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Enzyme encapsulation in the P22 viral capsid as a platform for biological nanoreactors

The capsid of the *Salmonella typhimurium* bacteriophage P22 presents a platform for encapsidation of protein cargo through genetic fusion. The capsid spontaneously assembles via interactions between a scaffold protein and the interior of the coat protein shell. By fusing proteins to a truncated scaffold protein it is possible to package cargo inside the capsid which has potential to generate thermostable, dynamic, targetable nanoreactors. The present work proves this concept with the encapsidation of two thermophilic enzymes, the monomeric alcohol dehydrogenase AdhD and the tetrameric β;-glucosidase CelB both from *Pyrococcus furiousus*. Both enzymes are shown to be active in the packaged form and present within the capsid in large numbers, 85 monomers /capsid in CelB and 250 monomers/capsid in AdhD. The functionalized capsids were shown to retain the temperature dependent maturation seen in the wild type.