

## Description of Research Process

Upon returning to Marquette University for my PhD, I realized that the process of searching and selecting literature was vastly different than my undergraduate (Psychology 1997) and master's (Physical Therapy 1999) experiences. The Science Library was gone and the new Raynor Memorial Libraries had merged resources together. In addition, research articles could be viewed, saved, and printed from online sources in the comfort of my office or home. Throughout this transition, the library staff was excellent in guiding me down the right path, very efficient in locating sources beyond Raynor holdings, and knowledgeable in organization techniques.

My research paper was a semester long assignment of a literature review investigating a neurophysiology topic of choice in which I focused on the influence of cytokines on obesity-associated pain. While there is a decent amount of literature on the associations between obesity and chronic inflammation and then obesity and pain reports, there is little known about central or peripheral mechanisms of obesity-associated pain. The majority of research has been completed in animal models and I hoped to outline these for their translational component to the human model. This topic parallels the specific aims in my PhD research project which is examining inflammatory markers, physical fitness, and pain in children. I utilized an online search of Pubmed, Medline, and Web of Science for keywords including "cytokines", "obesity", "pain", "central nervous system", and "peripheral nervous system" with further expansion into "central sensitization", "opioids", and "prostaglandins". My mentor, Dr. Marie Hoeger Bement also contributed several key articles from her past pain literature searches.

To organize articles, I created an Excel database identifying authors, dates of publication, journal titles, animal versus human research type, central versus peripheral components, identified or speculated mechanisms, and main conclusions. This chart allowed me to focus on critical aspects of each article and identify similar or conflicting features and results. In addition, as research builds upon itself, many articles were examined for their cited references. While many researchers focus on current literature for the answers, I found myself using both current articles and articles dating back to the early 1980s. These articles expanded the database, but provided foundational concepts to the topic. Key laboratories were identified for their pertinent data development in this topic area. A variety of articles involving animal and human subjects were gathered to present the full picture of the state of this topic. The database allowed me to rule out outdated materials, research methods that did not have solids methods, or articles that were not appropriate for this topic. Throughout the process, subsequent smaller databases were

developed; these data subsets were put into table format in my paper to allow the reader to visually organize the main concepts beyond just text format.

My research paper utilized peer-reviewed journal articles of both literature review and original research article format. Since the topic has a clinical and translational component, both animal and human studies were highlighted and compared. Most of the journal articles were available online electronically, but several were found in print format in the basement level of Raynor library due to their publication dates or in Storage S from the old Science Library Reserves. In addition, our Bement Pain Research Laboratory had a copy of the Sluka Pain textbook. Several articles were not initially available through Marquette's online subscriptions but were found utilizing the online interlibrary loan request. This service allowed for speedy obtainment of the articles in an electronic format.

Having identified a plethora of research, the paper was written in APA format per request of Dr. Sheila Schindler-Ivens. This citation process was expedited through Refworks, a Web-based bibliography database manager. Upon returning to Marquette University for my PhD, I began collecting, organizing, and managing research articles pertinent to my research project with Refworks. I have found this to be extremely helpful to manage research articles electronically by topic. In addition, the Write and Cite add-in to Microsoft Word allows me to cite articles in a live format as I write, and then convert them to many different bibliography styles in a very efficient manner. Rose Trupiano communicated with me via e-mail, phone, and a personal meeting to develop my Refworks skills and troubleshoot any difficulties.

While many of the changes to the literature review process have made things easier, the research process is still not straight forward. Conflicts in today's literature show the need for thorough analysis and additional research and investigation. The availability of articles online and in print can be overwhelming to the point where you do not know where to stop. Additional critical analyses of the methods, statistical analyses, discussion, and results sections are required to ensure quality references.

It is important for students at all levels to realize that research is very time consuming. It is easy to identify numerous articles of interest from abstracts, but requires thoughtful time to read, digest, and analyze the quality of the article. In addition, further exploration into the article's own citations or futuristic citations of the article are often required. Dedicated reading and writing time on a weekly basis is vital for a quality product. Furthermore, setting the writing project aside for a few days allows you to gain a new perspective on it and colleagues and mentors can provide additional insight towards improvement. Despite the challenges, completing efficient literature reviews and producing quality publications are necessary skills required to grow into an independent researcher who produces quality peer-reviewed publications.