frequently implicated, but many other domestic and wild animals may harbour the bacteria. *Salmonella* infections also cause substantial losses. To eliminate disease by non-typhoidal *Salmonella*, hygiene practices must target the whole food chain, from *Salmonella*-free animal feed to hygienic slaughtering, refrigeration of food and proper kitchen hygiene, at each stage preventing cross-contamination. To oversee control measures, public health surveillance programs are essential.

Enterohemorrhagic *Escherichia coli* (EHEC): How a beneficial bacterium turned evil

Sabrina Mühlen, Manfred Rohde and Petra Dersch



Escherichia coli.

***Escherichia coli* (*E. coli*) is a common bacterium that colonizes the human gut within a few hours after birth. Usually, "commensal" *E. coli* and its human host coexist in good health and with mutual benefits. The bacteria live in a layer of secreted mucus covering the cells of the intestine where they compete with other bacterial species for food. They support the host's metabolism, influence the development of its immune system and interfere with colonization by more virulent species of bacteria. Living in close proximity with each other, the bacteria are able to share genetic material not only with their close relatives but also with other bacterial species. This process is called horizontal gene transfer. Can it cause harmless bacteria to become pathogenic killers?**

Becoming virulent

Enterohemorrhagic *E. coli* (EHEC) is a pathogenic variant of *E. coli* which results from horizontal gene transfer between virulent bacteria and *E. coli*. EHEC is the causative agent of bloody diarrhoea. In approximately 10% of cases, the infection can progress into severe bloody diarrhoea with the destruction of kidney cells (haemolytic-uremic syndrome (HUS)) and kidney failure, which is fatal in 3 to 5% of cases. In order to become so virulent, two things had to happen: the acquisition of genes that aid interaction with the host cell, and infection with and integration of a bacterial virus (bacteriophage) that carries the genetic information for the Shiga toxin which is responsible for the development of HUS.

Horizontal gene transfer

Several routes for the exchange of genes have been identified and collectively termed horizontal gene transfer. These processes include the transfer of genetic elements such as virulence gene clusters (pathogenicity islands), and extra-chromosomal genetic elements (plasmids) from one bacterium to another. As the replication cycle of bacteria is generally rapid, changes in the genomic make-up that benefit the bacteria (e.g. acquisition of antibiotic resistance genes) are quickly passed to numerous bacteria. Horizontal gene transfer between bacteria occurs in all environments.

Sabrina Mühlen, Manfred Rohde, Petra Dersch
Helmholtz Zentrum für Infektionsforschung, Braunschweig, Germany