

Reflective Essay

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“Recent Advances in Nanoparticle-Based Cancer Drug Delivery” was written as a literature review paper for UWP104F, Writing in the Health Sciences. Presenting and evaluating the current state of scientific knowledge on a single topic, I highlighted important findings and examined the methodologies used in a total of 31 research articles. While pointing to gaps in the literature, I eventually developed my own stance by suggesting directions for additional research and application of the research. By utilizing search strategies and various research tools and sources provided by the UC Davis Library, I came to the conclusion that major hurdles such as nonspecific toxicity and controlling penetration of biological barriers still need to be overcome before nanoparticle carriers can be FDA approved and used in clinical cancer treatment.

I relied heavily on the UC Davis Library Website to access and learn about the various research tools and sources that were available to me as a student. Under the Guides & Tutorials section of the webpage, I utilized the “Quick Guide: 5 Steps to Better Library Research” to help narrow my research topic. This guide helped me identify key terms (nanoparticles, cancer, drug delivery, stimuli-responsive drug release, adverse effect) and the specific types of information needed in my literature review.

My original idea for the paper was to evaluate all of the current Stimuli-Responsive Drug Release methods; however, I quickly realized that Nanoparticle-Based Cancer Drug Delivery is such a trending topic in the field of oncology research that a preliminary “Nanoparticle-Based Cancer Drug Delivery” search in Google Scholar provided me links to over 10 current Stimuli Responsive Drug Release methods. I focused my review to only evaluate control drug release in response to external *magnetic fields*, *ultrasound*, and *internal pH* stimuli because I noticed that the majority of the articles published within the two months prior to writing my paper focused mostly on those three areas. This indicated that the experts in nanoparticle research may have realized more potential in magnetic fields, ultrasound, and internal pH compared to alternative methods which were researched only six months prior. Therefore, I determined that even though temperature, light, electric pulses, enzyme concentration, or redox gradients are also being researched, those responsive systems were beyond the scope of my review.

I then navigated to the Course Guide section of the library website and browsed the UWP104F listing in which I learned about databases such as PubMed, BIOSIS Previews, and PsycINFO to find relevant journal articles. To access the library’s resources off campus, I learned how to connect to the Library’s VPN by downloading Pulse Secure and utilizing the UCD-eLinks in order to access full text links from home. After exploring the UC Davis Library Catalog, the UC Melvyl Catalog, and Health Sciences eBooks, I found that the PubMed database best suited my research needs. Because my review depended on very specific nanoparticle research trials and laboratory studies, PubMed’s publication sources of almost exclusively journal references provided me with the most relevant research articles. Because there are an overwhelming number of published articles on the topic of nanoparticle use in cancer therapies, I

only used sources that were published after 2014 and gave priority to articles published most recently.

My preliminary searches included “nanoparticle drug delivery” in the title, and I expanded the search to include narrowed topics such as “magnetic fields” and “adverse effects” when I was writing about the shortcomings of the different nanoparticle delivery methods. After I found an article that was relevant, I utilized the *Similar Articles* section on the right-hand side of the abstract page to review articles of the same subject. It was from the Similar Articles section that I was able to find additional research articles that often either supported the original claim or provided me with alternative viewpoints. I made sure to identify any overlap and dissimilarities of the individual cases and their results. For example, I evaluated six different articles regarding ultrasound stimuli before determining that although ultrasound irradiation produces efficient tumor suppression, different studies apply different particle formulations which can lead to inconsistent and unreliable results. Another way I gathered various viewpoints and expanded my sources was to examine the author’s references of each article. This combined strategy of using multiple sources allowed me to cross reference my research to ensure that I was providing accurate information in my paper and maintaining my own credibility.

There were times in which I ran into difficulties finding detailed information on a very specific subtopic. When this occurred, I would take advantage of the MeSH section of the NCBI platform. For example, after typing in “nanoparticles,” I then selected the precise topical subheadings I was interested in such as “metabolism” or “therapeutic use.” The “organization and administration” subheading proved particularly useful when I wanted to investigate my three main areas of stimuli-response drug release. In addition, the *Expandable Subject Hierarchy* provided me with more opportunities to find particularly focused topics such as going from a broad search for “nanoparticles” to a specialized search for “dendrimers.”

Oftentimes, I would have to be flexible and creative with my search terms and strategies. To find additional sources on “adverse effects,” I brainstormed related key terms to optimize my searches. By imputing phrases such as “oxidative imbalance,” “DNA damage,” or “immunological damage,” I was able to find many more research articles that addressed multiple facets of potential harmful effects of nanoparticle-based drug delivery.

During the process of gathering and citing my sources, I relied heavily on EndNote to store citations and quickly insert them into my literature review. After installing the software, I watched the training videos provided by the UC Davis Library website so I could use the bibliographic reference manager more efficiently. One of the things I found most useful was organizing folders within EndNote so that I could easily find references to each of my subtopics of my paper. I eventually constructed a folder for each category and was able to quickly find each of the 31 references when I needed them.

In summary, the goals of this literature review were to evaluate the current state of nanoparticle-based cancer drug delivery and assess gaps in the current literature. With extensive use of search strategies and the UC Davis Library research tools and resources, I was able to develop a comprehensive review that demonstrates the need for further research on the long-term

side effects of nanoparticles in the body. Proper standards should be established for the examination of safety and efficacy issues before expanding the newly developed nanoparticle carriers into preclinical and clinical testing.