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## **Towards New Vanadium Enzyme Mimics**

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Nature has found a variety of ways to use hydrolysis prone metals like vanadium, but most of the uses humans have found for vanadium require careful exclusion of water. Using nature's toolkit, we can make new vanadium enzymes using the de novo designed Due Ferri single chain (DFsc) protein scaffold. The DFsc scaffold was designed to bind two iron atoms in a four-helix bundle, and we have recently found that it is able to bind to vanadium and functionalize it. Based on an analysis of vanadium enzymes in the PDB, we have further modified the sequence of the DFsc protein to contain arginine and lysine in the active site in order to promote vanadium binding. We have seen an enhanced ability of some of these modified DFsc proteins to bind vanadium by circular dichroism and 51V NMR, along with shifts in redox potentials of vanadium when bound to the proteins, and are determining the effect that the addition of these amino acids has on reactivity of these enzymes. Additionally, we are exploring the ability to use more complex vanadium co-factors for these and other protein scaffolds to expand catalytic capabilities of vanadium enzymes.