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Ultrasound Induced Drug Delivery

Stanford researchers have developed a method of versatile packaging and release of drug substances using ultrasound induced release.

Accurate drug delivery is a major consideration for pharmaceutical development. One option previously employed to deliver a drug to a desired location at a specific time was to engineer the active pharmaceutical ingredient itself. This allowed for the active ingredient to target a receptor more specifically but was accompanied by major drawbacks such as reduced targeting efficacy and side effect profile. In order to combat those drawbacks, a compound could instead be repackaged without altering the drug substance itself.

In order to achieve this, Stanford researchers developed single and double layered artificial shells to encapsulate desired contents (i.e. formulation droplets) within an additional physiologic media that would surround the formulation droplets. Most critically, after exposure to ultrasound the formulation droplets leakiness would increase allowing the drug substance to be released into the physiologic media. This technology has commercial potential as a drug delivery platform for neuro/psycho-active agents to brain targets in neurologic or psychiatric disorders, or to the peripheral nervous system in, e.g., pain disorders. It could alternatively be used to delivery chemotherapeutic drugs to tumors in an oncologic context or for vasoactive agents to parts of the cardiovascular system in cardiologic, vascular, or neurologic contexts.

Stage of research

In vivo data

Applications

- Drug delivery (parenteral administration)

- Neurologic or psychiatric disorders, pain disorders, oncologic, cardiologic, vascular, or neurologic contexts

Advantages

- Additional layer of material to encapsulate drug substance that is ultrasound responsive allows for greater drug loading efficiency and less leakage of the drug substance at baseline
- The drug substance could be a small molecule or larger molecules including peptides, proteins, or nucleic acids
- The shell could be made of polymers or lipids

Publications

- Raag D. Airan et al. Acoustomechanically activatable liposomes for ultrasonic drug uncaging. bioRxiv 2023.10.23.563690;

Innovators

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