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Ultrasensitive Detection and Manipulation of Biomolecules with Fluorescence Microscopy

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Our group is interested in the study of biomolecular interaction and biomarker sensing with the aid of fluorescence microscopic methods. Recently, we have

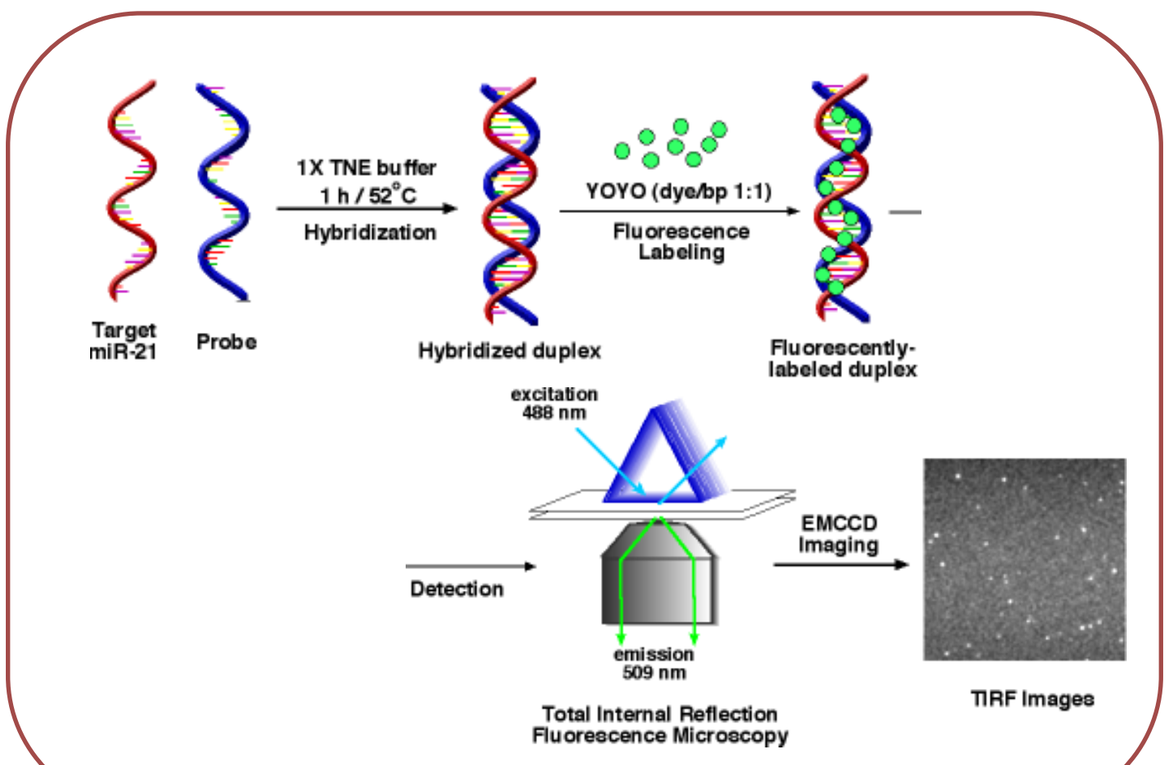
(1) developed ultrasensitive assays for the detection of potent cancer markers, e.g. microRNA; and

(2) studied the inhibitory effect of nanomaterials and transition metal complexes on regulating the fibrillogenesis of Alzheimer's disease-related beta-amyloid peptide, respectively.

Direct Quantification of Single-Molecule of MicroRNA by Total Internal Reflection Fluorescence Microscopy (TIRFM)

MicroRNAs (miRNAs) are regarded as potent cancer biomarker since they express differently in normal and cancerous tissues. However, the short length and low abundance of microRNAs brought challenges to the established biomolecular detection assays. Herein, we have:

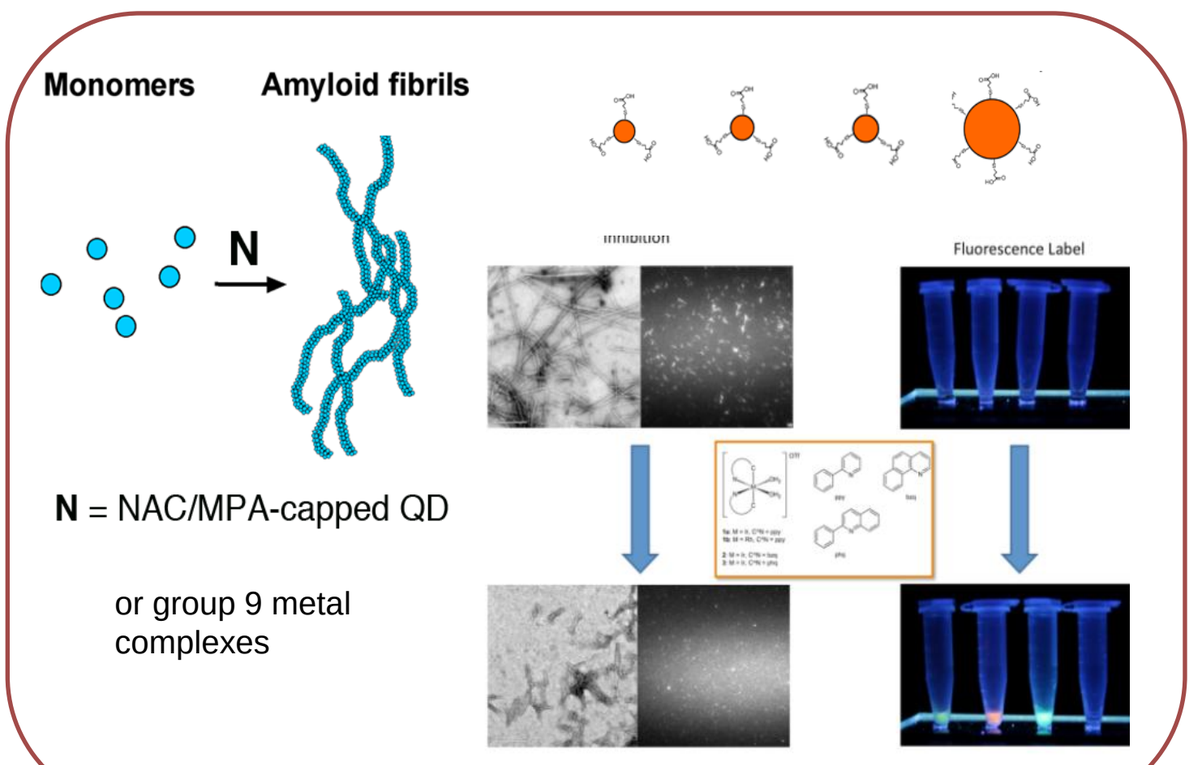
- Developed an ultrasensitive, low sample-consumption and pretreatment-free detection assay of miRNAs in single-molecule level with TIRF microscopy; and
- Quantified the expression of miRNAs in cancerous and non-cancerous cells and validated the result with RT-qPCR method.



Inhibition of Beta-Amyloid Fibrillogenesis by Nanoparticles, Quantum Dots and Group 9 Metal Solvato Complexes

Beta-amyloid peptide (Aβ) is found highly correlated to the occurrence of Alzheimer's disease (AD). It is believed that preventing the misfolding and self-aggregation of monomeric Aβ into neurotoxic fibrils is one of the therapeutic strategies of AD. We are interested in exploring the effect of different materials on the growth of Aβ fibrils. With TIRFM, we have studied the inhibition of Aβ with:

- Surface functionalized CdTe quantum dots
- Surface functionalized gold nanoparticles
- Group 9 metal solvato complexes
- Organic small molecules



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