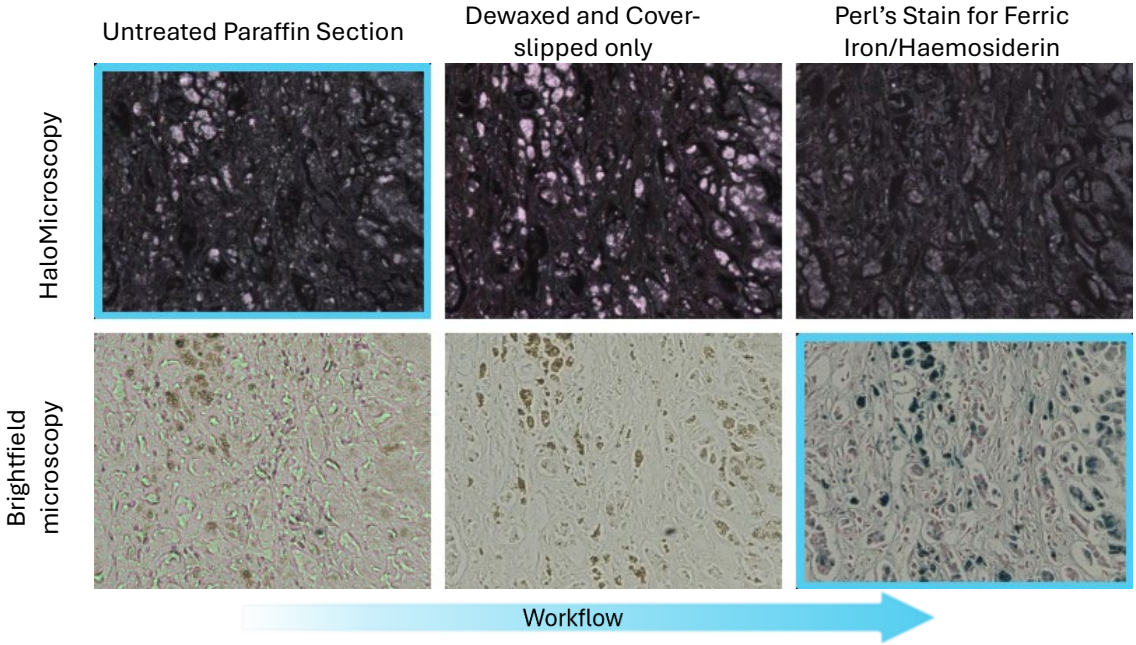
Visualising Iron in Unstained Tissue Sections

Examination of histologically prepared tissue sections using light microscopy is a foundational technique in biomedical and life science research, essential for identifying structural features and detecting pathological changes. Detecting iron in tissue is particularly important in diseases like haemochromatosis, where iron accumulation is a defining pathological feature and contributes directly to tissue damage. Traditionally, identifying iron requires staining methods such as Perls' Prussian blue, which can be time-consuming and may delay analysis. In addition, staining protocols may prohibit the reuse of the same tissue section for other analytical techniques.

The ability to visualise iron directly in unstained tissue sections reduces workflow steps and eliminates the costs and time associated with chemical staining. The HaloMicroscopy enables clear visualisation based on contrast in sample morphology and refractive index differences using visible light—allowing iron granules in unstained sections to be seen without labelling. This streamlines the workflow, making it possible to efficiently screen samples and quickly identify areas of interest, supporting faster diagnostic and research outcomes.

Detection of Iron in Haemochromatosis-Affected Tissue Sections

Liver tissue with confirmed haemochromatosis was sectioned at 5 µm and prepared in three formats: untreated, dewaxed and cover-slipped, and Perls' stained. In the unstained sections, the HaloMicroscopy visualised iron granules as bright, high-contrast structures distinct from surrounding tissue, with intensity measurements correlating well to regions positively identified by Perls' staining. This insight was obtained without requiring the two additional processing steps involved in the standard staining workflow.
Detection of iron in serial liver sections from a case of haemochromatosis:



Top row: HaloImages of untreated, dewaxed and cover-slipped, and Perls'-stained sections. *Bottom row*: Corresponding Brightfiled images of the same sections. In the unstained sections, iron-rich granules appear as bright features in the HaloImage (upper left), aligning with the Prussian blue signal observed in the Perls'-stained section (lower right), which would typically be acquired two steps later in the conventional workflow.

Our results demonstrate that the HaloMicroscopy can rapidly detect non-haem iron in unstained tissue, highlighting its potential for identifying other high-contrast, refractive-index structures such as metal deposits, amyloid plaques, or fibrotic tissue. This approach supports multimodal analysis and could streamline research and diagnostic workflows by reducing reliance on staining.