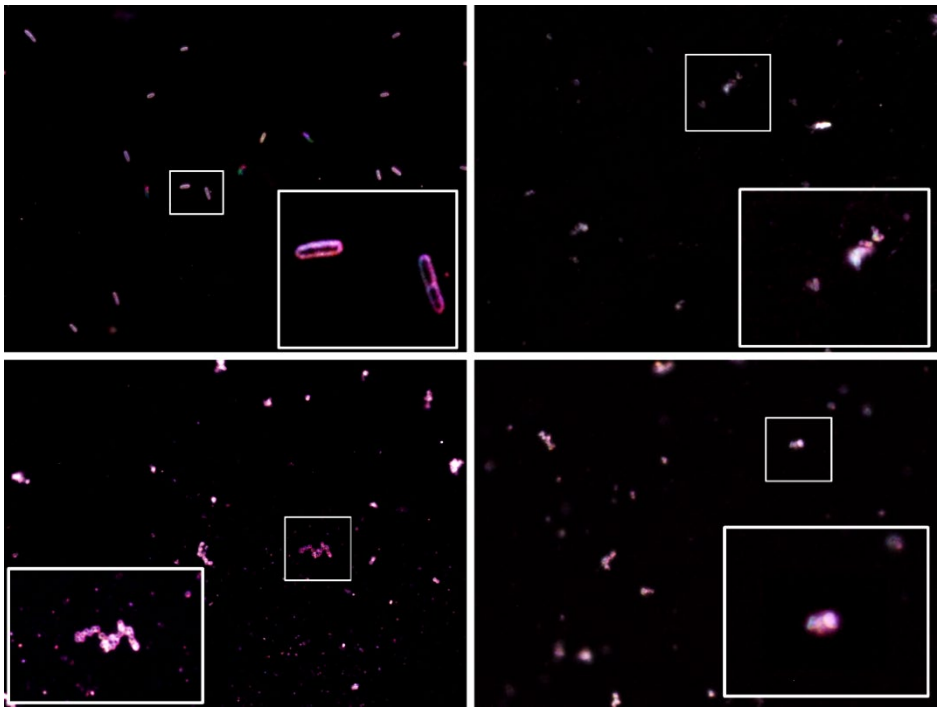
Antibiotic Response in Bacteria

The emergence and spread of antimicrobial resistance have become a global health crisis, underscoring the urgent need for tools that can assess bacterial response to antibiotics with greater speed, sensitivity, and accuracy. Conventional antibiotic susceptibility testing often relies on culture-based or fluorescence-labelling techniques, which can be time-consuming and disruptive to cellular integrity.
A side-by-side comparison of morphological and structural changes for untreated vs. antibiotic-treated bacterial samples reveals clear visual differences in bacterial density, organisation, and structural integrity using the HaloElement.

Antibiotic Impact on Bacterial Architecture

Exposure to antibiotics can induce rapid and profound changes in bacterial cell structure, often reflecting the mechanism of action of the compound. These morphological transitions were captured in real time using the HaloMicroscopy. The HaloImages show the changes when comparing untreated bacteria to those exposed to an antibiotic targeting cell wall integrity where distinct phenotypic differences emerged—ranging from changes in cell shape and clustering to signs of membrane damage and lysis. These architectural shifts provide early, visually accessible markers of antibiotic efficacy, offering a high-content, label-free alternative to traditional endpoint assays.

HaloImages of *Escherichia coli* and *Staphylococcus aureus* before and after antibiotic treatment:



Top panels: *E. coli* under control conditions (left) exhibit their typical rod-shaped morphology with clearly defined cell boundaries. After antibiotic treatment (right), cells show disrupted structures, indicative of damage.
Bottom panels: *S. aureus* in the untreated state (left) appear as smooth, spherical cocci organised in dense clusters. Upon antibiotic exposure (right), cells display increased granularity, irregular morphology, and reduced clustering, consistent with membrane damage and compromised structural integrity. All the insets highlight representative cells, emphasising visible phenotypic changes.

HaloImages reveal antibiotic-induced changes in bacterial structure with speed and clarity. This capability opens new opportunities for rapid phenotypic antibiotic susceptibility testing, real-time studies of antimicrobial action. By enabling high-content, live-cell analysis, HaloMicroscopy supports a wide range of microbiology and infectious disease research workflows—from basic science to clinical and pharmaceutical applications.