Generic Method Links Quantum Dots to Proteins

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Quantum dots are rapidly becoming biomedical researchers' tool of choice for adding a fluorescent label to a wide variety of biomolecules. Now, thanks to work from a multi-institutional team of investigators, researchers may have a simple, generic method for attaching quantum dots to proteins in a highly controlled manner. Amy Blum, Ph.D., of the Naval Research Laboratory, led this team, which published its results in the journal *Nanotechnology*.

The investigators took advantage of the fact that quantum dots bind strongly to short peptides containing the amino acid histidine, and that such histidine-containing peptides bind strongly to regions of a protein that contain the amino acid lysine.

The researchers start by first mixing a commercially available histidine-containing peptide with the protein they want to label – in this paper, the researchers used an antibody and a virus particle as their target proteins. They then add water-soluble cadmium selenide/zinc sulfide quantum dots to the modified protein, let the mixture sit at room temperature for two days, and then remove the unreacted quantum dots using either gel electrophoresis for small batches or size exclusion chromatography for larger batches.

Experiments with the virus particle showed that quantum dot labeling was uniform and controlled using this method. The researchers observed that this method prevented the formation of quantum dot-protein aggregates, a common occurrence using other labeling techniques.

The researchers note that while other investigators obtained similar results using proteins that had been engineered to have histidines available to bind quantum dots, this new method uses off-the-shelf chemicals rather than laboriously engineered proteins to achieve the same end.

Another important issue that the investigators addressed was the need to ensure that the labeling process did not interfere with the protein's function. To determine if the new method did indeed produce functional, labeled proteins, the researchers tested the labeled antibody to see if it still bound to its target with the same avidity as unlabeled antibody. This experiment showed that antibody binding ability was unchanged after quantum dot labeling.

This work is detailed in a paper titled, "Templated self-assembly of quantum dots from aqueous solution using protein scaffolds." Investigators from Geo-Centers, Inc., George Mason University, and The Scripps Research Institute also participated in this study. An abstract of this paper is available at the journal's website.

Source: National Cancer Institute