Protein tools to understand & use multivalency in nature

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Multivalency is a key principle in nature for many biological processes such as cell-cell communications, phase separation, and even simple DNA hybridization. For example, multivalent interactions between cells or with other organisms (bacteria and viruses) are governed by multiple ligand-receptor interactions on cell surfaces. Simple (and often weak) individual biomolecular interactions can be highly strengthened and diversified by employing multivalency. To study and employ multivalent bio-interactions, however, multivalent scaffold architectures that can display multivalent biomolecules in a well-defined manner must be developed. Here I will introduce several new strategies to fabricate large protein assemblies, which can be valuable assets to study multivalent interactions in nature. In particular, modifications and applications of fluorescent proteins and avidin proteins with highly interesting binding properties will be discussed. In addition, several examples of how newly fabricated biomolecules with multivalent interactions that can be applied for designing new bioanalytical or biointerfacing methods will be discussed.