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Therapeutic micro-bubbles for diagnostic and drug delivery modalities

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Cancer treatment usually involves systemic injection of toxic chemotherapeutic agents that cause severe side effects for the patient; it is also relatively inefficient use of expensive toxic drugs. The area of targeted drug delivery in which drugs are delivered in a carrier directly to the cancer has gained much interest in recent years. This approach reduces the side effects of the drug and also provides a direct localized, high-concentration treatment. Micro-bubbles (MBs) as used for Contrast Enhanced Ultra Sound (CEUS) imaging are micron sized gas encapsulated spheres, stabilized with a shell of biocompatible material (e.g., proteins, phospholipids). These MBs are capable of circulating in the vasculature; their high acoustic impedance mismatch with the surrounding tissue provides a strong enhancement of the ultrasound imaging. More recently, there has been considerable interest in the development of MBs as vehicles for drug delivery, by loading them with liposomes encapsulating a drug, the whole complex is functionalized and targeted toward the required location using antibodies, or other ligands. Here I am presenting our group at the University of Leeds (Leeds, UK) developing therapeutic micro-bubbles that act as both agents for CEUS imaging and targeted drug-delivery vehicles. Ultimately, a large amplitude sound wave is used to destroy the bubbles and trigger release of the drug at the targeted tumor. Theranostic MBs are a simple and versatile drug-delivery technique that could potentially improve cancer treatment, both in terms of patient experience and overall drug efficiency. Importantly, they offer new ways of delivering hydrophobic drugs, which have traditionally been difficult to deliver efficiently.

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Natural products from plant and hyper-saline sediment derived fungi: Structure elucidation and biological characterization

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Fungi are among the most important groups of eukaryotic organisms that have played a pivotal role as sources for drug leads during the last century. Different environmental factors may change the behavior of the fungi and favor the production of diverse range of secondary metabolites. Accordingly, this study involved alternative biochemical studies of some unexplored ecological niches. The first part of the study described the chemical investigation of the fungus *Alternaria sp*. an endophytic fungus isolated from the seeds of the traditional medicinal plant Ziziphus jujube. Twenty one metabolites have been obtained from *Alternaria sp*. Five of them are isocoumarin derivatives that were obtained for the first time from this genus. The remaining sixteen compounds isolated from the same fungus included alternariol derivatives and the new; 7-methoxyphathalide-3-acetic acid. The alternariol derivatives and some of the structurally related compounds showed high cytotoxic activity when tested against L5178Y mouse lymphoma cell line as well as pronounced antibacterial activities. The second part of the study was devoted to halophilic fungi as sources of bioactive metabolites. As an example *Penicillium sp*. isolated from the sediments of a hyper-saline lake of Wadi El-Natrun, Egypt. Eight compounds were isolated from such fungus including two new epidithiodiketopiperazine analogues named, pretichodermamide C and N-methylpretichodermamide B. The last compound proved to be highly active against the L5178Y cancer cell line. These results support the notion of an ecology based-approach to selection of fungal species for chemical studies, as this approach can be effective in the discovery of new bioactive fungal metabolites.

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