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I E C B

Aptamers for in vivo sensing in biological systems.

Frédéric DUCONGÉ
Molecular Imaging Research Center (MIRCen), Fontenay-aux-Roses, FRANCE.

Sophisticated structures of nucleic acids play a key role in lifecycles by interacting with proteins or other partners. Since 1990, several approaches of molecular evolution have been developed to study these natural properties of nucleic acid structures but also to develop synthetic ligands that bind to specific targets (amino acids, antibiotic, proteins…). The artificial ligands found by these techniques are named “aptamers”, from the latin "*aptus*" meaning "to fit", and the method to identify them was popularized using the term “SELEX” for "Systematic Evolution of Ligands by Exponential enrichment".
Aptamers have emerged as important tools for synthetic biology. It has been demonstrated that aptamers can be used as ligands, inhibitors or sensors for several applications including biosensors, biochips, chromatography, microscopy, flow cytometry... They present several advantages: 1- they have high specificity and affinity for their targets 2- they seem to lack immunogenicity 3- they can have an inhibitory activity on their targets, 4- they can be chemically modified in order to improve their stability against nucleases or to modify their pharmacokinetics, 5- straightforward modifications and functionalization of aptamers make them ideal targeting agents and 5- they can be selected against extracellular targets that are easier to access *in vivo*.
A few experiments have been conducted *in vivo* to evaluate the use of aptamers as molecular imaging probes, mostly in small animal models of cancer. Radiolabelled aptamers have been evaluated as radiotracers for SPECT imaging. Aptamers have also been tested as fluorescent sensors or as targeting agent to deliver drugs. Here we propose to describe the methods that are used to identify aptamers, especially aptamers targeting cell-surface biomarkers, and to present several methods to evaluate these aptamers *in vivo*.

Institut Européen de Chimie et Biologie
2, rue Robert Escarpit - 33607 Pessac, France
Tél. : +33(0)5 40 00 30 38 - Fax. : +33(0)5 40 00 22 15
www.iecb.u-bordeaux.fr