



BILKENT UNIVERSITY

unam - INSTITUTE of MATERIALS SCIENCE & NANOTECHNOLOGY

FACULTY OF SCIENCE

**MATERIALS SCIENCE and NANOTECHNOLOGY
GRADUATE PROGRAM SEMINAR**

“Towards Autonomous Therapeutic Agents”

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UNAM - Institute of Materials Science and Nanotechnology

Our research group in Molecular Nanotechnology Labs at UNAM is heavily involved in developing alternative reagents and delivery strategies for photodynamic therapy. Photodynamic therapy (PDT) is a noninvasive method of treating malignant tumors and age-related macular degeneration, and is particularly promising in the treatment of multidrug-resistant (MDR) tumors. The PDT strategy is based on the preferential localization of certain photosensitizers in tumor tissues upon systemic administration. The sensitizer is then excited with red or near infrared (NIR) light, generating reactive oxygen species (ROS) including singlet oxygen (1O_2) and thus irreversibly damaging tumor cells. Current practice of PDT is limited to a few functionalized porphyrins, however these compounds are not considered to be ideal drugs for use in PDT. Among the limitations, the most prominent is the low extinction coefficient of porphyrins in the body's therapeutic window (650–800 nm, low absorptivity region in typical mammalian tissues). As a consequence, many research groups worldwide are engaged in efforts to develop better sensitizers. One important aspect is the tight control of the delivery of cytotoxic singlet oxygen to be produced. In our latest design [1], a sensitizer which behaves as an “AND” logic gate was proposed. Singlet excited state of the sensitizer dye can take a number of different paths for de-excitation (returning to the ground state), through competing processes. Among these processes, photo-induced electron transfer (PeT), intersystem crossing (ic), fluorescence (fl), non-radiative de-excitation (nr) are the most prominent ones. The rates of fluorescence or non-radiative process are not affected by the modulators such as Na^+ and H^+ . But, the blocking of PeT by Na^+ binding to the crown ether moiety, leaves intersystem crossing as the major path for de-excitation. This is path for singlet oxygen generation. So, increasing concentration of Na^+ ions increases the rate of singlet oxygen generation. H^+ ions influence the same rate by a different mechanism, the added acid causes a bathochromic (red) shift in the absorption spectrum. This shift moves the absorption peak to the peak emission wavelength of the LED used in the excitation. Thus, the sensitizers are more effectively excited when the medium is acidic. Although this is a proof of principle study, we firmly established the fact that, molecular logic holds a greater promise than previously recognized. They are not merely bad copies of semiconductor logic gates, they are molecular systems which have the potential to combine sensing, computing and actuation, all in a sub-nm³ volume.

Date : February 5, 2010 (Friday)

Time : 15:40

Place : Faculty of Science Building, A Block, Seminar Room (SA 240)

Tea and cookies will be served after the seminar