Persistent inflammatory cell reactions are responsible for the pathogenesis of a variety of inflammatory diseases. Although many cell culture models have been developed to decipher the molecular mechanisms of host defense, animal testing remains the most reliable method for studying complex cellular and tissue responses during inflammatory processes. One of the main limitations of animal studies is that traditional histological analyses are unable to identify the dynamic interplay between different cell types. Here in, we present several strategies to evaluate and monitor in real-time, host reactions such as fibrin deposition, pH changes, and macrophage accumulation. With continued development, these methods may offer rapid, diverse, non-invasive, and cost-effective options to assess the extent of inflammatory responses in real-time for improving inflammation diagnosis and patient outcomes.