

Iron depletion and overload in bacterial biofilm environment

Haya Friedman, Fe-Free

Iron ions can act as double edge sword; on one hand, they enable cellular metabolism and survival and on the other hand, they can cause ferroptosis, death caused by iron overload. Death might occur in cell including bacteria, due to Fenton reaction with ferric ions, which can lead to production of reactive oxygen species (ROS).

Blocking iron entry into the bacterial biofilm is a strategy adopted by many scientists to hinder biofilm creation, and a large body of evidence shows that removal of iron by chelators can reduce biofilm and can improve healing caused by infectious bacteria. When iron entry into bacteria is blocked, it does not only cause biofilm disturbance, but also an increase in the mechanism(s) of iron absorption, like increase of siderophores and iron transporters. Healing by chelators does not take advantage of the increase in iron transporters and siderophores, however our technology may use this phenomenon to cause ferroptosis.

Our non-invasive technology can also block iron entry into bacterial biofilm, enough to destabilize the biofilm, but it only temporarily removes iron from the bacteria in the infected area. This creates a temporally iron rich-environment after the treatment, which together with the increase in bacterial mechanisms of iron entry into bacteria, might lead to iron overload and death, so called ferroptosis. Hence, our non-invasive drug-free technology can act by independent mechanisms to reduce biofilm flourishing.