Cell organelles are subcellular structures entrapping a set of enzymes to achieve a specific functionality. The incorporation of artificial organelles into cells is a novel medical paradigm which might contribute to the treatment of various cell disorders by replacing malfunctioning organelles. In particular, artificial organelles are expected to be a powerful solution in the context of enzyme replacement therapy since enzymatic malfunction is the primary cause of organelle dysfunction. Although several attempts have been made to encapsulate enzymes within a carrier vehicle, only few intracellularly active artificial organelles have been reported to date and they all consist of single-compartment carriers. However, it is noted that biological organelles consist of multicompartment architectures where enzymatic reactions are executed within distinct subcompartments. Compartmentalization allows for multiple processes to take place in close vicinity and in a parallel manner without the risk of interference or degradation. Here, we report on a subcompartmentalized and intracellularly active carrier, a crucial step for advancing artificial organelles. In particular, we develop and characterize a novel capsosome system, which consists of multiple liposomes and fluorescent gold nanoclusters embedded within a polymer carrier capsule. We subsequently demonstrate that encapsulated enzymes preserve their activity intracellularly, allowing for controlled enzymatic cascade reaction within a host cell.