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### **Binding and protonation of polypeptides and proteins in pH responsive gels**

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The binding and adsorption of polypeptides and proteins in pH sensitive gels is the result of the interplay between specific and non-specific interactions, protonation state and conformational properties of the proteins and the network. In this work we will present our recent predictions on the (non-trivial) adsorption of polypeptides and proteins on polyacid hydrogels. In particular we study the adsorption of polyhistidine and lysozyme on polyacrylic acid gels. We will show the qualitatively different response of the hydrogel to the adsorption of these different species and the large changes that occur in the acid base equilibrium within the hydrogel compared to the bulk solution. Of particular interest is how different amino acids within the same proteins show very different responses to pH changes, even though their bulk solution behavior is similar. The importance of charge regulation through acid-base equilibrium in biopolymers in general and its dependence on environmental conditions will be discussed.