The AptaReport™
Newsletter
WINTER 2018

Multifunctional Flourescent Aptamer Probe For Cadmium(II)

Cadmium (Cd) is an extremely toxic chemical element found in many products like plastics, fossil fuels, cosmetics, and wastewaters. As a carcinogen, it poses a threat to crops, livestock, and people. Zhu et. al. utilized Cd(II)-specific aptamer (CAP) to recognize and act as a signal reporter of the element. Presence of Cd(II) induced a conformational change in the aptamer, accompanied by a change in fluorescence intensity.

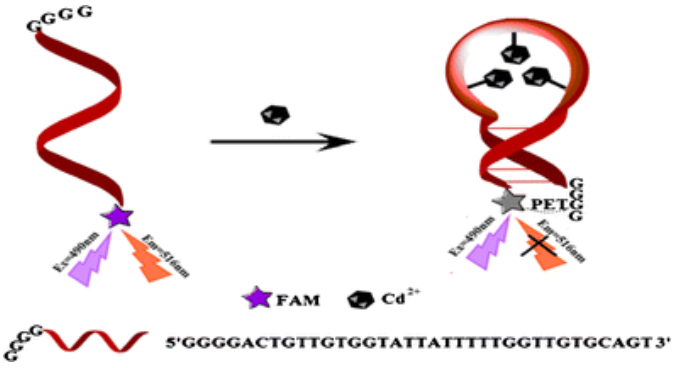


*Figure (adapted)**
Diagram depicting CAP conformational change in presence of Cd2+

The change is a result of a photo-induced electron transfer (PET) of the aptamer in the presence of target, shutting off the emission of the 516nm signal. This method has a reported detection limit of 2.15 nM, and the aptamer probe with a G4-based quencher avoids dual labeling of CAP with other fluorophore/quencher units. The strategy is more convenient and economical than other aptamer-based biosensors for Cd(II), and would be helpful in the design of various target assays in the environmental safety and biomedical fields.

-A.E.

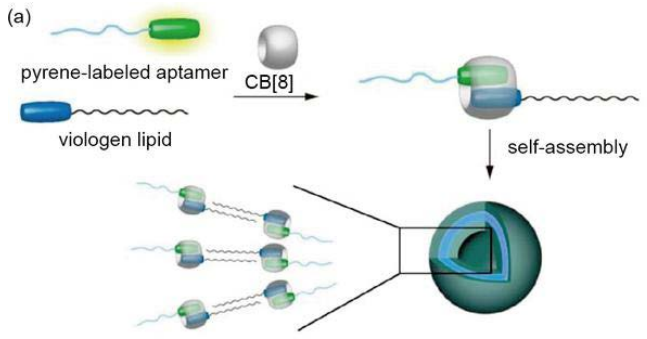
*Reference: Apta-Index™ ID #627

Aptamer-Based Self-Assembled Supramolecular Vesicles for Targeted Drug Delivery

Targeted drug delivery is an important issue in the field of medicine. Creating a drug with the desired effect is often not the problem, the problem is limiting the effect to only specific cells. For example, chemotherapy is effective at killing cancer cells, but also kills other cells that prove vital for the patient's long-term survival. Wu et al have combined aptamer specificity and vesicle capacity to carry drugs to create an exciting new system for targeted drug delivery. They use cucurbit[8]urils' (CB[8]) ability to join molecules together non-covalently to combine an aptamer with a lipid in a supramolecule, which can self-assemble into vesicles. The vesicles can be loaded with their desired drug, based on the size of the vesicle.

In their paper Wu et al used an aptamer specific for epithelial cell adhesion molecule (EpCAM), which is over-expressed in many cancers, and Dox, a common cancer fighting drug. They were able to show that their aptamer-lipid vesicles entered the cancer cells and released the Dox, but did not significantly enter the non-cancer cells. This demonstrates that their system is effective at targeted drug delivery. In addition, this system could be easily adapted to suit a variety of illnesses by simply changing the aptamer and drug, allowing for a diverse array of targeted drug applications.

Figure (Adapted) (a) Formation of ternary complex based on pyrene-labeled aptamer, viologen lipid, and CB[8].*



-M.T.

*Reference: Apta-Index™ ID #628

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Colorimetric Aptamer Assay For Small Molecule Detection In Food

Chloramphenicol (CAP) is a small molecular drug that was once misused to prevent disease in cows, but has since been seen to accumulate in the human body leading to health complications such as aplastic anemia. Luan et. al. developed an aptamer-based colorimetric assay to detect CAP. First, single-stranded DNA binding proteins (SSB) were linked to a magnetic probe (Fe3O4), while gold nanoparticles (Au NPs) were bound to a CAP aptamer (CAP-Apt). The nanoparticle/aptamer (Au NP)-(CAP Apt) complexes were attached to Silicon Dioxide, and the SSBs anchored them to the magnetic probe by binding the CAP-Apt in absence of target.

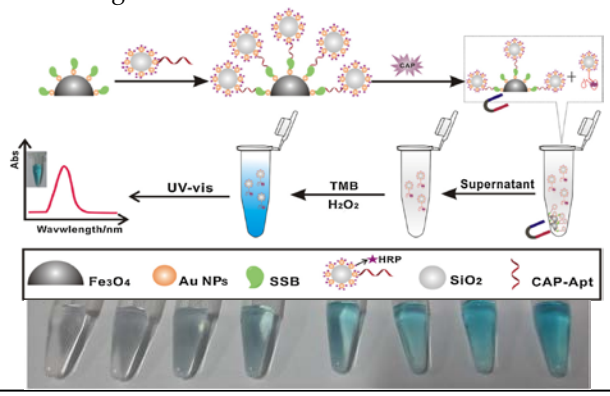


*Figure (adapted)**
A) Scheme describing development of colorimetric assay for Chloramphenicol (CAP) detection.
B) Example of color change at varying concentrations of CAP; 0, 0.05, 0.1, 5, 20, 40,80, 100 ng/mL, respectively.

Target introduction pulls the (Au NP)-(CAP Apt) complex off of the magnetic bead due to the aptamer's high affinity to Chloramphenicol (CAP). By magnetically separating the probe from the supernatant and adding it to a solution of 3,3',5,5'-tetramethylbenzidine (TMB) & hydrogen peroxide (H2O2), one could see a noticeable color change, by the naked eye, from clear to blue after only 15 minutes.

According to the Center for Disease Control and Prevention (CDC), 1 in 6 people will get sick by consuming contaminated food or beverage each year. Using a detection process like this could prove a reliable and effective way to easily accomplish food testing for various targets by simply changing the target specific aptamer used in the assay.

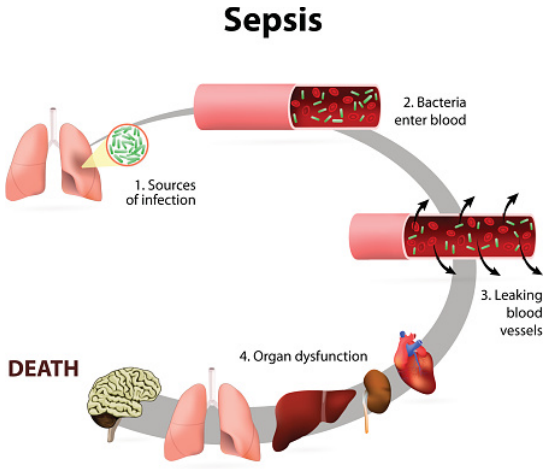
-A.E.

*Reference: Apta-Index™ ID #629

High Efficiency Binding Aptamers for Bacterial Sepsis

Sepsis is a deadly condition with a mortality rate of 40% that affects 18 million people worldwide annually. It is caused by a systemic inflammatory response to microorganisms or their toxins in the blood stream. The microorganisms in question are generally bacteria, but can also be fungi, viruses or protozoan parasites. Severe inflammation can lead to reduction of blood flow to the organs, which can lead to organ failure and death.

One of the challenges in treating sepsis is diagnosis. The current method involves bacteria culture of blood samples which takes 5 days to give results. A faster diagnostic method could directly impact patient survival. Graziani et al. have discovered two aptamers that can bind to a wide variety of sepsis-causing bacteria by binding to peptidoglycan. Peptidoglycan is the only cell wall polymer that is common to both gram-positive and gram-negative cells, so by using it as a target, their aptamer can bind to both kinds of bacteria. The best binding is shown by the aptamer Antibac1 to E. coli with a Kd of 31.82 nM. This aptamer could be used in faster diagnostic assays to allow for faster diagnosis and therefore treatment.



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*Reference: Apta-Index™ ID #630

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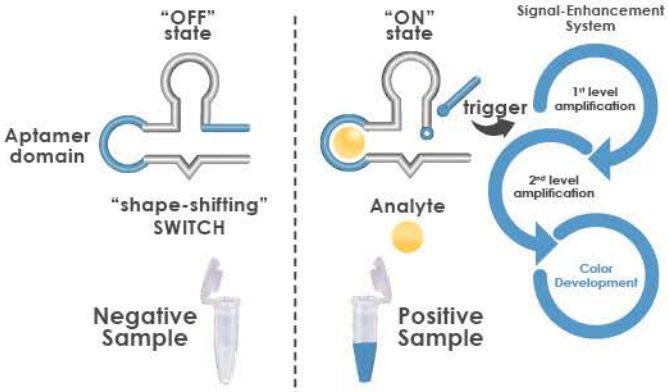

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HIGH Selectivity	+	++++	++++
Unknown Biomarkers		++++	++++
Small Target Selectivity	+	++++	++++
Difficult Target Selectivity		++++	++++
One-Step Detection			++++
In-Solution Detection			++++

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