Controlled drug delivery

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Signature: Carmeljcaruana (talk)

Controlled drug delivery systems

Controlled drug delivery systems consist in technologies whose purpose is to release therapeutic agents in a specific target AS NEEDED TO ACHIEVE THE DESIRED THERAPEUTIC OUTCOME.

Clinical usage

These systems have been being developed for the last decades by biomedical SCIENTISTS AND engineers, who have been trying to understand the physiological barriers to efficient drug delivery—such as transport in the circulatory system and drug movement through cells and tissues. Thus, several modes of drug delivery have been incorporated in the clinical practice. The primary method of accomplishing this controlled release has been through incorporating the chemicals within polymers HOW ABOUT CAPSULES, MICROCAPSULES, LIPOSOMES ETC. However, there are still some disadvantages as side effects that are present even in the most advanced molecular biology strategies. These side effects are due to interactions between the drug and other parts of the body, which are not the target of the drug. Therefore, there is a limitation to the design of optimal medications for many diseases - such as cancer, neurodegenerative and infectious diseases. To try to create OPTIMAL DRUG DELIVERY there are various aspects to take in account when treating the patient, such as the drug type and biological conditions (absorption, distribution, elimination, health situation), to avoid any undesired effects. To prevent the side effects the administration of the drugs are done locally instead of systematically, where the entire body is affected. This way, besides of decreasing the probability of occurring any side effects, the drug toxicity is also decreased and the treatment’s impact maximized. Nevertheless, some medications can only be administrated systematically. In these situations and when there are some side effects, it is used a topical (used on the skin) antibacterial ointment for a localized infection or a cortisone injection.

Different types of drug delivery systems

The controlled drug delivered systems have several distinct variants. These variants might be: sustained release (where it is intended a prolonged release); a pulse release or delayed release (for example to target different regions of the gastrointestinal tract). The release is a response to stimuli, that may be associated with pH, enzymes and temperature, among others. The controlled release has the “ability” to prolong the action and to maintain the drug levels within the therapeutic window, avoiding potentially hazardous peaks in drug concentration following ingestion or injection and to maximize therapeutic efficiency. These systems have different forms, like: pills, capsules, injectable drug carriers and devices (as contraceptive implants).

Current research

Current research on drug delivery systems can be divided in four broad categories: routes of delivery, delivery vehicles, cargo and targeting strategies.

Several technologies have been developed being an example the microneedle arrays, which consists in microscopic needles filled with a medicine. Being directed to vaccine delivery, that does not have to be refrigerated and that does not require special disposal methods, helping the rural isolated communities. Nanosponges, coated with the disease-targeting compounds, with the ability to attack tumors, degrading them by RELEASING medication at a controlled rate, have been developed. It may help treating glaucoma, helping to address multi-drug resistant diseases. Genes, proteins and stem cells based treatments, as an autoimmune disorder treatment project. It is based in microscopic, biodegradable particles that can selectively shut down immune cells associated with the autoimmune disorder multiple sclerosis (MS). May also help with allergies or with organ rejection in transplant patients. A developed plant virus nanoparticle, made from modified virus, has capability to attach itself to prostate cancer cells, making it possible to detect the cancer cells at earlier stages of the disease.

Conclusion

Hence, these systems are deeply associated to medical practice, being a useful tool to improve patients' lives. The developments will, therefore, enable the side effects, increasing efficiency of the procedures.

References

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