Rys, Meyer, and Sebranek. ~~Words~~
The Research Writer. Wadsworth, 2011.

17

The Literature Review

Q What is a literature review, who writes them, and for what purposes? How is a literature review similar to or different from other research writing?

A well-written literature review guides readers through the published studies on an academic topic. In such a review, you describe key qualities in each study, but you also synthesize these articles, books, and other documents by doing such things as pointing out similarities and differences between the pieces; noting writers' research strategies, methods, or perspectives; showing connections between the works, including how studies build on each other; and identifying traits (such as gaps) in the overall collection of studies. As a result, you and readers gain a valuable overview of the topic, including scholars' treatment of the topic, the status of these studies, and the questions or issues needing more study.

Topics to Consider Because literature reviews are written in all disciplines (particularly the social sciences, natural sciences, and applied sciences), you have many topics from which to choose. To make your choice, follow these steps:

1. Select a discipline or field of study.
2. To identify topics that scholars are writing about, scan the Web sites, journals, and conference programs of professional organizations within this field. Also use your library's databases (e.g., Lexis-Nexis, EBSCOhost, or ProQuest Direct) to identify abstracts and full-text articles.
3. List three or four topics that interest you and scan a few related studies for each, noting the writers' credentials, research methods, perspectives, and findings.
4. Choose the topic about which you find at least ten current and relevant studies that you can access within your research schedule.

Note: In the social, natural, or applied sciences, studies will address current cultural or scientific issues. However, in the humanities such as history or English, writers also commonly research a person, phenomenon, text, or problem from the past.

What's Ahead?

360

Guidelines for Writing a Literature Review

After choosing a topic, work through the research and writing process described below. For detailed instructions on specific tasks, see chapters 1-11.

1. **Narrow your topic as needed.** Use your library's search engines to narrow your topic. For example, if your assignment requires a ten-page literature review, and you choose the topic autism, a quick search that finds three hundred studies tells you that your topic is far too broad. To narrow the topic, you could focus on one facet of the disorder, such as the link between Asperger's Syndrome (one form of autism) and low levels of cortisol. Alternatively, you could narrow the topic by focusing only on studies produced at select universities (such as England's University of Bath) that are doing leading research on Asperger's Syndrome.
2. **Find and select studies.** To find additional quality studies, use research tools such as your library's online catalogue, print indexes and databases (see list on page 66), and computer searches of other libraries' holdings (see WorldCat, page 60). Choose promising studies and preview their contents by
   - reading the titles, headings, abstracts, openings, and closings, and by scanning the rest.
   - assessing which studies would together show the span of current research on your topic.
   - looking for traits in strategies, perspectives, or findings that will help you distinguish the studies, organize your presentation, and unify the paper.
   - selecting the number of studies needed to address your topic and to fulfill your assignment.

   Finally, copy or print the literature so you can mark passages and take notes.
3. **Discern your focus.** Based on your assignment and writing purpose, decide how to approach your topic. For example, your instructor might assign a review that is
   - **theory-based**—focused on the theoretical underpinning (the *why?*) of each study's hypothesis and procedures.
   - **methodology-based**—focused on the methods (the *how?*) of each study's methods, such as research materials, experiments, and measuring strategies.
   - **function-based**—focused on each study's intended use, such as (a) free-standing informative study, (b) context for a larger study (e.g., doctoral dissertation), or (c) support in a persuasive document (e.g., research or grant proposal).
   - **history-based**—focused on how your bevy of studies represents a unique period or serves a special function in the research history of your topic.
   - **topic-based**—focused on whatever aspects of the studies that best help readers understand the topic. (Note: Instructors usually assign broad topic-based reviews, such as the model literature review on pages 362-367.)

   Knowing the overall focus of your review will guide you when reading the studies, taking notes, drafting a thesis, and organizing your writing. For example, theory-based or history-based reviews are commonly organized chronologically.

4. **Read and analyze the studies.** Read each study carefully, noting its date, research site, and participants, along with the writer's description of the topic, initial hypothesis, research methods and procedures, supporting sources, and ultimate findings. Focus especially on qualities cited in your assignment. Compare and contrast these elements to assess how the studies are related.
5. **Draft a preliminary thesis.** Based on your analysis, write a thesis that asserts your core observation. For example, if you analyzed ten studies on the relationship between Asperger's Syndrome and cortisol levels, and you noted that two early studies using the same research strategy found no relationship, whereas eight subsequent studies using more current and reliable strategies did find a relationship, your thesis might assert that the findings of the later studies are more credible. (Note: A thesis based on synthesis of others' research is a valid argument when supported by relevant data in the research.)
6. **Write your review.** While the precise order of your paper may vary, most literature reviews have these parts:
   - **Opening:** Get the readers' attention and introduce the topic. Cite literature on the topic to describe the context or purpose of your review. State its thesis and explain the organization.
   - **Middle:** Briefly describe each study, especially its experiments, methodology, findings, and impact on current thinking on the topic:
     - Describe distinguishing qualities, but not the step-by-step process.
     - Cite details as needed, and summarize (but not quote) supporting passages. (For help writing summaries, see pages 238-239).
     - Analyze each study's strengths or weaknesses.

     Alternate patterns: You also might
     - describe (but not analyze) the studies,
     - describe studies individually and then analyze them collectively, or
     - group similar types of studies, explain why, and then describe and analyze each type.
   - **Closing:** Conclude by doing the following:
     - Briefly restate your findings, note unanswered questions, and recommend issues needing further research.
     - List the reviewed literature in an appropriately formatted bibliography.
7. **Revise the paper.** Revise your paper as needed for strong *ideas* (thesis, description, and analysis), clear and logical *organization* (clear title, headings, introduction, and closing), and an objective, academic *voice*.
8. **Edit and proofread.** Correct errors in grammar, punctuation, mechanics, and design. In addition, check (and correct as needed) documentation in your list of sources.
9. **Share your review.** In addition to submitting your literature review, find ways to share it with other students interested in the topic, perhaps by posting it on a class Web site.

362

Sample Student Paper: Reviewing the Literature

In the paragraph below, student-writer Dmitriy Kolesnikov describes how he chose to forego the assigned topic for writing a literature review in order to select a topic that "stimulated [his] curiosity." And what topic spurred his interest? He chose to study microRNA's possible link to cancer. As you read Dmitriy's paper, watch how he satisfies that curiosity by analyzing ten studies on the topic, and then synthesizing that literature by showing how each piece led him to conclude that microRNAs are linked to cancer and will likely help clinicians diagnose and treat the illness.

Writer's Reflection

I enrolled in Writing in the Biological Sciences in order to expand my writing abilities, which I already considered formidable prior to taking the class. However, I lacked an understanding of scientific writing methodology, and Dr. Haynes' class helped me immensely. Not only did I write several pieces of scientific writing, but I also learned how to properly read a scientific paper, a skill that had not been conveyed to me in earlier classes. "The Role of MicroRNA in Cancer" was my first successful attempt at synthesizing information found in numerous research articles. The assignment called for students to review a topic that they were familiar with, but instead I chose one that stimulated my curiosity. While the essay is intended primarily for students with college-level competence in biology, its introduction and conclusion may be comprehensible to laypeople. Since communication is crucial in science, as a prospective biologist, I appreciate the skills that I learned in Dr. Haynes' class. —Dmitriy Kolesnikov

Preparing to Read: What do you know about the causes of cancer? How familiar are you with cancer research?

Literature Review

The titles forecast the contents of the paper and the introduction.

The topic sentence identifies MicroRNAs as a class of non-protein-coding RNAs.

The Role of MicroRNA in Cancer

Introduction: MicroRNA function in cells

MicroRNAs (miRNAs) are a class of short (15-25 base long), non-protein-coding RNAs that regulate mRNA expression. They carry out this function through a variety of methods, including translational repression and mRNA cleavage. They possess complementary sequences to their target mRNAs, which allow them to carry out these functions. MiRNAs are similar to small interfering RNA (siRNA), but are less specific, and hence are capable of affecting the translation of large numbers of genes. MiRNAs have been implicated in a wide range of processes in the human body. While genomic analyses have suggested that the human genome codes for as many as 1000 miRNAs, only 300 have been extracted from human tissue and have had their function described. MiRNAs play diverse roles in cell functions, including apoptosis, angiogenesis, and cell proliferation.

Additional traits of this class are identified, particularly miRNA's link to cancer, the focus of the report.

Interestingly, miRNAs tend to inhabit regions of the genome that are prone to damage or mutation. Calin et al. (2004) demonstrated that as many as 52% of the 186 sample miRNAs clustered around cancer-associated genomic regions. These findings have powerful implications for miRNAs' role in cancer.

MicroRNAs as oncogenes

Oncogenes are defined as a type of gene that promotes cancerous growth.

One distinct type of cancer-related gene is the oncogene. Genes that merely have the potential to become involved in cancerous growth are proto-oncogenes, but they become full-fledged oncogenes when they accumulate mutations. Oncogenes actively promote tumor growth and invasion. They tend to be involved in cell proliferation, embryogenesis, and other crucial cell processes. Mutations in oncogenes are usually dominant.

The writer asserts that miRNAs are linked to multiple cancers, and he supports the point by summarizing the findings of seven recent studies.

Multiple miRNAs have been implicated in various cancers, including pancreatic (Bloomston et al., 2007), lung (Takamizawa et al., 2004), pituitary (Bottoni et al., 2005), and breast cancers (Ma, Teruya-Feldstein, and Weinberg, 2007). Due to their regulatory role in posttranscriptional processing, mutated miRNAs can easily lead to over- (or under-) expression of proteins. One of the earliest clusters of oncogenic microRNA, the mir-17-92 polycistron, was described by He et al. in 2005. In 65% of adenocarcinoma and lymphoma patients, pri-mir-17-92, a precursor of mir-17-92, was overexpressed compared to controls. The gene cluster was then transplanted into mice, resulting in 100% of samples displaying leukemia within 51 days. The control sample, on the other hand, showed no signs of malignancy.

Voorhoeve et al. (2006) reported that miR-372 and miR-373 act as oncogenes in testicular germ cell tumors. This particular form of cancer progressed into malignancy despite the presence of wild type p53, an important tumor suppression gene. In their experiments, miR-372/3-transformed cells displayed malignancy that is characteristic of testicular germ cell cancer, indicating that miR-372/3 probably allows the tumor to progress via a different pathway.

Another miRNA—miR-10b—has been implicated in metastasis. Ma, Teruya-Feldstein, and Weinberg (2007) demonstrated that miR-10b increases cell invasiveness *in vivo* as well as *in vitro*. This miRNA was overexpressed in secondary tumors of breast cancer. When inserted into a model organism (mouse), miR-10b interacted with HOXD10, an important gene in development, silencing it, and leading to a vast increase in invasiveness.

These results and others show that mutated miRNAs are capable of inducing a variety of steps necessary for cancer progression and development.

The heading identifies a second class of cancer-related genes.

MicroRNAs as tumor suppressor genes

A second class of cancer-related genes is tumor suppressor genes. They usually regulate cell processes, but when they accumulate mutations and become inactivated, they are no longer capable of restricting uncontrolled cell growth. Mutations in tumor suppressor genes tend to be recessive, since there are two copies of them in each cell and an individual mutated copy is not sufficient for malignant growth to occur. When both copies accumulate mutations, however, active oncogenes within the cell become unrestrained.

The writer defines tumor-suppressor genes.

Calin et al. (2002) hypothesized that miR-15a and miR-16-1 may be involved in tumor suppression, since their genes are found in regions that are frequently deleted in patients with chronic lymphomic leukemia (CLL). Likewise, down-regulation of the two miRNAs was chronicled in 68% of the CLL patients examined. Bottoni et al. (2005) confirmed these findings, observing that miR-15a/16-1 levels were expressed in low levels in pituitary adenomas. They also reported that miR-15a/16-1 levels correlated directly with those of p43, a known tumor-suppressor gene. Thus, they conclude, miR-15a and miR-16-1 probably regulate the expression of p43, which in turn suppresses tumorigenic growth.

He supports his claim by summarizing the findings of three recent studies.

Furthermore, Mayr, Hemann, and Bartel (2007) showed that the miRNA let-7 acts as a tumor suppressor gene with relation to Hmga2, an oncogene. Hmga2 is involved in proliferation during embryogenesis and development, and when it accumulates mutations, it becomes oncogenic. There are several conserved sequences between let-7 and Hmga2, further implying that the miRNA has a regulatory role.

Because they control large numbers of genes, individual miRNAs can have varying effects in different cancers. Calin et al. (2004) reported that a single miRNA, in this case miR-33b, is capable of acting either as an oncogene or a tumor-suppressor gene, depending on the sort of modifications that occur. Deletions can lead to oncogenetic properties, whereas hyper-methylation can induce loss of function, which damages the miRNA's tumor-suppressor role. Although miRNA genes tend to be short (~70 base pairs, from which the final product is cleaved) and thus usually do not accumulate gain-of-function or loss-of-function mutations, the fact that they tend to exist in clusters (Calin et al. 2004) greatly increases the likelihood that a genetic or epigenetic effect will modify miRNAs within a cluster.

The writer summarizes an additional study with similar findings.

A new heading and subheading signal that the writer will address how microRNAs can be used for diagnostic procedures.

Medical and diagnostic applications of microRNA

Diagnosis.

Since miRNAs tend to be over- or underexpressed in most cancers, this information can be utilized to determine which tissue may have become cancerous in the first place. Lu *et al.* (2005) demonstrated that a relatively simple method—attaching fluorescent beads to oligonucleotides

complementary to miRNAs of choice—identifies miRNAs with stunning accuracy. Moreover, they sampled miRNAs from a large number of tumors and normal tissues to find that miRNA levels in tumors were found in hierarchical clusters, indicating not only whether a tissue was cancerous with near perfect accuracy, but also where the tumor itself originated. They further utilized this approach to diagnose seventeen unclassified cancers and found that miRNA analysis is considerably more reliable as a diagnostic tool than mRNA, presumably because there is a great deal of "noise" among the mRNA.

He describes two studies in which microRNAs were successfully used to diagnose cancer.

The work of Bloomston et al. (2007) supports this application of miRNA. They sampled over 100 patients with pancreatic ductal adenocarcinoma and chronic pancreatitis, and used microarrays to detect miRNA expression level. They report that a group of miRNAs (some overexpressed and some underexpressed) could effectively differentiate between normal pancreatic cells and pancreatic tumor cells with a 90% success rate. A similar test, using a different set of miRNAs, successfully differentiated pancreatic cancer from chronic pancreatitis with a 93% accuracy rate. The ability to trace a cancer's progression throughout the body is imperative for proper diagnosis.

Prognosis.

The subheading signals that the writer will address microRNAs use for prognosis.

While diagnosis is an important clinical tool, a parameter that can also predict survival rates is far more valuable. Bloomston et al. (2007) proposed that miRNA expression values could be used to predict the likelihood of survival over long and short terms for patients with pancreatic ductal adenocarcinoma. While diagnostic tools are currently absent for that particular disease, Takamizawa et al. (2004) reported the use of miRNAs to predict postoperative survival rates of lung cancer patients. Expression analyses of let-7 miRNA were used to group lung cancer operation patients into two groups. Patients with underexpressed let-7 had a far less promising prognosis than those with overexpressed let-7.

The writer summarizes two studies that found microRNAs were helpful prognostic tools.

The fact that let-7 is one of the better-studied human miRNAs (particularly in lung cancer) is what allowed this prognostic application to be viable. However, much more work needs to be done with regard to other miRNAs and other human cancers. The work of Bloomston et al. (2007) on pancreatic cancer, for example, will likely inspire a number of further studies on prognosis via miRNA. However, multi-variate analyses of large clusters of miRNA will be necessary in order to have the desired prognostic effect for more complicated cancers.

366

Conclusions

The writer concludes by redefining microRNAs, reasserting their link to cancer, and projecting their future use for understanding and treating the disease.

MicroRNAs are a relatively new category of short regulatory RNAs that are found in chromosomal regions vulnerable to damage or rearrangement. Their role in cancers has recently been demonstrated to be very significant: over 50% of the miRNAs examined by Calin et al. (2004) were found to be in cancer-related genomic regions. Due to improved detection techniques, miRNA profiles have become an important tool in diagnosing the origin and type of certain cancers. Moreover, their expression profiles can predict survivorship over the course of years. Thus, miRNAs are likely to play an important role in the understanding and treatment of cancer in the near future.

The writer uses APA formatting to list the literature that he reviewed, though CSE would have been equally appropriate.

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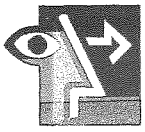
Reading Research Writing: Questions

To understand literature-review writing more fully, answer these questions:

1. Review Dmitriy's reflection on page 362 in which he says, "I also learned how to properly read a scientific paper, a skill that had not been conveyed to me in earlier classes." Given the literature that he reviewed in his report, what challenges might he have faced when reading the material? What tools or strategies might have helped him overcome these challenges?
2. To help readers understand the content of the literature and his synthesis of that content, Dmitriy uses five main headings and two subheadings. Review those headings and subheadings, and then explore whether they (a) help you understand the literature that he read and (b) serve as a unifying theme linking the pieces together.
3. Review three passages in which Dmitriy summarizes a source. Do these summaries effectively help you understand (a) the content of that piece of literature and (b) how the piece illustrates the idea in the heading that precedes it?
4. Review the introduction and conclusion. How do these frame Dmitriy's review of the studies?



FOCUS on Your Major: While literature reviews are commonly written in the social and natural sciences, a type of literature review is often practiced in humanities writing, as well. In longer papers and theses, writers might survey key secondary sources on their topics in order to put their own studies in context.

368

Practicing Your Research

1. **Respond to the model.** Read three articles that Dmitriy Kolesnikov summarizes in his literature review. Then write him an open letter in which you explain why you did or did not find that his summaries (a) accurately represented the original text and (b) warranted inclusion in his review. Share your letter with the class.
2. **Take a cross-disciplined approach.** Choose a topic that scholars in multiple disciplines research and write about: e.g., government-mandated inoculations, geothermal technologies, or a wildlife issue such as repopulating select national parks with wolves. Choose three research articles on the topic, each from a different discipline. Then write a literature review in which you compare and contrast the three studies.
3. **Make it multimedia.** Choose a topic in your discipline about which individuals write articles that include visual enhancements such as tables, graphs, charts, photographs, Web sites, or digital animations. Choose three of these articles and develop a PowerPoint literature review in which you show and explain how effectively the visuals in each article support the document's message.
4. **Take it to the street.** Choose a public policy about which people in your community are writing. Select three documents (e.g., articles, position statements) and analyze the quality of their research, arguments, and supporting data. Then write a literature review in which you aim to help the public understand the strengths and weaknesses of these documents. Finally, submit your review to your college or community newspaper, or publish it on an appropriate Web site.

Checklist: Use these seven traits to check the quality of your writing:

- ☑ **Ideas** Each summary accurately reports the content of its respective article, and the overall review logically synthesizes all articles.
- ☑ **Organization** The opening clearly introduces the topic; the body reviews the literature in a logical, coherent pattern; and the closing effectively wraps up the review.
- ☑ **Voice** The tone is energetic, but respectful of the literature and sensitive to the readers' background and needs.
- ☑ **Words** The word choice accurately communicates the literature's content and is understandable by the intended audience: e.g., where needed, technical terms are defined.
- ☑ **Sentences** Constructions are smooth, varied, and clear; transitions effectively link sentences and paragraphs.
- ☑ **Correctness** The writing includes no glaring errors in mechanics, usage, and grammar.
- ☑ **Design** The paper is correctly formatted in the assigned style, and all graphics are correctly and clearly displayed to support the document's message.