



## Larisa Klapshina

Russian Academy of Sciences, Russia

### Biography

Larisa Klapshina has received her PhD from Razuvaev Institute of Organometallic Chemistry of Russian Academy of Sciences, IOMC RAS (Nizhny Novgorod, Russia). Currently, she is a Senior Researcher at IOMC RAS. She and her group work in organic and organometallic synthesis and functional materials in biophotonics and biomedicine. She is author of about 100 articles.

[klarisa@iomc.ras.ru](mailto:klarisa@iomc.ras.ru)



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## MULTIFUNCTIONAL ANTICANCER DRUGS FOR PERSONALIZED MEDICINE BASED ON CYANO-ARYL PORPHYRIZING PIGMENTS: EFFICIENT PHOTSENSITIZERS IN PDT AND NEW TYPE OF FLUORESCENT MOLECULAR ROTORS FOR REAL-TIME MONITORING OF PDT TREATING

For a long time, the idea of separated diagnostic and therapeutic approaches was predominant in the development of new drugs in medicine. However, recently a significant increase has been observed in the trend to create the drugs which effectively combine diagnostic and therapeutic approaches. The development of multifunctional agents which allows effective therapy and non-invasive real-time monitoring of individual therapeutic response to the treatment procedure is an important challenge for modern pharmaceutical chemistry. Here we report the new series of novel aryl-cyano porphyrazine pigments containing heteroatoms (O, N, S) in the aromatic groups in the peripheral frame of macrocycle. We established that design of aryl substituents framing macrocycle provides a fine-tuning of photophysical and photodynamic properties of cyano-aryl porphyrazine pigments. *In vivo* experiments showed selective accumulation of porphyrazine in tumor that was indicated by higher fluorescence intensity in the tumor area in comparison with the normal tissues. High efficiency of cyano-aryl porphyrazine free bases as photosensitizers had been demonstrated by experiments *in vivo* on PDT of the CT26 tumors. Moreover, this series of tetrapyrroles showed the strong dependence of the fluorescence parameters (quantum yield and fluorescence life time) on the local viscosity. Such the dyes termed fluorescent molecular rotors (FMR) are very promising agents for optical sensing of intracellular viscosity. Since viscosity and diffusion rate in the domains of live cells define functional state of cells such the sensing allows, in principle, real-time monitoring of the tumor response to therapeutic procedure. We first proposed theoretical model describing the FMR properties of novel porphyrazine series as the unique example of FMR photophysical behavior originated within porphyrazine annular structure. The model is based on the twisted intramolecular charge transfer (TICT) mechanism upon photoexcitation and arises from segmental mobility of several potentially rotatable  $\pi$ -donor aryl groups which alternate with strongly electron withdrawing CN-groups. We believe that innovative cyano-aryl porphyrazines we developed are very promising for personalized medicine as photosensitizers in PDT with additional function of real-time optical monitoring of the tumor response to PDT treatment.