Abstract:
Electron bifurcation is a mechanism of enzyme catalysis in which a cofactor of lower redox potential is reduced by an electron donor of higher redox potential. Since 2008, when the observation of this event, previously known only from the Q-cycle in complex III, was extended by the discovery of flavin-based electron bifurcation, a total of 12 flavoproteins have been described that catalyze this event. The use of this catalysis has so far been observed mainly in anaerobic organisms, such as methanogens or acetogens, which live in environments with low-energy substrates. For these organisms, the ability to reduce high-energy molecules, in the form of ferredoxin or flavodoxin, capable of reducing molecules whose reduction they would have to catalyze at the expense of a chemiosmotic gradient or ATP hydrolysis is a significant advantage. Phylogenetic analyses that give a comprehensive overview of the possibilities for the overall spread of flavin-based electron bifurcation among organisms are still scarce in the literature. A similar situation applies to molecular mechanisms, for most enzyme complexes, such data are not yet available.