Precise, Targeted, and Controlled Release of Parenteral Cancer Treatments

By: Paul Dupont, Head of Digital Marketing at Pii

Last year marked the golden anniversary of the National Cancer Act, landmark legislation committed to fighting cancer. Unfortunately, the demand for oncology drugs is expected to rise due to an increasing prevalence of cancer cases and a surge in the geriatric population globally. The business is expected to see more growth in the coming years due to the growing R&D initiatives of the players engaged in the industry.

Oral administration is an appealing route of delivering cancer treatments. However, the gastrointestinal tract is characterized by specific and efficient physical, chemical, and biological barriers that decrease the bioavailability of medications, including chemotherapeutics. Compared with pills and tablets, a more efficient way of getting drug into the blood is to inject it directly into a vein. This way, all the drug gets circulated throughout the body and avoids degradation in the stomach.[1]

Parenteral drug delivery allows direct administration of drug substances and ensures bioavailability. Parenterals are sterile preparations containing one or more active ingredient for administration by injection or infusion. Of the $531.8 billion global parenteral drug sector, oncology represents almost 13% of that market.[2]

Since President Nixon signed the National Cancer Act, there have been incredible advancements in how cancer is detected, treated, and cured. One of the most promising is targeted therapy, which is the foundation of precision medicine. This treatment targets proteins that control how cancer cells grow, divide, and spread. Targeted treatments can control drug dosing.

Large Molecules Target Cancer Cells

The global parenteral drug market is dominated by large molecules. These biological injectable preparations for treating cancer include:

- Monoclonal antibodies (mAbs) are biological preparations identical to the immune cells. They recognize and find specific proteins on cancer cells. These antibodies bind to the specific antigens to evoke immune response in the body. Monoclonal antibodies dominate the global parenteral drug market in terms of revenue, and contribute 21% revenue share to the overall market.[2]

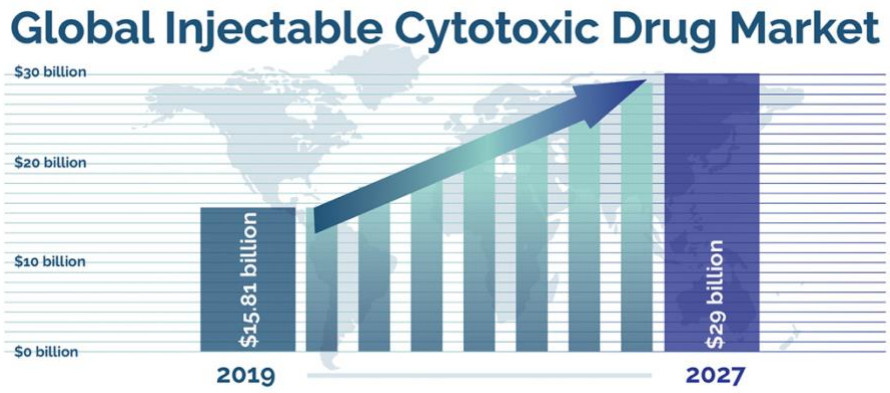
- Cytokines are soluble proteins that mediate cell-to-cell communication to evoke immune response by excreting effects on lymphocytes and other cells. A renewed interest in the anti-tumor properties of cytokines has led to an exponential increase in the number of clinical trials that explore the safety and efficacy of cytokine-based drugs, not only as single agents, but also in combination with other immunomodulatory drugs. These second-generation drugs under clinical development include known molecules with novel mechanisms of action, new targets, and fusion proteins that increase half-life and target cytokine activity to the tumor microenvironment or to the desired effector immune cells.

- Peptide antibiotics are a chemically derived class of anti-infective and anti-tumor drugs.[3] These peptides, owing to their high selectivity, specificity, small dimensions, high biocompatibility, and easy modification, provide good opportunities for targeted drug delivery. In recent years, peptides have shown considerable promise as therapeutics or targeting ligands in cancer research.[4]

Targeted Nanoscale Delivery

Targeted drug delivery can be used to increase the therapeutic index by protecting normal cells from damage and preventing drug resistance. For example, compared with conventional antitumor drugs, drug delivery systems such as drug nanoparticles (NPs) are expected to have more advantages in antineoplastic effects, including easy preparation, high efficiency, low toxicity, especially active tumor-targeting ability.[5] The increased popularity of targeted oncology drugs with the ability to treat multiple cancer types is projected to fuel demand growth.

Targeted nanoscale drug delivery technologies are particularly suited for hard-to-treat cancers – mesothelioma, pancreatic cancer, and glioblastoma (a fast-growing and aggressive brain tumor) – as the drugs can be delivered exactly where they are needed and nowhere else. Nanogels injected onto the cavity surface of the brain after a tumor has been removed, gradually release anti-cancer drugs to eliminate any residual tumor cells. Combining gels and molecular vehicles enables opportunities to enhance therapies and control delivery timescales.[6]



Injectable Cytotoxic Drugs Market Size, Share & COVID-19 Impact Analysis, Fortune Business Insights, Jan. 2021.

Controlling Payloads

Researchers continue to explore how to control delivery and release cytotoxic payloads at the site of disease, sparing normal organs. The global injectable cytotoxic drugs market was $15.81 billion in 2019 and could reach $29 billion by 2027.[7] The crucial role played by parental administration of cytotoxic drugs in countering the cancer cells has helped in the growth of this segment.

Industry is also exploring the benefit of long-acting injectables (LAIs). Such formulations release a compound over several weeks to provide a more effective treatment for chronic conditions, reducing dosing frequency and improving patient compliance. These tend to be intramuscular injections.

CDMO Expertise is Essential

According to Fact.MR, outsourcing is expected to be more prominent in oncology. This is primarily driven to an increase in number of large molecule drugs that need to be manufactured in injectable format.

“Today’s global pipeline is dominated by complex oncology products, while sales of rare disease treatments are predicted to double by 2026 – to up to $268 billion. Often based on highly sensitive molecules and delivered parenterally, these new products have fueled surging demand for technically sophisticated manufacturing support.”[8]
This CDMO support begins with early clinical trials of precise and targeted drugs – priority research for the National Cancer Institute as it looks to future treatments 50 years after the signing of the National Cancer Act.

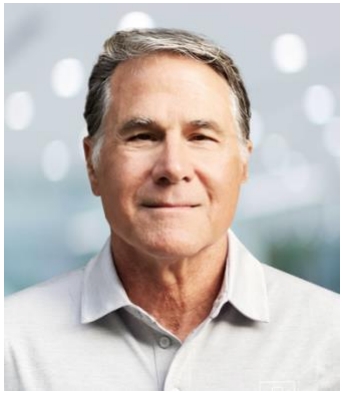
References

1. How do drugs know where to go in the body? A pharmaceutical scientist explains, Tom Anchordoquy, *Salon*, June 19, 2022.
2. Global Parenteral Drugs Market: Forecast, Trend Analysis & Competition Tracking – Global Review 2022-2032, Fact.MR, 2022.
3. Cytokines in clinical cancer immunotherapy, Pedro Berraondo, et. al., *Br J Cancer*, National Library of Medicine, Jan. 2019.
4. Anti-cancer peptide-based therapeutic strategies in solid tumors, Mohsen Karami Fath, et. al., *Cell Mol Biol Lett*., National Library of Medicine, April 2022.
5. A Review on Drug Delivery System for Tumor Therapy, Guoxiang Liu, et. al., *Front Pharmacol*, National Library of Medicine, Oct. 4, 2021.
6. How targeted drug delivery technologies can help in the fight against cancer, University of Cambridge, Jan. 11, 2022.
7. Injectable Cytotoxic Drugs Market Size, Share & COVID-19 Impact Analysis, Fortune Business Insights, Jan. 2021.
8. The 2022 Value Chain, *Contract Pharma*, March 8, 2022.

ABOUT Pii

Pharmaceutics International, Inc. (Pii) is a US-based contract development and manufacturing organization (CDMO) located in Hunt Valley, Maryland. The experienced scientists, engineers, and staff at Pii pride themselves on adroitly employing a phase appropriate method of drug development for the prudent use of their client's resources as they solve challenging problems. In addition to offering end-to-end development services, Pii manufactures a variety of dosage forms to include complex parenteral drugs and has a wealth of analytical testing capabilities. Its Hunt Valley campus has four aseptic suites with lyophilization capabilities. Our talented professionals stand ready to help! Visit us at: https://www.pharm-int.com/

ABOUT THE AUTHOR



Paul Dupont has 25 years of experience leading commercial operations in companies that offer complex technical solutions to solve the most pressing issues for businesses in an impactful way. His expertise includes strategic planning, new product development, implementing new business initiatives, guiding marketing activities to include direct and digital methods, optimizing sales operations, and creating remarkable customer experiences. His involvement as a business leader has delivered an immediate and long-term return on investment. He has used his Outcomes Driven Marketing strategy in a variety of organizations with extraordinary results.
Connect with Paul Dupont on Linkedin