

The advent of heme during evolution allowed for organisms possessing that compound to safely and efficiently carry out a variety of beneficial chemical reactions that otherwise were difficult or impossible. It was long assumed that a single heme biosynthetic pathway...the so called "classic pathway"...existed for both eukaryotes and prokaryotes. However, the outcome from extensive genome sequencing projects made it clear that many heme synthesizing prokaryotes lacked one or more "essential" heme synthesis enzymes. Over the past decade one of our lab's focuses has been on the characterization of previously unidentified enzymes to fill the missing steps. As an outcome we not only found enzymes to fill voids that existed for Gram negative bacteria, we unexpectedly discovered that Gram positive bacteria possess a heme biosynthetic pathway that is distinct from the classic pathway. Firmicutes and Actinobacteria possess a noncanonical heme pathway whose last three steps differ from anything previously shown with one of these steps being catalyzed by an enzyme found only in these bacteria.