Nanostructures of conjugates of antisense oligonucleotides and boron clusters as potential carriers for boron neutron capture therapy (BNCT)

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DNA nanotechnology is a branch of technology that exploits nucleic acids ability to self-assembly in order to construct nanostructures with specific properties. Based on our previous studies on boron clusters as modifying units for nucleic acids [1,2], conjugates of the epidermal growth factor receptor (EGFR)-directed antisense DNA oligonucleotides modified with boron clusters [o-carborane, $C_2B_{10}H_{12}$; dodecacarborane, $B_{12}H_{12}^{2-}$; and metallacarborane, $[Fe(C_2B_9H_{11})^{2-}]$ were obtained and tested as antisense agents [3,4]. In this communication, we present an application of DNA-functionalized boron clusters (oligopods) as building blocks for nano-construction of therapeutic nucleic acid systems. Thus, tri-substituted o-carborane, bis-functionalized with EGFR-targeted sense or antisense oligonucleotides were obtained by solid phase method. The complementary dipods were self-assembled to nano-structured complexes which were visualized by the non-denaturating polyacrylamide gel electrophoresis (PAGE), atomic force microscopy (AFM) and cryo-transmission electron microscopy (Cryo-TEM). Their silencing activity, stability against exo- and endo-nucleases as well as usefulness as potential agents in BNCT therapy were tested.

Acknowledgment: This research was financially supported by The National Science Centre in Poland [Grant number 2015/16/W/ST5/00413 for years 2015–2019].

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