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Extended Abstract
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Organic Chemistry: 2018- Microwave assisted synthesis of a library of near-infrared molecular probes for in-vivo imaging- Maged Henary

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A microwave-assisted method for the synthesis of a library of Near-Infrared (NIR) molecular probes such as symmetrical pentamethine cyanines and their corresponding precursors. This class of compounds is advantageous for in vivo imaging because of the low absorption of biological molecules in the NIR window. The microwave synthesis drastically reduced the reaction time for dye synthesis from days to min, as well as producing increased yields (89-98%) to the conventional heating method (18-64%). Also in this study, we demonstrate that it is possible to create tissue-specific (thyroid, salivary, and adrenal glands) near-infrared fluorophores using the inherent chemical structure. Thus, a single compact molecule performs both targeting and imaging.

Optical imaging has been the mainstay of histology, bioassays, and microscopy for several decades due to the high spatial resolution and exceptional detection sensitivity of the tactic . Particularly, multiple-channel imaging distinguishes optical imaging from other imaging methods.(Hilderbrand and Weissleder, 20102010) due to the massive optical imaging window, typically between 400 and 1200 nm, it's possible to use multiple fluorescent probes during a single experiment without significant bleed through between the imaging channels. Therefore, multichannel imaging has great potential to facilitate the observation of multiple molecular targets in cells and tissue. for instance , five distinct lymph gland drainages were visualized during a single imaging session using dendrimers labeled with fluorophores of various colors

Microwaves are a sort of electromagnetic wave with wavelengths starting from about one meter to at least one millimeter; with frequencies between 300 MHz (1 m) and 300 GHz (1 mm). Different sources define different frequency ranges as microwaves; the above broad definition includes both UHF and EHF (millimeter wave) bands. A more common definition in radio-frequency engineering is that the range between 1 and 100 GHz (wavelengths between 0.3 m and three mm). altogether cases, microwaves include the whole SHF band (3 to 30 GHz, or 10 to 1 cm) at minimum. Frequencies within the microwave range are often mentioned by their IEEE radar band designations: S, C, X, Ku, K, or Ka band, or by similar NATO or EU designations.

To be effective, many optical techniques require the utilization of designer molecular probes for detecting and tracking molecular processes or biomarkers of interest. Therefore, the event of latest molecular probes has attracted the eye of researchers for several decades due to their diverse applications in chemistry, biology, and medicine.(Ballou, et al., 2005,Rao, et al., 2007,Sameiro and Goncalves, 2009) In recent years, optical imaging of molecular processes in living organisms has stimulated interest within the development of molecular probes to be used within the near-infrared (NIR) region (700- 900 nm).(Achilefu, 2010,Escobedo, et al., 2010,He, et al., 2010,Hilderbrand and Weissleder, 2010) NIR molecular probes offer two major advantages over people who emit at visible wavelengths. First, biological tissues have lower absorption of NIR light than light .(Achilefu) this enables NIR light to penetrate deeper into tissue than light at visible wavelengths, thus enabling the assessment of data from deeper structures. Second, less autofluorescence is present at the NIR compared to visible wavelengths, enabling higher signal-to-background ratios. Therefore, molecular probes that emit light within the NIR region are expected to be suitable for in vivo imaging. Recent research efforts have targeting developing and utilizing such NIR probes in biomedical imaging applications. during this chapter, the NIR fluorescent probes (exclusive of natural NIR proteins) that are used for in vitro and in vivo imaging are going to be summarized. These include probes supported small-molecule organic fluorophores, nanoparticle-based probes and new multimodal imaging probes.

In vivo imagers, sometimes called preclinical imaging systems, are imaging systems that look deep into the tissues of living subjects. the advantages of this sort of system are that it gives the foremost complete picture of the biological effects of a treatment or disease progression and therefore the animal is kept alive allowing future analysis on an equivalent subject. An imager consists of three components: a box to carry the animal, the imager itself, and a computational system for analyzing the info . it's common for subjects to even be administered non-toxic dyes or probes to facilitate targeted tissue imaging. Lab imagers are often mini versions of clinical tools like MRI, CT, PET, and SPECT or fluorescence or bioluminescence optical imaging systems that are only utilized in the lab; modern systems often employ quite one among these imaging types. Determining what must be imaged, the extent of detail desired, and price point are all important to think about when purchasing an in vivo imager.

Microwave technology is extensively used for point-to-point telecommunications (i.e. non-broadcast uses). Microwaves are especially suitable for this use since they're more easily focused into narrower beams than radio waves, allowing frequency reuse; their comparatively higher frequencies allow broad bandwidth and high data transmission rates, and antenna sizes are smaller than at lower frequencies because antenna size is inversely proportional to transmitted frequency. Microwaves are utilized in spacecraft communication, and far of the world's data, TV, and telephone communications are transmitted long distances by microwaves between ground stations and communications satellites. Microwaves also are employed in microwave ovens and in radar technology.