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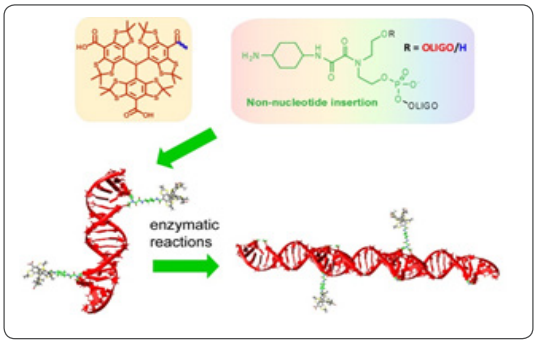
Modified oligonucleotides – A universal tool for synthetic biology and biophysics

Georgiy Yu Shevelev[1,4], Evgeny L Gulyak[4,1], Alexander A Lomzov[1,4], Andrey A Kuzhelev[2,4], Olesya A Krumkacheva[3,4], Maxim S Kupryushkin[1], Victor M Tormyshev[2,4], Matvey V Fedin[3,4], Elena G Bagryanskaya[2,4], and Dmitrii V Pyshnyi[1,4]

[1]Institute of Chemical Biology and Fundamental Medicine SB RAS, Russia
[2]N N Vorozhtsov Novosibirsk Institute of Organic Chemistry SB RAS, Russia
[3]International Tomography Center SB RAS, Russia
[4]Novosibirsk State University, Russia

During the last decades oligonucleotides has become a universal instrument for such fields as molecular biology, medicine and biophysics. The development of synthetic approaches for modification of RNA and DNA oligonucleotides for creating derivatives and analogues – is crucially important field which significantly broadens the possible spectrum of their application. One of the perspective usage of oligonucleotides as a molecular tool for biophysics and synthetic biology research – is their combination with small molecules (labels) such as fluorophores or spin labels which could produce physical signal. The present work is dedicated to the development of synthetic approaches for incorporation of spin labels into the arbitrary sites of DNA oligonucleotides and their further usage for interspin distance measurements. The separate problem which has been partially solved during this work is the development of approaches for providing interspin distance measurements within Nucleic Acids using DEER EPR technique at room temperature. The combination of developed Nucleic Acid spin-labeling approaches with enzymatic approaches for gene synthesis, such as Polymerase chain reacton and ligation allow ones to synthesize long spin-labeled DNA or RNA polynucleotides which could be used for structural studies of biologically important nucleoprotein complexes provided by NMR, EPR for facilitating achievements of structural biology.



Recent Publications

1. Georgiy Yu. Shevelev et all // Physiological-Temperature Distance Measurement in Nucleic Acid using Triarylmethyl-Based Spin Labels and Pulsed Dipolar EPR Spectroscopy // J AM CHEM SOC, 2014, 136 (28), pp 9874–9877.
2. Georgiy Yu. Shevelev et all // Triarylmethyl Labels: Improving the Accuracy of EPR Nanoscale Distance Measurements in DNAs // J PHYS CHEM B, 2015, 119, pp 13641–13648.
3. Georgiy Yu. Shevelev et all // Spin-labeled oligonucleotides-useful tool for the structural biology// FEBS JOURNAL, 2015 282, pp 350-350.
4. A.A. Kuzhelev, et all // Saccharides as Prospective Immobilizers of Nucleic Acids for Room-Temperature Structural EPR Studies // PHYS CHEM LETT, 2016, 7, pp 2544–2548.
5. M.V. Fedin, et all // Interaction of Triarylmethyl Radical with DNA Termini Revealed by Orientation-Selective W-band Double Electron-Electron Resonance Spectroscopy // CHEM PHYS PHYS CHEM, 2016, 18, pp 29549-29554.

Biography

Georgiy Yu Shevelev has his expertise within the synthesis and investigation of physical and chemical properties of Nucleic Acids and their analogs and derivatives. One of other areas of his interests are: determination of thermodynamic parameters of DNA complexes formation. Investigation of spatial (2D and 3D) organization of DNA and DNA-protein complexes using physical methods. Visualization of biological objects using Atomic Force Microscopy (cells, viruses, proteins, nucleic acids, nanotubes etc.). Single molecule force spectroscopy using Atomic Force Microscopy. Organic synthesis of phosphoroamidites, non-nucleotide insertions. Automated oligonucleotide synthesis of native and modified Nucleic Acids. Labeling of Nucleic Acids and proteins with fluorophores and spin labels for Fluorescence and EPR spectroscopy. Aptamer technology (CE-SELEX, Non-Selex). Producing and purification of recombinant proteins. Basics of Molecular Dynamic simulations and visualization (Hyperchem 8.0, Chimera).

metatezis@gmail.com