# Handbook of Biomedical Research Writing

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**Note on Copyright and Collaboration**

Foreward

이 책을 읽는 분들께

아마 이 책을 읽는 사람들 가운데 많은 수가 외국 잡지에 영어로 작성된 원고를 투고해 본적이 있을 것이다. 연구결과도 잘 정리되지 않고 말도 잘 안되어 어렵게 글을 써서 출판사에 투고했지만 논문 투고가 너무 많아 게재 공간이 부족하여 게재가 어렵다는 정중한 편지를 받기도 하고, 아예 내용이 부실하고 영어나 다른 부분에 문제가 있어 게재가 어렵다는 거절 편지를 받은 분들도 있을 것이다. 논문을 투고해서 여러 번 거절 당해 본 경험이 있는 사람은 스스로 포기하여 영어로 해외잡지에 투고하는 것을 중단하기도 하고, 일부는 심한 비평을 가하는 경우도 더러 본다. 우리 글로 논문을 쓰는 것도 중요하지만 의학지식은 궁극적으로 다수가 공유해야 하고 세상이 다양한 수단으로 연결되는 것과 같이 이제는 인터넷이란 도구를 통해 지식을 공유하고, 이를 통해 거대한 지식망이 형성되었기 때문에 본인의 생각이나 발견을 남들에게 더 많이 알리고 정보를 전파, 공유하기 위해서는 영어로 원고를 작성하는 것이 유리할 수 밖에 없다. 처음부터 명망이 있는 잡지에 논문이 수록되는 경우도 있지만 대부분의 저자나 투고자는 인용빈도가 낮은 잡지에 투고하거나 증례 등을 투고하면서 다양한 경험을 쌓은 후 소위 말하는 좋은 잡지에 투고해 어렵게 심사와 교정을 거쳐 게재허가 받는 것이 대부분이다. 잡지마다 각각 추구하는 영역이나 주제가 다르기 때문에 자신의 원고를 게재하기 위해서는 내용이 어떤 잡지에 적절한 지 찾아야 하고 그 잡지에서 요구하는 형식이나 요령에 맞게 투고해야 한다.

의학논문에서 중요한 것은 과연 자신이 투고하고자 하는 원고 내용이 원저로서 가치가 있는가 하는 것이다. 물론 전제로 연구 방법이 윤리적이어야 하는 것은 부연하지 않겠다. 새로운 과학적 사실이나 관찰 내용을 발견하거나 이미 잘 알려진 사실에 반대하는 논리적인 근거가 있거나 기존 논문에서 다루지 않은 변수들을 조명한다면 논문으로서 가치가 있을 것이다. 많이 발표된 증례도 이전에 기술되지 않았던 새로운 관점에서 기술한다면 증례로서 충분한 가치가 있을 것이다. 그러나 단지 연구 대상이 많다는 이유나 지역적 특성만을 강조한다면 처음 한 두 번은 게재가 가능할 지 모르나 논문으로서 큰 의미를 가질 수는 없다. 잡지 방침에 따라서는 새로운 과학적 발견이 아니더라도 게재되는 경우도 있는데 이는 저자 자신이 설정한 가설이 논리적이고 연구 배경이 관심을 끌 수 있으며 연구 방법에서 객관성이 합리적인 방법으로 규명된 경우이다. 또는 긍정적인 연구 결과 없이도 게재되는 경우는 위 조건을 만족시키면서 고찰 등에서 이런 결과가 나올 수 밖에 없는 상황을 잘 분석하여 중요점을 강조하면 충분하다. 대부분 잡지가 상호심사를 원칙으로 하기 때문에 편협한 심사위원이 아니라면 영어가 익숙하지 않더라도 과학적 진실을 밝히려는 합리적인 내용 전개가 있다면 심사자 역시 좋은 지적을 하고 개선 방향을 제시하며 게재를 유도할 것이다. 즉 논문에서 중요한 것은 고유한 결과를 가지는 원저로서의 중요성과 저자가 처음 제시한 가설을 무리 없이 합리적으로 풀어나가는 기술일 것이다.

저자가 연구 내용을 잘 정리하고 결과를 정리하였으면 초록을 먼저 작성해 자신의 연구 내용을 어떻

게 요약할 수 있는지 생각해 본다. 초록은 본문과 독립적, 즉 본문을 읽지 않더라도 초록만 보고서도 본문의 내용을 짐작할 수 있어야 한다. 많은 심사자가 초록을 먼저보고 심사여부를 결정하고 일부에서 초록만 보고 인용하기 때문에 좋은 초록을 쓰는 것은 논문을 반 이상 작성한 것이나 마찬가지다. 다음에는 초록 내용을 토대로 투고하고자 하는 잡지의 형식에 맞게 원고에 살을 첨가하며 기술한다. 좋은 논문을 쓰기 위해서는 좋은 외국 잡지에서 사용하는 논문의 구조와 방식, 흔히 사용하는 서술 요령을 알아 두는 것이 중요하다. 좋은 논문을 쓰고자 하는 사람은 우선 많은 논문을 읽으면서 호기심을 가지고 논문을 비판적으로 읽고 판단하는 훈련을 하는 것이 중요하다. 자기가 목표로 하는 잡지에 어떤 내용이 주로 실리는 지, 어떤 사람들을 대상으로 하는지 알면 도움이 될 것이다.

이 책은 해외잡지에 투고하면서 사전에 영어교정을 해 온 경험이 많은 원어민 교정자가 관찰한 다양한 경험을 바탕으로 영어가(addition) 모국어가 아닌 임상가, 연구자가 영어로 논문을 작성하는데 도움을 주고자 만들어진 것이다. 이 책에는 과학 논문을 쓰는데 필요한 기초 문법과 문장의 구조, 한국사람들이 흔히 사용하는 문장 전개의 오류나 꼭 알아야 하는 문장, 그리고 이를 해결하는 방법을 제시해 준다. 막연히 외국어로 논문을 쓰면서 생기는 불안감이 아마 이 책을 사전에 보면서 참고하면 많은 도움이 될 것이다. 끝으로 이 책으로 우리나라 연구자들이 더 쉽게 영어 원고를 작성할 수 있었으면 한다.

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# 1.0 Introduction to Biomedical Research Writing

This handbook is designed for biomedical scientists and healthcare professionals who need to publish their research in English. It surveys the structure of each section of clinical and basic biomedical science journal articles and texts for correspondence with journal editors.

## 1.1 Types of Biomedical Texts

The following tables list the most common biomedical research texts. They indicate where to get more information about writing each type of text in this book or other sources.

### 1.1.1 Published Texts

Published texts include all kinds of material found in journals and at conferences.

| | |
|---|---|
| **Full-length journal articles** | Research articles with the traditional IMRD structure are covered in chapters 2-5. |
| **Shorter research reports** | Shorter articles follow the same structure as full-length ones. They have different names in different journals: "letters," "reports," "brief communications," etc. There is no rule for the length of full-length vs. shorter papers. The short papers in one journal may be equal in length to the longer papers in another journal. |
| **Review** | A review does not report on new research. Instead, it surveys a group of articles on one topic and provides a summary and analysis of the topic. |
| **Case reports** | A case report tells the story of a rare clinical diagnosis or treatment. See chapter 7. |
| **Case reviews** | Case reviews survey a large number of clinical cases. |
| **Critiques of other articles** | When authors make an error in published journal texts, another author can provide a short critique in the following issue of the journal. These are often called "letters to the editor." |
| **Other journal content** | Journals and professional newsletters accept all kinds of other short articles: opinions, news reports, policy recommendations, even photos and video. |
| **Posters** | Posters have become another version of the shorter research report or conference proceedings. See chapters 2-5 for general information about writing up your research. |
| **Presentation Slides** | Creating well-designed and well-written slides with PowerPoint or other software is challenging. See this website for some good tips: http://writing.engr.psu.edu/slides.html . |
| **Theses and dissertations** | When students must write a research paper to graduate with a Master's or doctoral degree, the requirements are usually similar to writing one or more journal articles. One major difference is that students are expected to provide more background information, such as definitions of key terms, and survey the literature more thoroughly in order to prove knowledge of the field. However, most of the content of chapters 2-5 should be |

| | |
|---|---|
| | applicable to dissertation writing. In addition, there are many books on the market that cover theses and dissertations in more detail. |

### 1.1.2 "Hidden" Texts

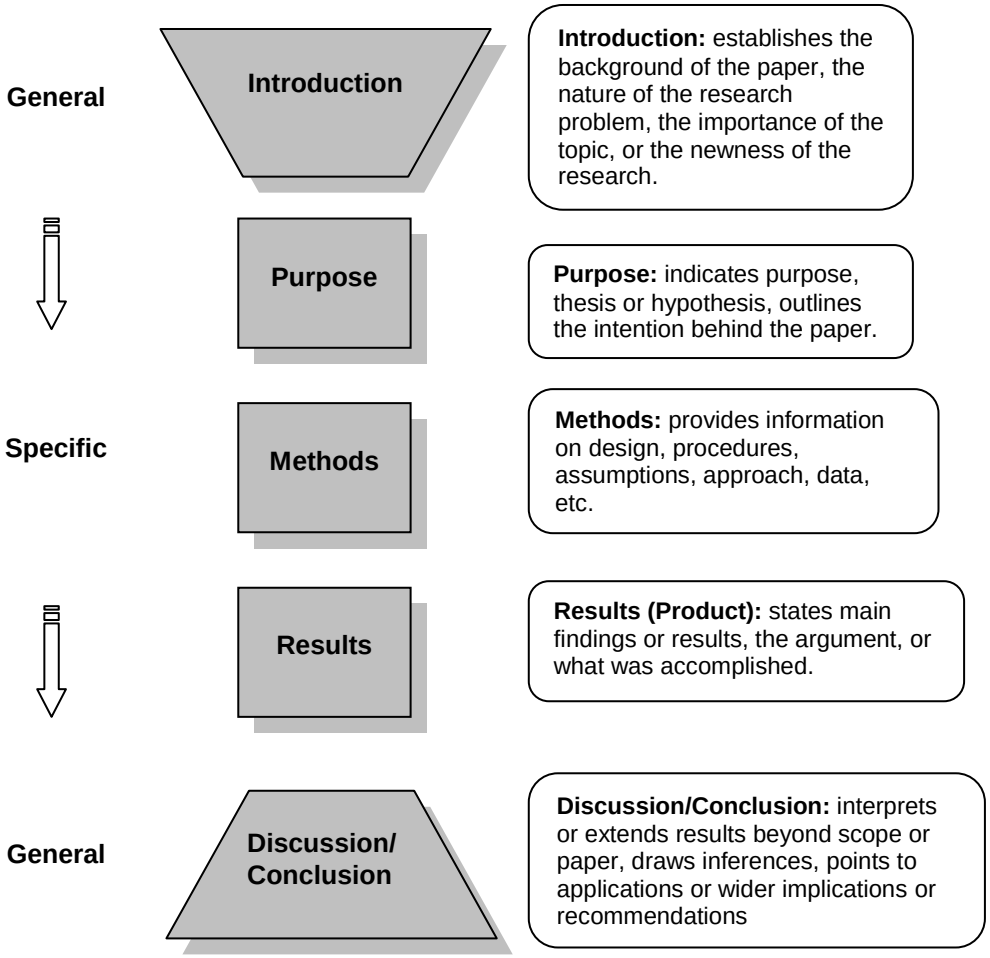
These texts are "hidden" because they are not published and it is sometimes difficult to find good examples.

| | |
|---|---|
| **Submission letters** | When sending a text to a journal for publication, this letter or email provides basic information to the journal editors. See chapter 8. |
| **Reviewer comments** | Senior scholars write comments when they review articles for journal publication. |
| **Response to reviewers** | The article other must then respond to the reviewer's comments. See chapter 8. |
| **Conference proposals** | In the sciences, conference proposals (written before acceptance) and conference abstracts (often written after acceptance) have much in common with journal article abstracts and short journal articles. For more details, refer to chapter 5 on abstracts. |
| **Application letters and resumes/CVs** | Writing cover letters and CVs for job and school applications is a common challenge. However, they are not covered in this book because there are a number of excellent online sources of advice and examples. See the *Chronicle of Higher Education CV* Doctor articles, for example: http://chronicle.com/jobs/tools/cvdoctor/2007/ |
| **Other professional correspondence** | Every scientist or healthcare professional must write other kinds of formal email, such as recommendations and requests for recommendation. There are also lab equipment and supply ordering, requests to other scholars to share data or specimens, grant applications, and correspondence with government agencies. Follow the general letter and email writing guidelines in chapter 8. |

## 1.2 The Parts of a Journal Article

A traditional journal article in the sciences consists of four parts: Introduction, Methods, Results, and Discussion/Conclusion (IMRD). One way to approach these sections is to consider the purpose of each. Here are the questions you should try to answer in the abstract and again in more detail in the rest of the article:

- Why do we care about the problem and the results?
- What problem are you trying to solve?
- How did you go about solving or making progress on the problem?
- What's the answer?
- What are the implications of your answer?



# 2.0 The Methods Section

Most science writers start with the methods section, sometimes called “materials and methods.” For most people, the methods section is also the easiest to write. Therefore, this book will present the methods section first. However, keep in mind that experimental or clinical procedures are not only presented in the methods section. The most important aspect of the methods may be mentioned briefly in the abstract and the introduction. In addition, key procedures often introduce paragraphs in the results section, i.e. by doing X procedure, we found Y result. Therefore, the contents of this chapter apply to descriptions of methods or procedures anywhere in a research report.

## 2.1 Structure of the Methods Section

The methods section has a simple pattern of organization. It tells the story of your research from beginning to end. Nevertheless, the methods section of clinical research reports requires a specific set of content, as detailed by the Information for Authors of the *Annals of Internal Medicine*:

> For studies involving humans, describe in the Methods section how participants were assembled and selected, and the sites or setting from which they were recruited. Then describe study procedures including any interventions, measurements and data collection techniques. Use figures to diagram study processes including the flow of participants through the study. Provide the number of patients at each stage of recruitment and follow-up, including the number who declined to participate and the number who completed follow-up. State, if true, that an institutional review board approved the study or affirm that the protocol is consistent with the principles of the Declaration of Helsinki (World Medical Association), and state whether participants gave their informed consent. For studies that have numerical data and use statistical inference, include a section under Methods that describes the methods used for the statistical analysis and that states the specific statistical software. For all studies, include a statement at the end of the Methods section describing the role of the funding source for the study. If the study had no external funding source or if the funding source had no role in the study, state so explicitly.
>
> Annals of Internal Medicine. Information for Authors. http://www.annals.org/shared/author_info.html#manuscript-text . Retrieved 3 February 2008.

For basic science, the contents of the methods section may be quite different. The Information for Authors of the journal *Cell* focuses more on the reader’s ability to understand the author’s experimental procedures well enough to replicate them. This does not mean that all the details must be included in your own article. Common procedures should just be mentioned briefly with a citation to another article that describes them in detail.

> The Experimental Procedures section needs to include sufficient detail so that readers can understand how the experiments were done, and so that all procedures can be repeated, in conjunction with cited references. This section should also include a description of any statistical methods employed in the study. A more detailed version of the procedures and details such as oligo sequences, strains, and specifics of how constructs were made can be included in Supplemental Data, but it is not appropriate to move the majority of the Experimental Procedures to Supplemental Data in order to shorten the text.
>
> Cell Information for Authors. http://www.cell.com/misc/page?page=authors#SubmissionRA . Retrieved on 3 February 2008.

## 2.2 Expressions of Time

As you organize the story of your research project, some expressions of time will be necessary. Most writers use expressions of time (e.g., before, while, simultaneously) correctly until they focus on them. Then, they have a tendency to overuse them.

The most common expressions of time are adverbs: “also,” “then,” and “next.” Although it’s possible to use them at the beginning of a sentence, the more common location in research writing is next to the verb. Here are some examples.

**Examples:**

OK: **Then/Next** we combined the two mixtures.
Better: We **then/next** combined the two mixtures.

OK: **Also**, blood clots were found in the legs.
Better: The blood clots were **also** found in the legs.

Tip
When using adverbs of time, such as “also,” “then,” and “next,” in the middle of a sentence, the correct location depends on the verb. With forms of BE (am, is, are, was, were), the adverb follows the verb. With all other verbs, the adverb comes before the verb.

Using anesthesia **is also** recommended.
We **also recommend** using anesthesia.

In the first example below, expressions are usually placed at the beginning of sentences. Several short sentences have no connection to the sentences around them. Although there are no grammar errors, the style is not ideal.

**OK Example:**
Cells "burn" glucose at low temperatures. **First,** glucose is oxidized to pyruvate in 10 steps. It releases small amounts of energy **at each step**. **Next,** pyruvate is oxidized in most eukaryotic cells to $CO_2$ and water. This
takes 9 steps. **Then** the electron transport system traps energy in ATP bonds. **At that time,** the products of the biological oxidation reaction ($CO_2$ and water) are the same as those obtained by high temperature burning, but much of the energy is trapped in ATP bonds.

In the following revision, short sentences have been connected to the sentences around them to show their logical relationship. For example, the first three sentences have been combined using “when” and changing the verb “releases” to “releasing.” Although one adverb (“Next”) is left at the beginning of a sentence for variety, the others (“first” and “then”) have been moved next to the verbs, which sounds more advanced. Finally, the last expression, “at that time,” has been replaced with a non-time expression. The last sentence is not actually related by time. Instead, it is explaining more about the nature of the process.

**Better Example:**

**When** cells "burn" glucose at low temperatures, the glucose is **first** oxidized to pyruvate in 10 steps**, releasing** small amounts of energy at each step. **Next,** pyruvate is oxidized in most eukaryotic cells to $CO_2$ and water**, which** takes 9 **more** steps. The electron transport system **then** traps energy in ATP bonds. **In this process,** the products of the biological oxidation reaction ($CO_2$ and water) are the same as those obtained by high temperature burning, but much of the energy is trapped in ATP bonds.

Both texts modified from: Orme F. Biology 1A. An Electronic Tutorial. Merritt College, Oakland. http://members.aol.com/BearFlag45/Biology1A/LectureNotes/lec09.html . Retrieved September 2007.

# 2.3 Active and Passive Voice Verbs

The most basic purpose of the methods section, and method descriptions elsewhere in the text, is to describe your actions. Therefore, we can expect that verbs will be important in the methods section. In English, there are two basic ways to describe actions—by using active and passive verbs. When the person doing the action is not as important as the action itself, you can communicate this with a passive verb. The following section will explore active and passive verbs in detail.

### 2.3.1 The form of the active and passive voice

We normally use the active voice. The active voice puts the person or thing doing the action in the subject position. In this example, the nurse is the actor.

**Example:**
The **nurse** administered the medication.

The passive voice changes the word order. The object ("medication") becomes the subject.

**Examples:**
The **medication** was administered by the nurse.
OR
The **medication** was administered.

Mentioning the actor ("nurse") becomes optional. This is often useful in research writing.

## Passive Verb Grammar

The form of the passive voice verb is: BE + past participle (or "PP")

"BE" refers to the past, present or future form of "to be": was, were, am, is, are, will be.

The past participle is usually Verb + "ed," but there are many irregular forms.

For a list of irregular past participles, see: http://www2.gsu.edu/~wwwesl/egw/verbs.htm .

### 2.3.2 Typically Passive Verbs

Some verbs are usually passive. Here are some examples:

## To be born

We use "I was born in . . ." so often in normal conversation that most people do not realize the verb is passive. In fact, although it's possible to say "The mother bore the baby," it's not very common. This is a classic example of the main reason for using a passive—to omit the actor (the person or thing doing the action). Everyone knows that your mother bore you, so you do not need to mention it.

On the other hand, sometimes in biomedical writing, it is necessary to discuss the mother. The following example is the title of a clinical case report about a baby with certain health problems.

**Example:**
Concurrent multiple morphea and neonatal lupus erythematosus in an infant boy **born to** a mother with SLE

Ohtaki N, Miyamoto C, Orita M, Koya M, Matsuo M. Concurrent multiple morphea and neonatal lupus erythematosus in an infant boy
born to a mother with SLE. Br J Dermatol. 1986 Jul;115(1):85-90.

**Tip:**

In research writing, you may find the expression “boy born **to** a mother.” This is different than most other passive verbs, which use “by.” In the example above, the word “to” replaces “by.” “Boy born” is a shortened form of the passive expression “boy that was born.”

## To be hospitalized

The words “hospitalized” and “admitted” are passive, except when the emphasis is on the patient voluntarily entering the hospital.

Examples:
Passive: The patient **was hospitalized** for complications following outpatient surgery.
Active: The **patient admitted himself** to a drug treatment program.

Note: “Committed” has the opposite meaning. The patient has no choice.

Example:
The patient **was committed** to a psychiatric facility.

“Discharged” is typically passive as well.

Example:
The patient **was discharged** from the hospital when treatment was complete.

## To be deemed

The word “deemed” means “officially decided to be . . .”

Example:
The infant **was deemed** to be ready for solid food.

## To be staffed

Although “staff” is usually a noun, referring to people, “to staff” can be a verb.

Example:
The hospital **was staffed** by emergency personnel during the storm.

## To be said

Of course, “say” is also common as an active verb (e.g., “she said something”), but it has a unique meaning in the passive. It means “most people say” and can replace a less formal expression from conversation: “they say.” Depending on the context, it may refer to “the public” or “scholars in our field.”

Example:
It **is said** that acupuncture is more effective than medication for pain relief.

### 2.3.3 Verbs That Are Never Passive

You’ve probably studied these rules before. However, when you are writing most of your paper in the passive voice, it is easy to accidentally make one of these errors. Use the active voice in all of these situations.

## Containing Verbs
(hold, comprise, lack, etc.)

**Example:**
Active: O The flask **contains** a hazardous chemical.

Passive: X A hazardous chemical **is contained** by the flask.

The verb "consists of" seems to cause a lot of trouble for English learners. It is never passive.
**Example:**
Active: O The human heart **consists of** four chambers.

Passive: X The human heart **is consisted of** four chambers.

## Reflexive Action

**Example:**
Active: O The diabetes patient **administered** her own medication.

Passive: X Her own medication **was administered** by the diabetes patient.

## Reciprocal Action

**Example:**
Active: O Family members **supported** each other through the grieving period.

Passive: X Each other **were supported** through the grieving period.

## Intransitive Verbs
(fall, live, die, become, etc.)

This is the most common error in this category. Verbs without an object are called intransitive. They cannot be passive because there is nothing to use for the subject.

Example:
Active: O The temperature **fell**.

Passive: X The temperature **was fallen**.

**Tip:**
If you are trying to decide whether a verb can be changed to the passive, ask yourself this question: Is an object after the verb possible?

Example: ??? "The mouse ran." OR "The mouse was run." ???
Think: "The mouse ran *something*. No, that's not possible. It doesn't make sense to 'run something.' Therefore, the verb 'run' has no object, and it cannot become passive."
Write: "The mouse ran."
(Actually, "run" does exist with an object in English, but it has another meaning—to run a machine, for example.)

### 2.3.4 Verbs That May Be Active or Passive

Basically, the passive voice allows you to focus on the action or object of action. It also allows you to avoid mentioning the person or thing doing the action ( the "actor"), or at least take the emphasis off the actor. In descriptions of procedure, or methods, in particular, the action or object of the action is more important than the actor. Anyone in the lab can run an assay. Hopefully, all of them will get the same results. Therefore, not mentioning the lab worker makes the procedure appear more objective and puts the focus on the procedure.

**Examples:**
X Doxazosin **was titrated** at two-week intervals **by the lab assistant.**
O Doxazosin **was titrated** at two-week intervals.

On the other hand, if you need to mention the actor, you can use “by +actor.” In the following clinical study, the action is the main focus, but the qualifications of the clinicians are important, so they are mentioned in a “by-“ phrase.

**Example:**
Ultrasound-guided biopsies **were obtained by a radiology resident** (HD) working under the direct supervision of a board-certified radiologist (LN). . .

. . . All specimens **were examined by a board-certified pathologist** (EWH). . .

However, additional actions by the board-certified pathologist are listed in passive sentences.

**Example:**
. . . Glomeruli in each section **were counted**. A quality score **was** then **assigned** on the basis of whether the specimen was fragmented, appeared crushed, or was < 6 mm long. The presence of muscle throughout the specimen or constituting a part of the specimen **was noted**.

Diagnostic quality of percutaneous kidney biopsy specimens obtained with laparoscopy versus ultrasound guidance in dogs. Rawlings CA, Diamond H, Howerth EW, Neuwirth L, Canalis C. J Am Vet Med Assoc. 2003 Aug 1;223(3):317-21.

Tip
Sometimes it is not easy to choose between active and passive. If the researcher did the work, use a passive verb. If the object of research (patient, molecule, etc.) did something to itself, use an active verb.

In the example below, “was increased” is used to describe an experimental variable that the researcher controls i.e. deliberately changes. In this example, the researchers changed the sample size.

**Example:**
To protect against an underpowered comparison owing to either loss to follow-up or overestimation of the efficacy of high-intensity therapy, the originally planned sample size **was increased to** a total of 90 patients.

Crowther MA, Ginsberg JS, Julian J, Denburg J, Hirsh J, Douketis J, et al. A comparison of two intensities of warfarin for the prevention of recurrent thrombosis in patients with the antiphospholipid antibody syndrome. N Engl J Med. 2003 Sep 18;349(12):1133-8.

However, when simply indicating results the active form is used. This describes an outcome that the researcher did not deliberately manipulate.

**Example:**
Among men whose consumption **remained stable or increased**, a 12.5-g increase in daily alcohol consumption (as a linear variable) was associated with a relative risk of myocardial infarction of 0.78 (95 percent confidence interval, 0.62 to 0.99).

Mukamal KJ, Conigrave KM, Mittleman MA, Camargo CA Jr, Stampfer MJ, Willett WC, et al. Roles of Drinking Pattern and Type of Alcohol Consumed in Coronary Heart Disease in Men. N Engl J Med. 2003 Jan 9;348(2):109-18.

Thus “increased” and “was increased” can have totally different meanings depending on the sentence.

**Choose the correct form for each sentence below. Answers follow.**
1. Patients were randomly assigned to receive eplerenone (25 mg per day) or matching placebo for four weeks, after which the dose of eplerenone **increased/was increased** to a maximum of 50 mg per day.

2. After week 1, the mean systolic and diastolic blood pressure **increased/was increased** in both groups from base line to each time point throughout the remainder of the trial.

Pitt B, Remme W, Zannad F, Neaton J, Martinez F, Roniker B, et al. Eplerenone, a Selective Aldosterone Blocker, in Patients with Left Ventricular Dysfunction after Myocardial Infarction. N Engl J Med. 2003 Apr 3;348(14):1309-21.

**Answers**

1. The dose of eplerenone was increased. The researcher did it.
2. The blood pressure increased. It happened naturally.

Note: Objects of research (patients, molecules, etc.) may also appear in a "by-" phrase, if they act on another object. In the journal article title below, the acetylocholine work to relax the muscle.

**Example:**

The obligatory role of endothelial cells in the relaxation of arterial smooth muscle **by acetylcholine**

Furchgott RF, Zawadzki JV. The obligatory role of endothelial cells in the relaxation of arterial smooth muscle by acetylcholine. Nature. 1980 Nov 27;288(5789):373-6.

### 2.3.5 Using "We"

In a few biomedical fields, everyone uses "we" and in some other fields, no one does. However, in most fields, you or the journal editor may choose. Before you submit your article to the editor, skim the methods sections of several articles from a recent issue of the journal. Look for the use of active and passive verbs and follow the custom of the journal. If both are used, you may mix them.

Using the passive voice is more traditional, and some editors believe that using "we" is too informal. However, using the active voice (e.g. "we found that . . .") is easier to read. It also draws attention to the authors. In the most competitive fields, authors are trying to find new ways to promote themselves, so many have started to use "we" more frequently.

Tip

When writing formally without co-authors, use "we" instead of "I." In English, we sometimes call this "the royal 'we'" because kings and queens once used it, or "the editorial 'we'" because it is common in newspaper editorial opinions. You can also use it in conference presentations and for presenting yourself as a consultant in business.

### 2.3.6 Choosing Active or Passive in Other Situations

In the cases presented below, there are some guidelines, but there are no strict rules, so if the journal editor doesn't have a preference, you can make your own decision about writing style. You may also wish to observe how other authors in your field handle these cases.

## Innovation

According to Swales and Feak, "There is a tendency for passive sentences to indicate routine procedures while active sentences indicate new, deliberately chosen, important, or unexpected procedures."

Swales JM and Feak CB, 1994 p. 161

Turner recommends: "Use active sentences using "we" or "our" if you want to emphasize YOUR decisions, YOUR method, or YOUR innovation. For standard procedures, generally use the passive structure."

Turner A. *English Solutions for Engineering Research Writing*. 2006. p. 166.

In the following example, excluding subjects over 60 is presented as an important decision based on the results of a previous study.

**Example:**

Nyengaard and Bendtsen [14] observed that the number of glomeruli decreases with age owing to the accelerated loss of glomeruli after the age of 60 years. Consequently, **we excluded** all subjects who were 60 or older.

Keller G, Zimmer G, Mall G, Ritz E, Amann K. Nephron Number in Patients with Primary Hypertension N Engl J Med 2003;348:101-8.

## Emphasis

Also use active sentences any other time you want to emphasize a point. Here's an example from the same article that even uses the word "emphasize."

**Example:**

Irrespective of the ongoing discussion concerning the optimal method of counting glomeruli, **we would emphasize** that in the present controlled study, the difference between the patients with hypertension and the control subjects was so large and consistent that it is highly unlikely that the result was due to a methodologic artifact.

## Broad Statement

When a journal allows the use of "we," it is also more common to describe the general method with the active voice at the beginning of the paragraph, and then use the passive voice for a more detailed description of the method in the rest of the paragraph.

**Example:**

To estimate the number of glomeruli and the average glomerular volume per kidney, **we determined** the number of points on the grid that touched the cortical area, including the glomerular area; the number of points on the grid that touched the glomerular area; and the number of glomeruli found in the reference section. Cortical areas with obvious technical artifacts **were excluded**. The sampling volume **was calculated** by multiplying total tissue area (the number of points on the grid that touched the cortical area x the grid area) by the thickness of the section (e.g., 3 µm x 8 sections = 24 µm). A correction for tissue shrinkage (x1.04) **was made**, and the resulting volume, multiplied by the specific weight of the fixed kidney, yielded the mass of the portion of the cortex being examined ($m_{exam\ cor}$). The weight of the kidney under examination **was divided** by the weight of the total kidney cortex, yielding a ratio ($m_{exam\ cor}$ :$m_{total\ cor}$). The number of glomeruli **was** then **determined** with the following equation: number = $1 \div (m_{exam\ cor} : m_{total\ cor}) \times \sum Q-$, where Q- is the number of glomeruli found in the reference section but not in the comparison section.

Keller G, Zimmer G, Mall G, Ritz E, Amann K. Nephron Number in Patients with Primary Hypertension N Engl J Med 2003;348:101-8.

### 2.3.7 Using a Noun or Adjective instead of the Passive Verb

Many verbs can be changed to nouns or adjectives:
need → necessary
inform → information
fail → failure
propose → proposal

Occasionally, a noun or adjective may communicate a point more clearly than a passive verb. In both examples below, the actor is not mentioned.

**Example:**
The passive is needed.
⇩
The passive is necessary.

In the following example, two other options would be "We excluded/included" and "X, Y, and Z were excluded/included." The active voice is not necessary, as this is not an innovative or particularly

interesting part of the procedure. The passive would be difficult to read because of the long list. Therefore, using “inclusion” and “exclusion” is the best option.

**Example:**
**Inclusion criteria** comprised death before the age of 60 years; concentric left ventricular hypertrophy, a medical history of primary hypertension, or both; and the characteristic arteriolar lesions of the kidney found in patients with hypertension. **Exclusion criteria** were evidence of secondary hypertension, diabetes, a history of alcohol or drug abuse, or evidence of renal disease on histologic examination of the kidney.

Keller G, Zimmer G, Mall G, Ritz E, Amann K. Nephron Number in Patients with Primary Hypertension. N Engl J Med. 2003 Jan 9;348(2):101-8.

# 2.4 Purpose and Manner Expressions

In addition to simply describing your actions, the methods section includes justifications, or reasons why you carried out certain procedures. When the procedure is routine, explaining your goal may not be needed, but when the procedure is new, complex, or controversial, you should include a purpose statement to answer the question “Why?”

### 2.4.1 Purpose

A purpose statement explains the goal of an action.

In the examples, below . . .
A = action
B = goal

These three expressions follow the same pattern:

[Clause A] to [verb B].
[Clause A] in order to [verb B].
[Clause A] so as to [verb B].

**Example:**
The mixture is heated **so as to** separate the strands of DNA.

The order can also be switched:

To/In order to [verb B], [clause A].

**Example:**
**In order to** separate the strands of DNA, the mixture is heated.

Tip
“So as to” is rarely used at the beginning of a sentence and is less common in research reports. On the other hand, “to” and “in order to” are very common in the methods section of research reports and usually appear at the beginning of the sentence.

Consider the examples again.

**Examples:**
The mixture is heated **so as to** separate the strands of DNA.
**In order to** separate the strands of DNA, the mixture is heated.

In both cases, what is the goal?

Answer: *to separate the strands of DNA*

What is the procedure for reaching the goal?

Answer: *The mixture is heated.*

Here are two more purpose expressions. These ones use a gerund ( ), or "-ing" verb.

[Clause A] for the purpose of [verb+ing B].
[Clause A] with the aim of [verb+ing B].

**Example:**
The mixture is heated **with the aim of** separating the strands of DNA.

One more purpose expression connects two clauses.

[Clause A] so that [clause B].

**Example:**
The mixture is heated **so that** the strands of DNA will separate.

### 2.4.2 Manner

A manner statement explains how to do something. It is the reverse of a purpose statement, and is also common in the methods section.

In the examples below . . .
A = action
B = manner

Here is the pattern:

[Clause A] by [verb+ing] [noun]

Purpose and manner statements are closely related. Compare these two sentences:

**Examples:**
The mixture was heated **in order to** separate the strands of DNA. (purpose)
The strands of DNA were separated **by** heat**ing** the mixture. (manner)

What was the goal (of heating the mixture)?

*to separate the strands of DNA*

How (were the strands separated)?

*by heating the mixture*

Basically, the information is the same, but the focus is different. The emphasis is on the first part of the sentence in each case.

## 2.5 Condensed and Extended Methods Descriptions

When your procedure is routine, the methods section may be brief, but when you develop a new procedure or use a controversial procedure, you will need to explain it in more detail. Most papers contain a mixture of routine and novel methods, so they will contain a mixture of brief and detailed descriptions.

According to Swales and Feak (2004), there are several differences between condensed (brief) and extended (detailed) descriptions of procedures. They include the two topics discussed above, purpose and manner statements, plus a few more:

**Variation in Methods Sections**

| Condensed | Extended |
|---|---|
| Tends to describe familiar, standard methods | Tends to describe new or unusual methods |
| Assumes background knowledge | Provides background information |
| No named subsections | Several named subsections |
| Uses abbreviations and citations as shorthand | Uses longer descriptions |
| Running series of verbs (e.g., "collected, stained, and stored") | Usually one finite (main) verb per clause |
| Few "by + verb-ing" statements (explaining "how") | Several "how" statements (see Manner above) |
| Few definitions and examples | More definitions and examples |
| Few justifications (explaining "why") | Several justifications (often "In order to . . .") (see Purpose above) |
| Few linking phrases | Wide range of linking phrases |

Adapted from Swales JM, Feak CB. *Academic Writing for Graduate Students, 2nd ed*. Ann Arbor: U of Michigan; 2004.

These characteristics are usually mixed in a methods section, even in the same paragraph. The following example is typical.

### 2.5.1 Example of a methods section included in the article

The traditional research article contains a separate methods section after the introduction. In this typical example, aspects of both condensed and extended styles are mixed.

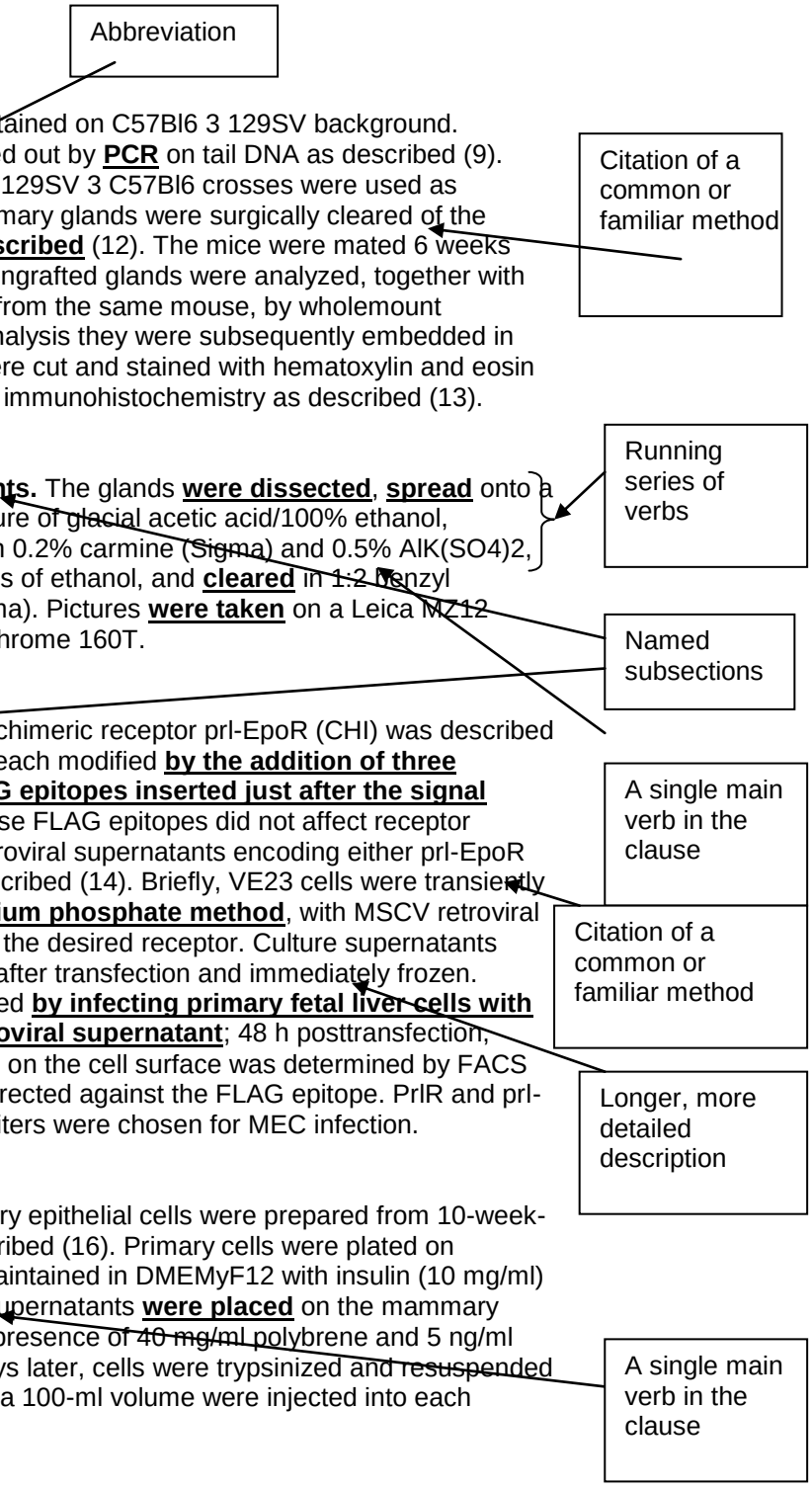
**Materials and Methods**

**Mice.** *PrlR*1/2 mice were maintained on C57Bl6 3 129SV background. Genotyping for PrlR was carried out by **PCR** on tail DNA as described (9). Three-week-old F1 females of 129SV 3 C57Bl6 crosses were used as recipients. Their inguinal mammary glands were surgically cleared of the endogenous epithelium **as described** (12). The mice were mated 6 weeks after transplantation, and the engrafted glands were analyzed, together with control unmanipulated glands from the same mouse, by wholemount microscopy. For histological analysis they were subsequently embedded in paraffin and 8-mm sections were cut and stained with hematoxylin and eosin or, alternatively, processed for immunohistochemistry as described (13).

**Mammary Gland Wholemounts.** The glands **were dissected**, **spread** onto a glass slide, **fixed** in a 1:3 mixture of glacial acetic acid/100% ethanol, **hydrated**, **stained** overnight in 0.2% carmine (Sigma) and 0.5% AlK(SO4)2, **dehydrated** in graded solutions of ethanol, and **cleared** in 1:2 benzyl alcoholybenzyl benzoate (Sigma). Pictures **were taken** on a Leica MZ12 stereoscope with Kodak Ektachrome 160T.

**Retroviral Supernatant.** The chimeric receptor prl-EpoR (CHI) was described (14). Prl-EpoR and PrlR were each modified **by the addition of three consecutive N-terminal FLAG epitopes inserted just after the signal sequence**. The addition of these FLAG epitopes did not affect receptor function (data not shown). Retroviral supernatants encoding either prl-EpoR or PrlR were generated as described (14). Briefly, VE23 cells were transiently transfected **by using the calcium phosphate method**, with MSCV retroviral constructs (15) each encoding the desired receptor. Culture supernatants were collected at 48 and 72 h after transfection and immediately frozen. Retroviral titers were determined **by infecting primary fetal liver cells with known dilutions of each retroviral supernatant**; 48 h posttransfection, expression of PrlR or prl-EpoR on the cell surface was determined by FACS analysis by using antibodies directed against the FLAG epitope. PrlR and prl-EpoR supernatants of similar titers were chosen for MEC infection.

**Cell Culture.** Primary mammary epithelial cells were prepared from 10-week-old virgin female mice as described (16). Primary cells were plated on collagen-coated dishes and maintained in DMEMyF12 with insulin (10 mg/ml) and EGF (5 ng/ml). The viral supernatants **were placed** on the mammary cells at day 3 of culture in the presence of 40 mg/ml polybrene and 5 ng/ml choleratoxin (17). One or 2 days later, cells were trypsinized and resuspended in PBS, and '0.5 3 106 cells in a 100-ml volume were injected into each cleared fat pad.




Brisken C, Socolovsky M, Lodish HF, Weinberg R. The signaling domain of the erythropoietin receptor rescues prolactin receptor-mutant. Proc Natl Acad Sci U S A. 2002 Oct 29;99(22):14241-5.

### 2.5.2 Example of a Methods Section at the End of the Article

A newer format for long journal articles with detailed methods involves putting most of the procedural details at the end of the article in a separate methods section and integrating the most important procedures into the results section—IRD(m) instead of IMRD. See the results chapter for another more detailed example.

## Part One: From the main text

Within the main article, the authors use concise language to explain their procedure. They may provide reasons, but not as many details.

**Example of Methods Sentence Embedded in the Results Section**

**RESULTS**

**Lack of PPs in relB±/± and nfkb2±/± mice**

Histological examination of adult mice revealed that RelB is required for PP development. Whereas wild-type mice had several easily detectable PPs, serial sections of Swiss roles of the small intestine did not reveal any histological evidence of rudimentary PPs in relB±/± mice. While nfkb1±/± mice had small PPs with a poorly developed microarchitecture, nfkb2±/± mice also lacked PPs and only occasionally had lymphoid aggregates in the small intestine (data not shown). **To examine whether PP development is blocked at an early stage in nfkb2±/± and relB±/± mice, we stained whole intestines from newborn mice for VCAM-1.** Figure 1 shows that VCAM-1+ PP organizing centers formed normally in wild-type (Figure 1A) and nfkb1±/± mice (Figure 1B), but were absent in nfkb2±/± (Figure 1C) and relB±/± animals (Figure 1D). Thus, both p52/p100 and RelB are essential for the development of PPs, whereas the p50 subunit of NF-kB plays only a minor role in this process.

## Part Two: From the methods section after the main article

At the end of the article, the authors provide details necessary for replicating the study. These details would not be interesting to most readers, but would be very useful for someone who wants to do a similar study. This part will include many citations that describe common or familiar methods. It will also explain new methods more extensively.

**Example of the Methods Section Describing the Same Procedure in More Detail**

**MATERIALS AND METHODS**

**Immunohistochemical analyses**

Whole-mount immunohistochemistry was performed **as described previously** (Yokota et al., 1999). In brief, intestines **were fixed** in 2% paraformaldehyde overnight, **washed** with PBS and **subjected** to serial dehydration with methanol. **Following** 0.1% $H_2O_2$ treatment and rehydration, non-specific binding was blocked with PBSMT [2% skimmed milk, 0.3% Triton X-100 in phosphate-buffered saline (PBS)] and specimens were incubated overnight with anti-VCAM-1 mAb (PharMingen; clone 429, diluted 1:1000). **After** washing in PBSMT and PBST (0.3% Triton X-100 in PBS) and incubation with anti-rat IgG-horseradish peroxidase (1:500), color reactions were performed using diaminobenzidine (DAB) and nickel chloride (Vector

Same procedure. Very different descriptions.

Laboratories). RelB immunohistochemistry was performed **as described previously** (Weih et al., 2001).

Yilmaz ZB, Weih DS, Sivakumar V, Weih F. RelB is required for Peyer's patch development: differential regulation of p52-RelB by lymphotoxin and TNF. EMBO J. 2003 Jan 2;22(1):121-30.

## 2.6 Replicable or Not

In some fields, giving enough information so that your readers could replicate your study is critical. In other fields, it is less important. It may also depend on the journal. When you're not sure whether to provide more detail, look at other articles in the journal you are aiming for. Often, the detail can be made available in supplements online.

## 2.7 Borrowing Routine Expressions

Beyond the purpose statements, there is typically little analysis in a methods section. It includes your procedures, but not the results or analysis of results. Therefore, much of the language of methods sections can be borrowed from other papers. It is acceptable to borrow sentences that describe routine procedures. However, if the procedure was reported for the first time by a certain author, you should cite that author's paper.

## 2.8 Describing Your Population

Most biomedical researchers do not concern themselves with differences among ethnic groups. However, in a few fields of study, such as nutrition, characteristics such as nationality, ethnicity, and/or religion may be relevant in the definition of the population studied. There are also some rare genetic illnesses that tend to appear in patients of a certain race or nationality. As a result, writers have to find the best way to describe these groups. The best way is often more specific and accurate than the way that we describe people in everyday conversation.

In Korea, the vast majority of the population fits into the same ethnic group and shares a similar cultural background. As a result, much of the clinical research simply specifies "in Korea" or "in Koreans" in the title and descriptions of the population studied. However, it is important not to make the same assumption about research carried out in other countries. If you cite a study that took place in Australia, for example, and no ethnic description is given, the correct description of the research subjects would be "patients from Australia" or "residents of Australia." There are many Koreans and other East Asians living in Australia. A few might be included in the research sample. Therefore, in a literature search for a disease that purportedly occurs more often in East Asians, it would not be correct to assume that the Australian study contains no East Asians, unless the authors have specifically mentioned so.

Likewise, the population of Korea is becoming more diverse. According to the Korean Ministry of Justice, there are now over a million foreign-born residents of Korea. Therefore, in describing your own research population, it should become standard practice soon to specify "ethnic Koreans" or "residents of Korea." The former would include people with Korean parents or grandparents living abroad. The latter would include anyone from any country living in Korea.

Korean Ministry of Justice Immigration Service. http://www.immigration.go.kr/HP/IMM/index.do . Go to "자료실" -> 통계자료실 -> 2007 년 12 월 통계월보. Retrieved on February 11, 2008.

According to Article Requirements section on "Defining Ethnicity" from the medical journal BMJ, "Ethnicity and culture are socially determined variables of limited use in biological research, though they are useful in health services research. All the variables are confounded by socioeconomic status."

The BMJ recommends that authors "try to use accurate descriptions of race, ethnicity, and culture rather than catch all terms in common use. In the methods section of research articles describe the logic behind any ethnic groupings used."

The BMJ goes on to list a number of ways to describe your sample, including:

- genetic differences
- self assigned ethnicity, using nationally agreed guidelines
- observer assigned ethnicity
- country or area of birth (participant's own, or parents' or grandparents' if applicable)
- years in country of residence
- religion.

BMJ Article Requrements. http://resources.bmj.com/bmj/authors/article-submission/article-requirements . Retrieved January 21, 2008.

The following example describes a study in Japan that includes residents of Japan who are from other countries or who have ancestors from other countries. Note how they are described.

**Example:**

We recruited 11 unrelated patients with BCD and characteristic clinical features; **eight of Japanese, two of Middle Eastern, and one of Chinese ancestry**. . . Two novel mutations, L173W and Q450X, were identified in **a Japanese patient** and **two unrelated patients from Middle Eastern countries**, respectively.

Lin J, Nishiguchi KM, Nakamura M, Dryja TP, Berson EL, Miyake Y. Recessive mutations in the CYP4V2 gene in East Asian and Middle Eastern patients with Bietti crystalline corneoretinal dystrophy. J Med Genet. 2005 Jun;42(6)

# 3.0 The Introduction Section

The introduction section of the paper is complex, but it is possible to break it down into steps and follow a fairly predictable pattern. Once you understand the purpose, audience, and structure of a typical introduction section, you should be able to write your own. Keep in mind that the introduction should not repeat the same words as the abstract and should contain your own unique interpretation of the literature. Unlike the method section, it is not appropriate to "borrow" sentences from other papers for your introduction section. However, you should study how other authors organize their introductions and follow the customs of your own field of study.

## 3.1 The Purpose of the Introduction Section

The traditional journal article in the sciences consists of four parts: Introduction, Methods, Results, and Discussion/Conclusion (IMRD). As mentioned in the previous chapter, these sections answer the following questions:

- Why do we care about the problem and the results?
- What problem are you trying to solve?
- How did you go about solving or making progress on the problem?
- What's the answer?
- What are the implications of your answer?

***The first two questions are the object of the introduction section.***

## 3.2 The Audience of the Introduction Section

The potential readers of your journal article may include the following groups:

- Researchers in your discipline
- Researchers doing similar work
- Graduate students
- Researchers in other disciplines (sometimes)

Therefore, the audience includes people who need a lot of background information to understand your work, and also includes people who understand your work without much background information. Assume that you are writing your introduction especially for those who do need the background information.

If you publish in a more specialized journal, you can expect an audience that shares more of your background knowledge. That means your introduction will be different than one for an interdisciplinary journal like *Science* or *Nature,* or even one of the more generalized journals of your own field.

## 3.3 The Structure of the Introduction Section

An introduction section is not a simple list of article summaries. When you discuss other articles, you should mention only the most interesting and relevant information from each article. Show how other authors' ideas and findings relate to your own research or argument.

Your citation of other papers should not usually include summaries of all sections of those papers. Instead, as you cite other papers, you may focus on whatever is relevant from another author's article:

- Main argument
- One minor argument
- Main results

- One of the results
- All or part of the method

You can position yourself in various ways relative to each author you cite:

- Following
- Building on
- Comparing to
- Contrasting with
- Disproving

One technique for organizing and taking notes on a collection of articles before writing the introduction to your paper is a literature review matrix. This is a chart that lists each article you have read. Next to each title, summarize the key points, then indicate how the article is related to your paper. For example, “results agree with mine, but the method is problematic” or “disagree with this author’s analysis of the problem.”

Here are two links to examples of literature review matrices online:

http://cimh.networkofcare.org/downloads/handouts/January%2019%202006%20Summary%20Matrix%209-15-05%20v.11.doc

http://www.scotland.gov.uk/Publications/2004/08/19843/42012

As you collect information, you may wish to highlight text copied from the article in a different color, so that you don’t accidentally use it as your own words later. The author’s exact words must be rephrased in your paper.

Once you have collected the information about each article, consider how all the studies fit together. In your introduction, discuss the big picture, grouping articles in one citation when they have something important in common. You may discuss some studies in more detail, while only mentioning other articles briefly.

## Tip

According to Turner,(2006) introduction sections in the sciences typically have three main parts. As detailed below, some of the subsections are optional. Subsections K and L below are rare in biomedical articles, except biomedical engineering. Note that the main three steps are typically in this order, but the subsections may be in any logical order.

### STEP 1. State the importance of the topic

A) Give background information on the topic.
B) OR Clearly define the research problem and its importance.
C) SUGGESTED: Define the key terms.
D) OPTIONAL: Classify previous approaches.
E) AND Review previous research in the field.

Note: The background information serves to indirectly argue that the topic is important and helps the reader understand the context for the research.

### STEP 2. Show problems with previous research, methods, or theories

F) Criticize previous research or methods by showing the weaknesses of a method or theory.
G) AND/OR Indicate a “gap,” knowledge that is missing in your field.

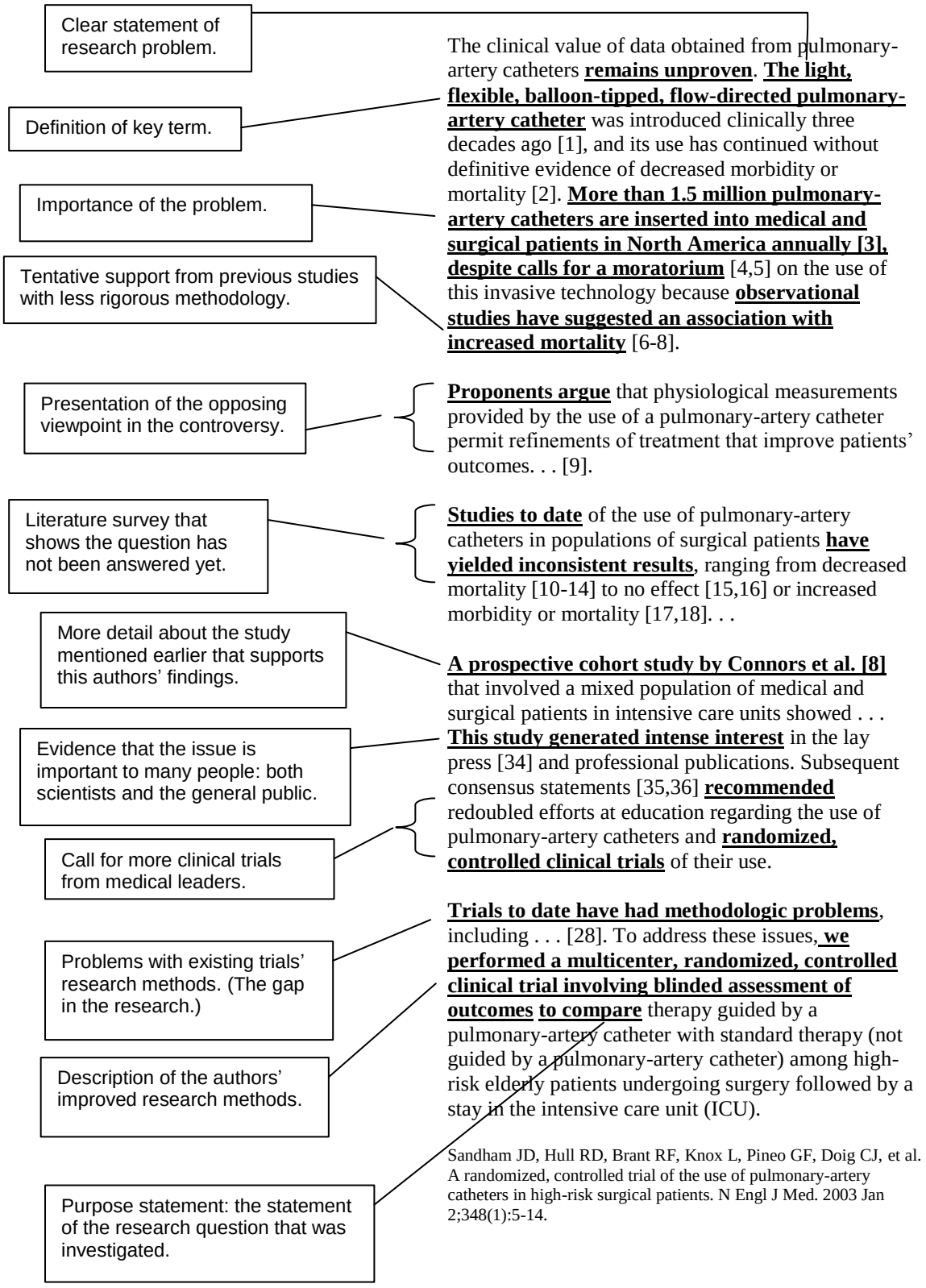
### STEP 3. Introduce your paper as a solution to these problems or missing areas of research

H) Clearly indicate how the purpose of your paper is to solve a problem or fill a gap in knowledge in your field by introducing the objective of your paper.
I) OR Clearly indicate how your approach is different from previous papers.
J) Optional: introduce the basic methodology used in the paper.
K) Optional: Summarize your main results (only in some fields).
L) Optional: indicate the organization of each section of your paper (only in some fields).

Turner A. *English Solutions for Engineering Research Writing*. 2006. p. 142.

## 3.3.1 What Makes a Good Introduction?

Below is an example of an introduction section from a clinical article. It contains many of the parts from the suggested outline above. Notice how this example aims for a more general audience than just researchers in the same field. Surely the field's own researchers would know the definition of "pulmonary-artery catheter," but the authors define the term in the second sentence. The authors focus on citing articles that prepare the reader to learn about the authors' own research. If some of the articles also mention information relevant to the authors' own results, they may cite those articles again in the discussion section.



### 3.3.2 Variations of the Standard Introduction Structure

Sometimes several parts of the suggested structure are not needed. Here is an extreme example. In this article, the problem is very simple. A device in the hospital is causing infections. There is no potential disagreement with other researchers. The authors simply had to find the cause of the increased infections and report on it. The only necessary literature to review is other reports of similar outbreaks.

**Example:**

Although infectious complications of flexible bronchoscopy are uncommon, [1,2] nosocomial outbreaks related to bronchoscopy have been reported, [3-10] and endoscopes, including brochoscopes, are the medical devices most commonly linked to outbreaks. At Johns Hopkins Hospital, between June 2001 and January 2002, the rate of isolation of Pseudomonas aeruginosa from bronchoalveolar-lavage specimens was three times as high as the usual rate. We investigated the cause of the increase and implemented control measures.

Srinivasan A, Wolfenden LL, Song X, Mackie K, Hartsell TL, Jones HD, et al. An outbreak of pseudomonas aeruginosa infections associated with flexible bronchoscopes. N Engl J Med. 2003 Jan 16;348(3):221-7.

## 3.4 Getting Started

(adapted from Swales, 1990)

The first sentence is the most difficult to write. Writing the method section of your journal article first is recommended. However, it is still necessary to begin the introduction eventually. Here are some expressions you can modify to create a first sentence.

### Examples:

**Expressions for a journal article's first sentence**

- Recently, there has been a **growing** interest in . . .
- The possibility of . . . has generated **wide** interest in . . .
- The development of . . . is a **classic** problem in . . .
- The development of . . .has led to the hope that . . .
- Knowledge of . . . has a **great** importance for . . .
- The study of . . . has become an **important** aspect of . . .
- A **central** issue in . . . is . . .
- The . . . has been **extensively** studied in recent years.
- **Many** investigators have recently turned to . . .
- The relationship between . . . and . . . has been investigated by **many** researchers.
- **Many** recent studies have focused on . . .

Two other types of sentences are common near the beginning of an introduction. Both make generalizations.

### Examples:

**Expressions that make a generalization about the current state of knowledge or practice**

- The aetiology and pathology of . . . is **well-**known.
- There is now **much** evidence to support the hypothesis that . . .
- The . . . properties of . . . are **still** not completely understood.
- A standard procedure for assessing . . . has been . . .
- . . . are **often** criticized for . . .

### Examples:

**Expressions that make a generalization about phenomena, focusing on frequency or complexity:**

- . . . is a **common** finding in patients with . . .
- An **elaborate** system of . . . is found in . . .
- There are **many** situations where . . .
- . . . is a **rich** source of . . .

Swales JM. *Genre: English in academic and research settings*. Cambridge: Cambridge U Press; 1990. p. 144-146.

Note how the underlined words in the examples above strengthen the author's argument. For more examples of expressions for strengthening and weakening an argument, see the Results and Discussion chapter.

Keep in mind that while most research reports begin by showing why a research question is important or a problem is common, in clinical case studies, the introduction should do the opposite: show that the phenomenon is rare. See the Clinical Case Reports chapter for examples.

# 3.5 Writing Definitions

**Tip**
Although they may appear anywhere in a research report, definitions are common in the introduction section. In particular, they are one strategy for starting the first paragraph.

According to Swales and Feak, definitions can be a single sentence, just part of a sentence, or several sentences long. Each kind of definition is presented below.

Swales JM, Feak CB. *Academic Writing for Graduate Students, 2nd ed*. Ann Arbor: U of Michigan; 2004.

## 3.5.1 Sentence Definitions

Here is the pattern for definitions within a single sentence:

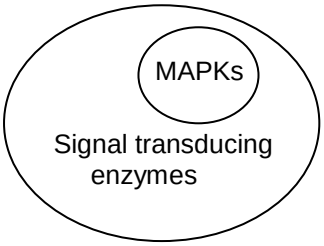
[Term] is/are [member of class] that [distinguishing characteristic].

**Term:** word defined
**Class:** a group in which the defined item belongs
**Distinguishing Characteristic(s):** what makes this item different from other similar items

**Example:**

Mitogen-activated protein kinases (MAPKs) are important signal transducing enzymes, unique to eukaryotes, that are involved in many facets of cellular regulation.

Chang L, Karin M. Mammalian MAP kinase signalling cascades. Nature. 2001 Mar 1;410(6824):37-40. Review.




In the example above, the **term** is "MAPKs." The **class** is "signal transducing enzymes." The **distinguishing characteristics** that make MAPKs different from other signal transducing enzymes are the following: they are "unique to eukaryotes" and they "are involved in many facets of cellular regulation."

Tip:
Try to be as specific as possible when choosing a class name for a definition. “Something” is not a useful class name. A few common class names are the following: technique, method, process, device, system.

Swales and Feak also mention a few other expressions that can be included in definition sentences:

- commonly referred to as
- is known as
- is defined as

**Examples:**

These mass immunization campaigns have taken place across large swathes of northern Uganda, southern Sudan and the east of the Democratic Republic of Congo (DRC), countries which make up part of what **is known as** the "meningitis belt."

Doctors without Borders. “Over 1.5 million to be immunized against meningitis.” http://www.doctorswithoutborders.org/. Retrieved 29 September 2006.

Dental erosion **is defined as** a progressive loss of hard dental tissues by a chemical process without bacterial action.

Brunton PA, Hussain A. The erosive effect of herbal tea on dental enamel. J Dent. 2001 Nov;29(8):517-20.

## 3.5.2 Short Definitions

Short definitions are simply a parenthetical comment in a sentence.

**Examples:**

*Canis familiaris* **(**the domestic dog**)** can transmit rabies to humans if not vaccinated.

Canis familiaris, **commonly referred to as** the domestic dog, can transmit rabies to humans if not vaccinated.

Atopic dermatitis, **commonly referred to as** eczema, is a chronic skin disorder categorized by scaly and itching rashes.

MedlinePlus Medical Encyclopedia. http://www.nlm.nih.gov/medlineplus/ency/article/000853.htm/. Retrieved 29 September 2006.

Short definitions may be surrounded by commas, or may be introduced by these expressions:

- ,that is,
- ,i.e.,
- ,or
- ,which is
- ,known as
- ,referred to as

Note that all of these expressions are preceded by a comma (,). However, “that is” is both preceded and followed by a comma. The expression “i.e.” is equivalent to “that is.” Also note that “known as” and “referred to as” were mentioned earlier as variations of the sentence definition. Here, they are used to introduce a short definition, and then the sentence continues with other information.

### 3.5.3 Extended Definitions

Extended definitions contain multiple sentences or even multiple paragraphs. Often, the first sentence is itself a sentence definition, as described above.

Tip
**Types of Information in Extended Definitions**
(adapted from Reinhart, 2002)

- An enumeration (numbered list) of the characteristics or features
- A discussion of different types or kinds
- A description of the structure of components
- A list of one or more examples
- A description of how something is made
- A discussion of how something works or is carried out
- A description of applications
- A discussion of the history or evolution of the concept, including its future potential
- A comparison/contrast with a similar concept

Reinhart S. *Giving Academic Presentations*. Ann Arbor: U of Michigan; 2002.

Here is an example of an extended definition at the end of the introduction section of a review article. After an introductory sentence definition, the remaining sentences focus on application of the plant to traditional medicine.

**Example:**

St John's wort is the common name for the flowering plant, *Hypericum perforatum*, which grows as a common weed in much of the United States. Extracts of the plant have been used for centuries as a therapy for "insomnia and other nervous conditions" [6]. Its yellow flower was traditionally gathered for the feast of St John the Baptist, and "wort" is the Old English word for plant—hence, the derivation of its common name.

In the past few years, the use of St John's wort in the United States has been rising exponentially, with annual sales increasing from $20 million to $200 million between 1995 and 1997 alone [7]. It has long been a popular antidepressant in Germany [8].

Gaster B, Holroyd J. St John's wort for depression: a systematic review. Arch Intern Med. 2000 Jan 24;160(2):152-6. Review.

## 3.6 Writing Research Questions as Statements

Experimental papers present a research question in the introduction sections, followed by an answer to that question in the results and discussion sections. However, typically, the research question or problem is not in question form.

Here are a number of common ways to write a question in a research report. Note that, grammatically, none of them are in a question form and none have a question mark at the end. Obviously, the question “What time is it?” is not a biomedical research topic; however, it serves as a simple example of the question forms. Replace it with your own research questions.

### 3.6.1 Common Forms of Question Restatement

**Examples:**

**We don’t know the time.**

Investigations so far have been unable to determine the time.

It is unclear what time it is.

The research is inconclusive as to what time it is.

There is some question as to what time it is.

It might also be of interest to investigate the time.

Until researchers develop a more accurate clock, we will be uncertain of the time.

In the following examples, replace “measured” with your own research method and replace “time” with your research subject.

**Examples:**

**We investigated the time.**

The second experiment measured the time.

The time was measured.

Examples:
**Other questions:**

*“Can we know the time?”*
*“How can we measure the time?”*

The question remains how we can measure the time, or even whether we can know it at all.

It has not been determined whether the time can be known and, if so, how it can be measured.

*“To what extent can we measure the time?”*

Another issue raised by this study is whether and to what extent we can measure the time.

## 3.6.2 Grammar of questions

### 1. YES/NO questions

YES/NO questions use “whether” (and sometimes “if”). These questions can be answered “yes” or “no.” Many hypotheses in research fall into this category.

**Example:**

. . . we sought to determine **if** Treg cells could control the activation of autoreactive cells . . .”

Tang Q, Adams JY, Tooley AJ. Bi M, Fife BT, Serra P, et al. Visualizing regulatory T cell control of autoimmune responses in nonobese diabetic mice. Nat Immunol. 2006 Jan;7(1):83-92.

In the example above, the research question is: “Can Treg cells control the activation of autoreactive cells?” The answer may be “Yes, they can” or “No, they cannot.”

### 2. Wh- questions

Wh- questions use “who,” “what,” “when,” “where,” “why,” “how.” “How” can be followed by “much,” “many,” “long,” “few,” etc. Wh- words can sometimes be preceded by a preposition (to what extent, for what purpose, by what means, to where, etc.).

**Examples:**

**1. <u>What</u> is the main differentiation regulator?** (Wh-question)

Today many researchers are investigating **<u>what</u>** the main differentiation regulator is.

**2. How exact is the molecular mechanism?** (Wh-question)

It has not yet been determined **<u>how exact</u>** the molecular mechanism **<u>is</u>**.

**3. Will systems biology be the key for solving the secret of life?** (Yes/No question)

The question remains **<u>whether</u>** systems biology will be the key for solving the secret of life.

**4. Is LIF important to mES cells?** (Yes/No question)

Investigations so far have been unable to determine the **<u>importance</u>** of LIF to mES cells.

These four examples were written by the author's graduate students.

In the second example above, note the movement of "is" after the subject "molecular mechanism." In the fourth example, note how the writer changed the adjective "important" to the noun "importance."

## 3.7 Reporting Verbs

When you report on someone else's research or ideas, you will often use a reporting verb. You can use many of the same verbs to describe your own ideas and data.

**Examples:**

Lee (2008) states/claims/argues/maintains/suggests/asserts/hypothesizes/concludes that . . .

We believe/argue/maintain/would suggest that . . .

Note: Some reporting verbs show an objective attitude toward the reported information (e.g. describe, examine, propose, recommend, theorize, support). Other verbs show an evaluative attitude—either positive or negative (e.g. claim, assume, contend).

Also note: some reporting verbs can be followed by "that" (e.g. recommend that, claim that, assume that, contend that, propose that, theorize that). Others cannot be followed by "that" (e.g. describe, support, examine).

Over 400 reporting verbs have been identified across disciplines (Hyland, 1999 as cited in Swales & Feak, 2004), but only a few are used most of the time. According to Hyland (1999) and Maynard (n.d.), the most common reporting verbs in biology, epidemiology and nursing include the following: describe, find, report, show, suggest, observe, examine, demonstrate, and propose (as cited in Swales & Feak, 2004). Next time you read an article in your field, note which reporting verbs are most common.

Swales JM, Feak CB. *Academic Writing for Graduate Students, 2nd ed*. Ann Arbor: U of Michigan Press; 2004.

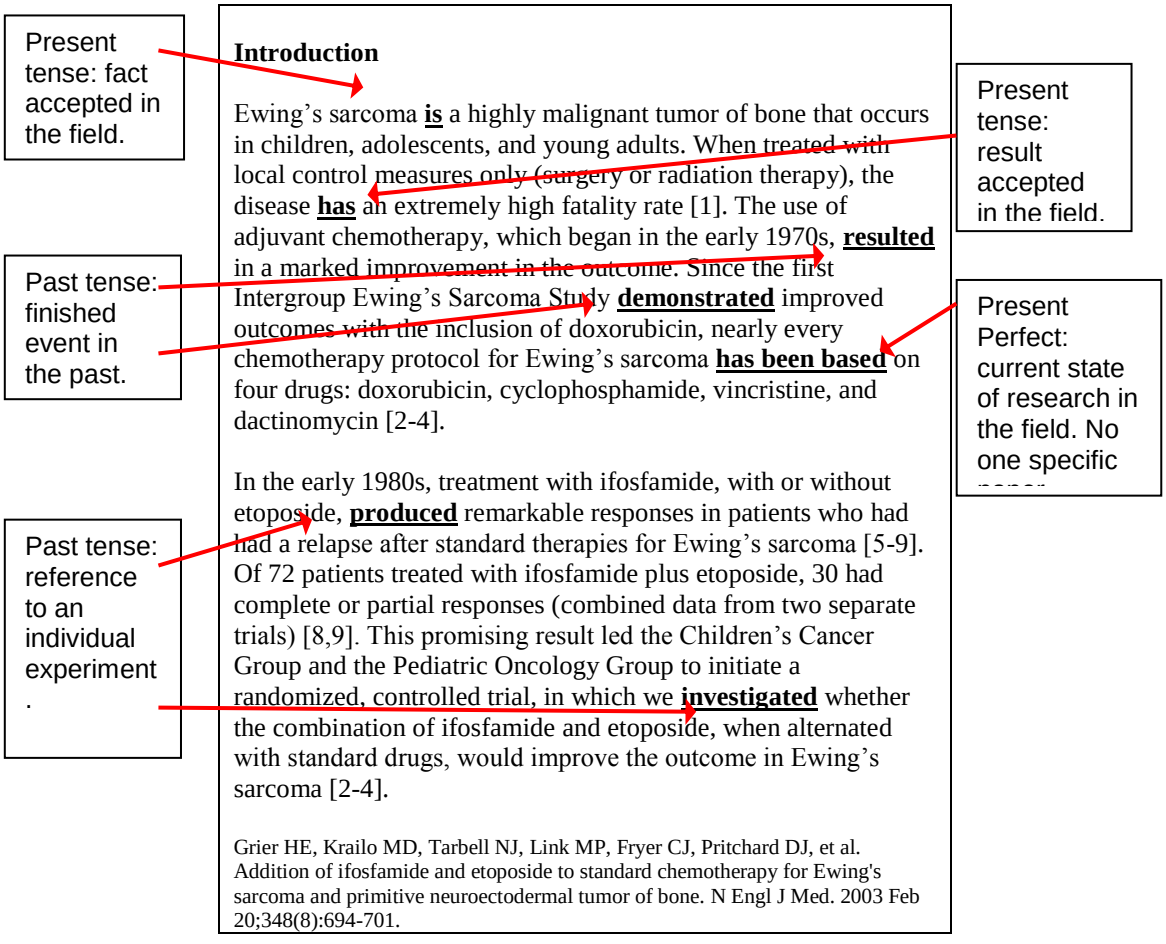
# 3.8 Verb Tense in Introduction Sections

According to Turner (unpublished), verb tense in journal article writing is not simply about time. Many verb tenses work together to paint a picture of the current state of research in the field in the introduction section.

1. **Present tense:** A fact or a practice that is generally accepted in the field.
2. **Present perfect tense:** (have + PP) a summary of generalization about research in the field or general trends in society. No specific time or date. In citations many studies are usually summarized.
3. **Past tense:** Results of individual experimental papers. Finished events in the past with a specific time.
4. **Other structures**

   **Example:**

   Interruptions of antiretroviral treatment **are increasingly being used** for treatment failure and to …



# 4.0 The Results and Discussion Sections

The results and discussion sections present your research findings and your analysis of those findings. A few papers also contain a conclusion section, which usually focuses on practical application or provides a short summary of the paper. The results, discussion and conclusion sections are combined into one chapter in this book because they are sometimes combined in journal articles. Most articles do not contain all three sections.

## 4.1 The Purpose of the Results and Discussion Sections

To review, the traditional journal article in the sciences consists of four parts: Introduction, Methods, Results, and Discussion/Conclusion (IMRD). They answer these questions:

- Why do we care about the problem and the results?
- What problem are you trying to solve?
- How did you go about solving or making progress on the problem?
- What's the answer?
- What are the implications of your answer?

***The last two questions are the object of the results and discussion sections, respectively. If a paper contains a conclusions section, it also focuses on implications.***

## 4.2 The Structure of the Results Section

The *Annals of Internal Medicine*'s Information for Authors provides the following advice for preparing the results section of a clinical journal article:

> Fully describe the study sample so that readers can gauge how well the study findings apply to their patients (external validity). Then present primary findings followed by any secondary and subgroup findings. Use tables and figures to demonstrate main characteristics of participants and major findings. Avoid redundancy between text and tables and figures.
>
> *Annals of Internal Medicine*. Information for Authors. http://www.annals.org/shared/author_info.html#manuscript-text . Retrieved 3 February 2008.

In clinical medicine, there are a number of organizations of scholars that have developed regulations for reporting on various types of studies. Before drafting your article, even if you plan to publish in a smaller journal, check the author's guidelines of a major journal for a list of these recommendations. *The Annals of Internal Medicine* and *BMJ* have excellent detailed author's guidelines and links to checklists. For example, the following is an excerpt from the checklist for studies of diagnostic accuracy. The group of scholars is named "STARD."

**STARD checklist for reporting of studies of diagnostic accuracy: Results section**

| Section and Topic | Information to Be Included |
|---|---|
| RESULTS | |
| *Participants* | When study was performed, including beginning and end dates of recruitment. |
| | Clinical and demographic characteristics of the study population (at least information on age, gender, spectrum of presenting symptoms). |
| | The number of participants satisfying the criteria for inclusion who did or did not undergo the index tests and/or the reference standard; describe why participants failed to undergo either test (a flow diagram is strongly recommended). |
| *Test results* | Time-interval between the index tests and the reference standard, and any treatment administered in between. |

| | |
|---|---|
| | Distribution of severity of disease (define criteria) in those with the target condition; other diagnoses in participants without the target condition. |
| | A cross tabulation of the results of the index tests (including indeterminate and missing results) by the results of the reference standard; for continuous results, the distribution of the test results by the results of the reference standard. |
| | Any adverse events from performing the index tests or the reference standard. |
| *Estimates* | Estimates of diagnostic accuracy and measures of statistical uncertainty (e.g. 95% confidence intervals). |
| | How indeterminate results, missing data and outliers of the index tests were handled. |
| | Estimates of variability of diagnostic accuracy between subgroups of participants, readers or centers, if done. |
| | Estimates of test reproducibility, if done. |

Bossuyt PM, Reitsma JB, Bruns DE, Gatsonis CA, Glasziou PP, Irwig LM, et al. Towards complete and accurate reporting of studies of diagnostic accuracy: the STARD initiative. Standards for Reporting of Diagnostic Accuracy. Clin Chem. 2003 Jan;49(1):1-6. Review. Download the whole STARD checklist here: http://www.equator-network.org/index.aspx?o=1050

Biomedical researchers doing basic science can follow a more flexible structure, depending on the nature of the study and the journal. The sample description for experimental papers would typically appear in the methods section, not the results, as mentioned above for clinical papers. Start with the most important finding, and continue through each result in a logical way. This may be according to time, if one result followed from the next, or it may be from most to least important. An example is provided later in this chapter, in the section entitled "Results Structure of an Experimental Study in the IRD(m) Format."

## 4.3 The Structure of the Discussion Section

According to the Instructions for Authors of the *Journal of the American Medical Association (JAMA)*, the discussion section is "a comment section placing the results in context with the published literature and addressing study limitations."

*JAMA*. Instructions for Authors. http://jama.ama-assn.org/misc/ifora.dtl#ManuscriptComponents. Retrieved on 3 February 2008.

Similarly, *Cell*'s Instructions for Authors stipulates that "the Discussion should explain the significance of the results and place them into a broader context. It should not be redundant with the Results section. This section may contain subheadings and can in some cases be combined with the Results section."

*Cell*. Information for Authors. http://www.cell.com/misc/page?page=authors#SubmissionRA . Retrieved on 3 February 2008.

Interestingly, because *Cell* does not have a clinical focus, the role of discussing limitations is not central enough to mention in the Instructions for Authors. In fact, unlike clinical journals, journals like *Cell* that publish long experimental reports are more likely to allow combining the results and discussion into a single section and may not contain a conclusion section at all.

Turner notes that the discussion section is a mirror image of the introduction. While the introduction starts with general background information and moves to the specific purpose of the author's research, the discussion starts with an analysis of the author's own specific results and moves to general implications of the research.

Turner A. *English Solutions for Engineering Research Writing*. 2006.

Tip
The *Annals of Internal Medicine* journal's Information for Authors offers these recommendations for structuring the discussion section:

1. Provide a brief synopsis of key findings, with particular emphasis on how the findings add to the body of pertinent knowledge.

2. Discuss possible mechanisms and explanations for the findings.
3. Compare study results with relevant findings from other published work. Briefly state literature search sources and methods (e.g., English-language MEDLINE search to Jan 2007) that identified previous pertinent work. Use tables and figures to help summarize previous work when possible.
4. Discuss the limitations of the present study and any methods used to minimize or compensate for those limitations.
5. Mention any crucial future research directions.
6. Conclude with a brief section that summarizes in a straightforward and circumspect manner the clinical implications of the work.

Annals of Internal Medicine. Information for Authors. http://www.annals.org/shared/author_info.html#manuscript-text . Retrieved 3 February 2008.

# 4.4 Examples of Results and Discussion Sections

## 4.4.1 Clinical Study Results and Discussion Structure with Traditional IMRD Format

Below is presented most of the text from the results and discussion sections of a clinical report on the relationship between eating meat and getting various types of cancer.

Cross AJ, Leitzmann MF, Gail MH, Hollenbeck AR, Schatzkin A, Sinha R. A prospective study of red and processed meat intake in relation to cancer risk. PLoS Med. 2007 Dec;4(12):e325.

Note: It was possible to reprint long excerpts of this journal article thanks to the *PLoS Medicine* journal's generous open-access policy. For more details, see http://journals.plos.org/plosmedicine/license.php .

| Comments | Results Section |
|---|---|
| The first sentence of the results section summarizes the procedure detailed previously in the methods section. A summary of the findings for the first variable—red meat intake—is provided. | During a mean follow-up of 6.8 y, 53,396 cancer diagnoses (36,907 male cases and 16,489 female cases) were ascertained. The mean energy–adjusted red meat intake in this cohort was 34.6 g/1,000 kcal (38.0 g/1,000 kcal in men and 29.5 g/1,000 kcal in women). The medians of extreme quintiles ranged from 9.8 to 62.7 g/1,000 kcal for red meat and 1.6 to 22.6 g/1,000 kcal for processed meat. |
| The characteristics of patients studied are related to the amount of meat that they eat. | In general, those in the highest quintile of red meat intake tended to be . . . [demographic characteristics, habits and health] (Table 1). |
| The first subheading. Within this section, results for the first of two types of meat are presented.<br><br>First: A list of all the types of cancer risk increased by eating red meat.<br><br>Next: statistical procedures that clarified the connection between meat and cancer was not related to other causes. | **Red Meat**<br><br>Individuals in the highest quintile of red meat intake, compared with those in lowest, had a statistically significant elevated risk of several malignancies (Table 2), including esophageal, . . . colorectal, . . . liver, . . . lung, and borderline statistical significance for laryngeal cancer . . . The positive association for red meat intake and colorectal cancer was due more to cancer of the rectum . . . than the colon, . . . Additional fine control for smoking did not alter the associations for cancers of the esophagus, colorectum, liver, lung, or larynx. In addition, the tests for interaction between smoking and both red meat . . . and processed meat . . . |

| | |
|---|---|
| | intake for lung cancer risk were not statistically significant. . . |
| A list of cancer types not related to eating red meat.<br><br>Reference to a figure that contains the data of the first two paragraphs. | Red meat intake was not associated with gastric or bladder cancer, leukemia, lymphoma, or melanoma. The associations between red meat and cancer are summarized in Figure 1 . . .; the figure also shows the null findings for sex-specific cancers, such as . . . |
| Unexpected findings. Red meat seems to help prevent one kind of cancer. | Unexpectedly, red meat intake was inversely associated with endometrial cancer. . . |
| Findings that were relevant only for men in the study. Mention of no difference between women and men for other kinds of cancer. | In further sex-specific analyses, red meat intake was positively associated with pancreatic cancer among men only . . . We observed no differences in risk by sex . . . |
| The pattern of results for red meat intake is repeated again for processed meat intake. Positive, null, and negative results. Lists of types of cancer that fit in each category. Statistical issues for each finding. | **Processed Meat**<br><br>[Paragraphs omitted: Similar results for processed meat intake]<br>[Paragraph omitted: Analysis of risk for more specific types of cancer] |
| An analysis of each variable—red meat and processed meat—independent of the other. Statistical methods for this analysis are mentioned, followed by results. | We conducted sensitivity analyses excluding processed meats from the red meat variable to determine whether the risks associated with red and processed meat are independent of each other. . . The positive associations for red meat and cancer of the liver, esophagus, colorectum, and lung all remain . . . Furthermore, the inverse association for red meat and endometrial cancer remained . . . |
| Remaining interesting statistical details are grouped at the end, to answer any potential concerns the reader may have about the effectiveness of the study. | [Paragraph omitted: Additional statistical analysis showing that results remain significant after controlling for a number of variables.] |

In the following excerpts from the discussion section of the same paper, study results are underlined. Note how the findings mentioned briefly without analysis in the results section are now mentioned again with more analysis and comparison to similar studies. Here, potential limitations of the data are also presented. The results are discussed from strongest proof to weakest. After that, the authors discuss the whole study in general and statistical details and conclude with a clinical application.

| Comments | Discussion Section |
|---|---|
| Topic of the article mentioned first. Note the similarity to the article title. Most significant results also summarized at the beginning of the discussion section. Thus the first paragraph contains no "analysis." | In this large, prospective investigation of red and processed meat intake in relation to cancer risk, **we found elevated risks for colorectal and lung cancer with both meat types. Red, but not processed, meat intake was also associated with increased risk for cancer of the esophagus and liver. We observed borderline statistically significant elevated risks for advanced prostate cancer with both red and processed meat intake, for laryngeal cancer with red meat, and for bladder cancer and myeloma and with processed meat intake.** |
| The strongest finding from the results section is repeated here, then analyzed. Another review of studies is mentioned. The finding agrees with the previous studies. | **The cancer site most consistently associated with meat intake has been the colorectum**. A recent meta-analysis . . . reported elevated risks in the highest category of consumption of . . . meat [9]. **Our study** included over 5,000 colorectal cancer cases, and it **lends strong support** to implicate red and processed meat as risk factors for this malignancy. **Consistent with previous studies** [9], we observed a stronger positive association for rectal than colon cancer. |

| | |
|---|---|
| Another finding is stated. That this study is the largest of its kind is mentioned. Previous studies are summarized. A potential limitation is mentioned. | **The positive associations for both red and processed meat that we report for lung cancer were of similar magnitude to the findings for colorectal cancer**. To date, our study includes the largest prospective analysis of meat intake and lung cancer risk. Previous case-control studies have reported elevated risks for lung cancer for those in the highest categories of red meat [17–19], fried red meat [8,19], well-done red meat [17], and processed meat intake [20]. Despite conducting analyses to show that very fine control of smoking history, using a 31-level variable, did not attenuate the lung cancer associations, there remains a potential issue of residual confounding by smoking, because it is such a strong risk factor for this disease. |
| Another finding is presented. Similar studies are mentioned. That this study is the first one with a prospective methodology is emphasized. | **We found a positive association between red meat intake specifically and cancers of the esophagus and liver, and a borderline significant positive association for laryngeal cancer.** The first prospective study of meat intake and esophageal cancer was published recently; that study had only 65 cases and found a positive association for processed meat, but not red meat, with esophageal adenocarcinoma [21]. Our study suggests a threshold effect for red meat intake on esophageal cancer risk, beginning at a low level of intake, with no further increase in risk with higher intakes, as reflected in the p-trend ($p = 0.13$), although it is possible that the referent group had a smaller-than-expected cancer incidence by chance. Data on meat intake and cancers of the liver and larynx are limited, and our study is the first prospective investigation to report on these associations. Two case-control studies reported elevated risks for laryngeal cancer for those in the highest intake categories of red meat intake [22,23] and fried beef/veal [24]. |
| This paragraph contains only findings and comparison to similar studies. There is a brief mention that there are not many studies of this issue. | **In our study, those in the highest quintile of processed meat intake had borderline statistically significant elevated risks for myeloma,** a malignancy that has not been well-studied for dietary associations, **and bladder cancer.** A study of two prospective cohorts combined [25], and one case-control study [26], both found elevated risks of bladder cancer for those in the highest categories of processed meat consumption, but another cohort study found no association [27]. |
| An unexpected finding is highlighted with the word "unexpectedly" right at the beginning. Because it is unexpected, the authors clearly show that they adjusted the statistics to avoid confounding from other possible causes. However, the authors also cite studies that offer the opposite results. | **Unexpectedly, we found an inverse association between red meat intake and endometrial cancer; this association was not attenuated by adjustment for known risk factors, such as body mass index or menopausal hormone therapy, or by fine control for smoking**, which has been inversely associated with this malignancy [28]. Previous studies have reported null [29,30] or positive relations [31] between red meat and endometrial cancer. We also observed inverse associations between processed meat intake and leukemia and melanoma. In contrast to our findings, childhood leukemia has been positively associated with intake of processed meats in a case-control study [32]. |
| There is quite a bit of research on this finding, so the authors group articles and describe them only briefly. They also offer another potential limitation of their findings. | **Both red and processed meat intake were positively associated with pancreatic cancer in men, but not women.** Red meat has been associated with pancreatic cancer in some [33,34], but not all [35–39] previous cohort studies, as has processed meat in one cohort [34] and several case-control studies [40–44]; although a sex-specific association has not been reported before. Although the association between pancreatic cancer and red or processed meat intake in men was unchanged by fine control for smoking, residual confounding by smoking is still possible. |

| | |
|---|---|
| | [Paragraph on other cancers omitted.] |
| Previous studies conflict. The authors' results may explain why. | Previous studies of meat intake and prostate cancer are conflicting. Some studies have reported null findings [5,60–66], and others suggest positive associations [67–74]. **Despite finding no association between red or processed meat intake and overall prostate cancer risk, we observed a suggestion of an elevated risk for advanced prostate cancer with both meat types.** If the relation of meat intake to prostate cancer is confined to advanced disease, this could explain some of the inconsistencies in the literature as most previous studies have not specifically addressed advanced prostate cancer. |
| Although two recent studies have found a breast cancer/red meat connection, the authors did not find one. They speculate why. | With regard to breast cancer, a pooled analysis of eight cohort studies found no association with red meat intake [75]; however, the two most recent prospective studies found positive associations for both red and processed meat [76], specifically for estrogen and progesterone receptor–positive breast cancers in premenopausal women [77]. Although **breast cancer risk related to meat intake did not appear to differ by menopausal status in our study,** we had very few premenopausal cases (n = 94) and lacked information on hormone receptor status for a large number of cases. |
| | [Paragraph on null cancer risks omitted.] |
| No more results given. Interpretation of possible reasons for the results. Reasons are based both on understanding of biological mechanisms and on results of other associational studies. | Both red meat, regardless of processing procedure, and processed meat can be linked to carcinogenesis by different mechanisms; for example, they are both sources of saturated fat and iron, which have independently been associated with carcinogenesis. Associations between saturated fat and cancer are likely to be related to energy balance in general, whereas iron is thought to contribute to carcinogenesis specifically by generating free radicals and inducing oxidative stress [94]. Most recently, dietary fat was positively associated with breast cancer [95], and iron intake was positively associated with liver [96] and colorectal cancers [97]. |
| | [Paragraph omitted: More analysis of biological mechanisms for meat/cancer connection.] |
| The authors suggest reasons for the difference in risk for two types of cancer. | With regard to **the stronger relation of red and processed meat to rectal cancer than to colon cancer,** there is variation in several characteristics along the large intestine. . . |
| Gap in the research and statistical strengths of study. | Despite abundant biologic pathways linking meat intake to carcinogenesis at numerous anatomic sites, this is the first comprehensive and prospective analysis . . . A particular strength of this study includes the large size of the cohort. . . An additional strength was that our study provid[ed] adequate statistical power to detect associations. Furthermore, recall bias and reverse causation were minimized by . . . |
| Limitations of the study and why they are not serious. | Potential limitations of this study include some degree of measurement error . . . The energy-adjusted correlation coefficients . . . were . . . These correlations compared very favorably to other . . . Although some measurement error remains, the error associated with . . . tends to result in . . ., and we attempted to minimize this error by . . . [omitted: additional minimizations of error and potential errors]. |
| Conclusion: Main findings repeated again here in the last paragraph. Clinical application of findings. | In conclusion, **a diet high in red or processed meat was associated with an elevated risk of both colorectal and lung cancer; in addition, red meat was associated with an elevated risk of esophageal and liver cancer**. A decrease in the consumption of red and |

| | |
|---|---|
| | processed meat could reduce the incidence of cancer at multiple sites. |

## 4.4.2 Results Structure of an Experimental Study in the IRD(m) Format

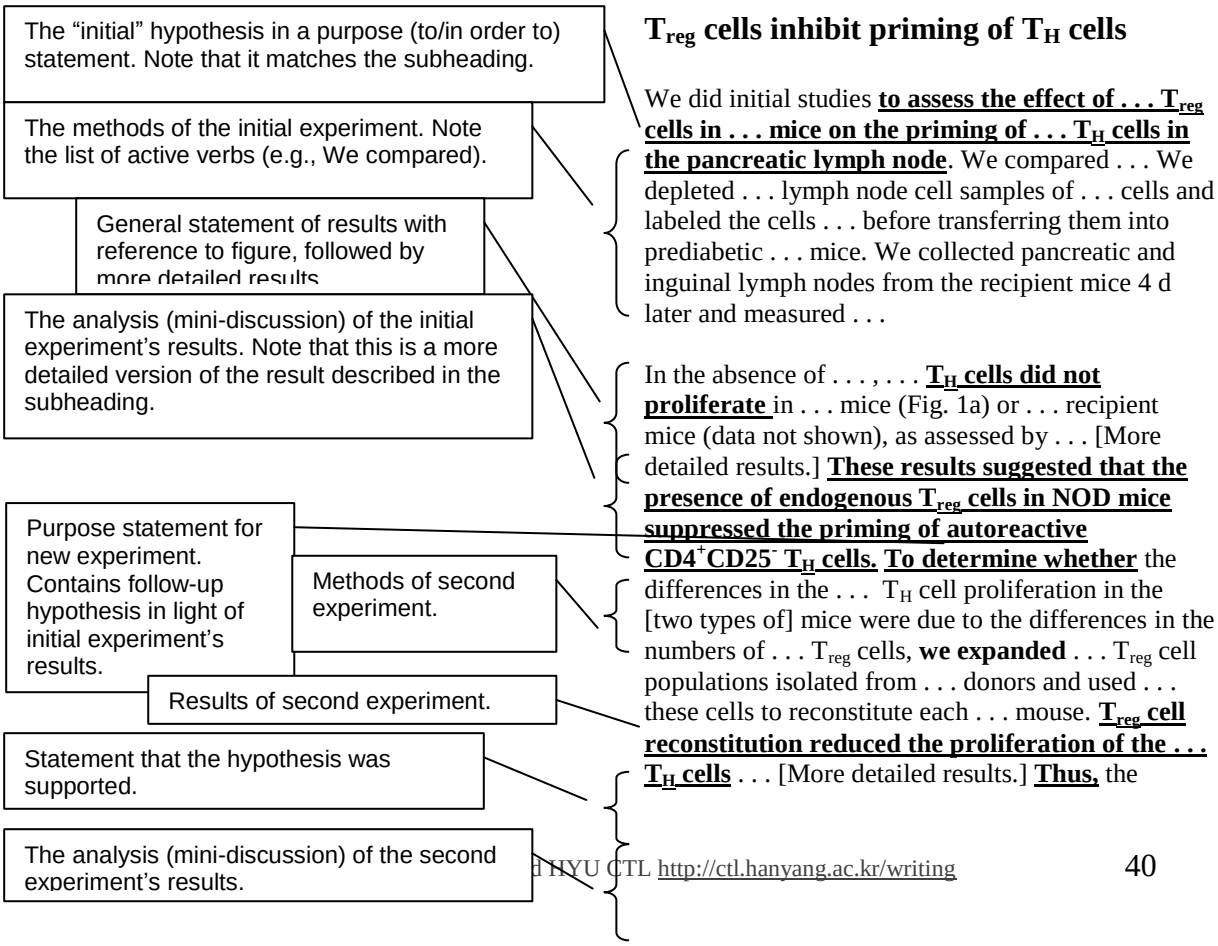
Here are some observations about the results structure of an experimental study in the field of immunology. Relative to clinical papers, the entire article is quite long. Although not all basic science journals follow the pattern, this journal uses an IRD(m) format. In other words, the article contains a short introduction, followed by longer results and discussion sections. Then there is a separate methods section at the end in small print. Only when necessary for understanding the results, a few concise summary statements about the method are provided in the results section as well, as detailed below. In this paper, out of 10 pages, 7.5 are devoted to the results and discussion.

Tang Q, Adams JY, Tooley AJ. Bi M, Fife BT, Serra P, et al. Visualizing regulatory T cell control of autoimmune responses in nonobese diabetic mice. Nat Immunol. 2006 Jan;7(1):83-92.

The results section of this article is very long and contains several subsections, each with its own subheading. The subheadings denote the main findings:

| Subheading | Grammatical Structure |
|---|---|
| $T_{reg}$ cells inhibit priming of $T_H$ cells | Sentence with active verb |
| $T_{reg}$ cells alter $T_H$ cell dynamic activity | Sentence with active verb |
| $T_H$ cell and $T_{reg}$ cell homing | Nouns: this section is a description |
| Lack of stable $T_H$ cell–$T_{reg}$ cell interactions | Shorter version of "there are no stable . . . interactions |
| $T_H$ cells and $T_{reg}$ cells interact with DCs | Sentence with active verb |

Within each subsection, the authors actually describe several cycles of experimentation. In this particular journal, the summary of each cycle is like a mini-research report, containing a hypothesis, description of methods, main result and more detailed results, and an analysis (discussion) of the result. After explaining one procedure's results, the authors draw a brief conclusion that leads to the next procedure. Note: more often, in other journals it is common not to include the whole cycle. In particular, extra method details and analysis belong in the methods and discussion sections, not in the results section (personal communication, Jeehee Youn).



reduced priming and activation of . . . $T_H$ cells in these mice was **not due to** the high frequency of transferred cells. Instead, proliferation of . . . $T_H$ in the pancreatic lymph node inversely correlated with the number of $T_{reg}$ cells in these mice.

The excerpt above contains two full cycles of hypothesis-methods-results-analysis. The first cycle is the initial experiment with tentative, general findings.

The second cycle asks why this result was found. The experiment supports the new hypothesis. The subsection continues from there with several more cycles of experiments.

The third cycle begins, "Next we determined whether reconstitution of [one type of] $T_{reg}$ cells was more effective than [another type of] $T_{reg}$ cells in inhibiting the priming of BDC2.5 T cells in . . . mice." The third cycle is structured exactly like the first two.

From there, the authors go on to answer more questions about their initial findings to verify that the cause-effect relationship still holds under various conditions. They come to their main conclusion, that $T_{reg}$ cells inhibit priming of TH cells. All the additional subsections of the results section tell the story of experiments that help the authors describe the cause and effect process in more detail.

Again, for each procedure and its results, there is a cycle in the structure of a mini-journal article. Each cycle contains, at minimum, purpose and results. Some also contain an initial review of the literature and/or research question and a very brief description of the method used. In this journal, most also contain a brief interpretation of the results, but generally, further analysis of the results should be saved for the discussion section.

Although the subject is difficult, the results section is basically a story—the story of the experiments and thought processes of the authors from beginning to end. What makes it easier to read is the repetition of the same content structure and grammatical features in the description of each experimental cycle, as shown in the table below.

**Sections in the Description of an Experimental Cycle**

| Part of Experimental Cycle | Language to Signal the Part |
|---|---|
| Hypothesis in a purpose statement | (In order) to determine . . . |
| Methods | We did . . .We compared . . .We depleted . . .We collected . . .etc. |
| Results | We detected . . . We almost never found . . . etc. |
| Analysis | These results suggested/demonstrated that . . . indicating that . . . Thus . . . etc. |

Other features of the authors' particular style also make it easier to read. The subheadings use a present tense verb, which is shortest and easiest to read, but the main text uses the past tense, which more accurately reflects the fact that the experiments happened in the past. In this particular article, figures and tables are always mentioned in parentheses, never in the sentences of the text. These authors also tend to use the active voice for their main procedures, but passive for procedures that are not as central for understanding the context of the whole paper.

**Example of Less Central Procedure:**

In the absence of islet antigen . . . TH cells did not proliferate in . . . mice **as assessed by** CFSE dilution using flow cytometry.

The authors also make good use of signaling phrases to organize the text.

**Examples:**

- In fact, . . .
- Moreover, . . .
- In addition, . . .
- Therefore, . . .
- However, . . .
- Furthermore, . . .

# 4.5 Showing Certainty about Claims

The results and discussion sections of a research report focus on making claims and then adding support for those claims.

## 4.5.1 What are "Claims"?

1. Statements about your ideas
2. Statements about your data
3. Statements about other people's ideas and data

In other words, "claim" is a very general word, and there are many claims in a single journal article.

Here is an example of a claim.

**Example:**

Basic claim: An increase in smoking among teenagers caused long-term health problems.

When the proof of your idea or data is clear, you should strengthen your claim. When the evidence is less certain, you should limit or weaken your claim. Below are some examples of strengthening and limiting the example above.

**Examples of Stronger Claims:**

An increase → A sharp increase
caused → undeniably caused, clearly caused, undoubtedly caused, must have caused, etc.
long-term health problems → widespread long-term health problems

You could also add expressions to the beginning of the sentence:

It is clear that an increase . . .
A great deal of evidence leads us to conclude that an increase . . .
We must conclude that an increase . . .

**Examples of Limited Claims:**

An increase → a probable increase
caused → may have caused, seemed to have caused, contributed to, was one cause of, etc.

Again, you could also add expressions to the beginning of the sentence:

We have reason to believe that an increase . . .
It is possible that an increase . . .

Below is a longer list of expressions from Hyland (2004) that strengthen or limit claims. Note that they have a range of meanings, both positive and negative, so choose carefully after looking at several examples from Google Scholar or other published papers.

Hyland, K. Disciplinary Discourses: Social Interactions in Academic Writing. Ann Arbor: U of Michigan; 2004. p. 192.

## 4.5.2 Expressions for Strengthening a Claim

**Nouns**
certainty
evidence
the fact that
(without) question

**Adjectives**
assured
certain that
clear
conclusive
is essential
impossible
improbable
inevitable
least
more than
obvious
plain
precise
reliable
sure
true
unambiguous
undeniable
undoubted
unequivocal
unmistakable
unquestionable
well-known

**Verbs**
conclude
confirm
convince
demonstrate
determine
expect
we find
we know
it is known that/to
perceive
prove
show
surmise
we think

**Modals**
could not
must
will
will not
would not

**Adverbs**
actually
always
assured(ly)
at least
certainly
clear(ly)
conclusive(ly)
convincingly
decided(ly)
definite(ly)
impossibly
improbably
manifest(ly)
more than
necessarily
never
obvious(ly)
particularly
patently
plain(ly)
precise(ly)
quite
reliable/reliably
sure(ly)
unambiguous(ly)
unarguably
undeniably
undoubted(ly)
unequivocal(ly)
unmistakably
unquestionably
wrong(ly)
right(ly)

**Interjections**
of course
doubtless
in fact
indeed
no doubt

**Transition**
given that

## 4.5.3 Expressions for Limiting a Claim

**Adverbs**
admittedly
almost
(not) always
apparently
approximately
basically
conceivable/conceivably
essentially
evidently
formally
frequently
(in) general
generally
hypothetical(ly)
ideally
largely
likely
mainly
maybe
more or less
not necessarily
normally
occasional(ly)
often
ostensibly
partly
partially
perhaps
possible/possibly
predominant(ly)
presumable/presumably
probable/probably
quite
rare(ly)
rather
relatively
seemingly
seldom
somewhat
sometimes
superficially
technically
in theory
theoretically
typically
unlikely
usually
virtually

**Verbs**
appear
argue
assume
believe
claim
deduce
discern
doubt
estimate
guess
hypothesize
(we) imagine
imply
indicate
infer
interpret
perceive
postulate
predict
presume
propose
seen (as)
seem
speculate
suggest
suppose
surmise
suspect
tend

**Modals**
could
may
might
should
should not
would

**Nouns**

assumption
our belief
certain extent
conjecture
contention
implication
possibility
prediction
probability
(general) sense
tendency

**Adjectives**
about
a certain [noun]
around
consistent with
most
open to question
plausible
questionable
uncertain
unclear
unsure

**Transition**
provided that

## 4.5.4 Study Limitations

Near the end of the discussion section of your journal article, you should include a paragraph or two addressing the limitations of your study. This is particularly critical in clinical studies, where not acknowledging limitations could lead clinicians to apply your findings before they have been adequately investigated. Here are some examples adapted from Swales of expressions for limiting claims in the discussion section.

**Expressions for limitations of the study:**

- It should be noted that this study has been **primarily** concerned with . . .
- This analysis has **concentrated on** . . .
- The findings of this study are **restricted to** . . .
- This study has addressed **only** the question of . . .
- The **limitations** of this study **are clear** . . .
- We would like to point out that **we have not** . . .

**Expressions for stating conclusions that should NOT be drawn:**

- However, the findings **do not imply**
- The results of this study **cannot be taken as evidence** for . . .
- Unfortunately, we are **unable to determine** from this data . . .
- The **lack of** . . . means that we **cannot be certain** . . .

**Expressions for very limited studies:**

- **Notwithstanding** its **limitations**, this study **does suggest** . . .
- **Despite** its **preliminary** character, the research reported here **would seem to indicate** . . .
- **However exploratory**, this study **may offer some insight** into . . .

## 4.5.5 Using modals to strengthen or limit a claim

One of the groups of words in each of the two lists above is modals. Modals (can, may, could, etc.) can strengthen or limit a claim. In fact, modals are probably the most common way to show degree of certainty. However, they are very difficult to define for English learners. There is no exact translation among different languages. Here is a more detailed description of the modals. More examples follow later in this chapter.

| | Description | Examples |
|---|---|---|

| | | |
|---|---|---|
| **Past and present: no modal. Just a regular verb**<br><br>**Future: WILL** | Giving generalizations: statements that people in the field generally agree on<br><br>OR<br><br>Citations: Summarize the findings of others (report, describe, demonstrate, show, prove, etc.).<br><br>OR<br><br>Reporting certain results: May be proven mathematically. (Rare in biomedical science.)<br><br>AND<br><br>Predictions: No or little doubt about the future. | **Generalization:**<br><br>1. Prevalence of mixed depression, a combination of depression and manic or hypomanic symptoms, **<u>is</u>** high in patients with bipolar disorders.<br><br>Benazzi F. Bipolar disorder—focus on bipolar II disorder and mixed depression. Lancet. 2007 Mar 17;369(9565):935-45.<br><br>**Citation:**<br><br>2. Genetic studies[11] **<u>show</u>** high heritability of the trait, and segregation analysis suggests the presence of an autosomal codominant major gene conferring susceptibility to podoconiosis.<br><br>Davey G, Newport M. Podoconiosis: The most neglected tropical disease? Lancet. 2007 Mar 17;369(9565):888-9.<br><br>**Prediction:**<br><br>3. Those likely to be sick will face ever increasing premiums, and voluntary coverage **<u>will</u>** continue to decline.<br><br>Luft HS. Universal health care coverage: a potential hybrid solution. JAMA. 2007 Mar 14;297(10):1115-8. |
| **CAN** | Possibility: It is possible, but will not happen every time.<br><br>OR<br><br>Ability | **Possibility:**<br><br>1. Recent studies [3,4,36–38] have shown that therapeutic hypothermia **<u>can</u>** result in better outcomes for patients with out-of-hospital ventricular fibrillation.<br><br>SOS-KANTO study group. Cardiopulmonary resuscitation by bystanders with chest compression only (SOS-KANTO): an observational study. Lancet. 2007 Mar 17;369(9565):920-6.<br><br>**Ability:**<br><br>2. How **<u>can</u>** we explain the discrepancy between studies of mite avoidance in children that suggest some benefit [6,8,17] and the data from our study and other studies involving adults that show no improvement in asthma control? [5,10,21]<br><br>Woodcock A, Forster L, Matthews E, Martin J, Letley L, Vickers M, et al. Control of exposure to mite allergen and allergen-impermeable bed covers for adults with asthma. N Engl J Med. 2003 Jul 17;349(3):225-36. |
| **WOULD** | Limited by a condition: Often used with an "if" subordinate clause that describes the condition. (The "if" clause is usually unstated when it is clear from the context.) | **Limited by a condition:**<br><br>1. This fundamental restructuring of the payment system **<u>would</u>** achieve both universal coverage and improved efficiency [if . . . ].<br><br>Lurie N, Dubowitz T. Health Disparities and Access to Health. JAMA. 2007 Mar 14;297(10):1118-21.<br><br>2. [If . . . ] the best impetus for change **<u>would</u>** result not from litigation, regulation, or other outside forces, but from within the health care system. |

| | | |
|---|---|---|
| | Other uses:<br><br>"We would (like to) [reporting verb]. . ." This is a special expression that allows you to use reporting verbs for yourself.<br><br>OR<br><br>Past tense of WILL | Kirschner KL, Breslin ML, Iezzoni LI. Structural Impairments That Limit Access to Health Care for Patients With Disabilities. JAMA. 2007 Mar 14;297(10):1121-5.<br><br>**Using a reporting verb with "we":**<br><br>3. We **would** like to emphasize that we cannot prove whether the measured antimyelin antibodies in our patients are antibodies with demyelinating capacity or whether they represent an epiphenomenon of myelin destruction.<br><br>Berger T, Rubner P, Schautzer F, Egg R, Ulmer H, Mayringer I, et al. Antimyelin antibodies as a predictor of clinically definite multiple sclerosis after a first demyelinating event. N Engl J Med. 2003 Jul 10;349(2):139-45.<br><br>4. . . . we **would** recommend the use of a technique including predilation with shorter balloons, the use of longer single stents in order to cover the entire zone of balloon injury, . . .<br><br>Moses JW, Leon MB, Popma JJ, Fitzgerald PJ, Holmes DR, O'Shaughnessy C, et al. Sirolimus-eluting stents versus standard stents in patients with stenosis in a native coronary artery. N Engl J Med. 2003 Oct 2;349(14):1315-23.<br><br>5. Our hypothesis was that high-intensity warfarin **would** be more effective than moderate-intensity therapy.<br><br>Crowther MA, Ginsberg JS, Julian J, Denburg J, Hirsh J, Douketis J, et al. A comparison of two intensities of warfarin for the prevention of recurrent thrombosis in patients with the antiphospholipid antibody syndrome. N Engl J Med. 2003 Sep 18;349(12):1133-8. |
| **SHOULD** | Reasonable expectation (more than 50%)<br><br>OR<br><br>Stating limitations indirectly (a "recommendation" to oneself)<br><br>Other Uses:<br><br>Making recommendations about future studies or clinical treatment | **Reasonable expectation:**<br><br>1. D-Dimer is a marker of endogenous fibrinolysis and **should** therefore be detectable in patients with deep-vein thrombosis.<br><br>Wells PS, Anderson DR, Rodger M, Forgie M, Kearon C, Dreyer J, et al. Evaluation of D-dimer in the diagnosis of suspected deep-vein thrombosis. N Engl J Med. 2003 Sep 25;349(13):1227-35.<br><br>**Stating limitations indirectly:**<br><br>2. Potential limitations of our study **should** be acknowledged.<br><br>**Recommendation about future studies:**<br><br>3. Further analysis of these mice **should** more clearly define the contribution of SDF1 in this setting and, more globally, to the nonredundant roles for RBP2 demethylase activity in vivo.<br><br>Klose RJ, Yan Q, Tothova Z, Yamane K, Erdjument-Bromage H, Tempst P, et al. The retinoblastoma binding protein RBP2 is an H3K4 demethylase. Cell. 2007 Mar 9;128(5):889-900.<br><br>**Recommendations about clinical treatment:** |

| | | |
|---|---|---|
| | | 4. … the decision to perform ablation **should** also take into account the risk of a fatal complication.<br><br>Pappone C, Santinelli V, Manguso F, Augello G, Santinelli O, Vicedomini G, et al. A randomized study of prophylactic catheter ablation in asymptomatic patients with the Wolff-Parkinson-White syndrome. N Engl J Med. 2003 Nov 6;349(19):1803-11.<br><br>5. Both generalists and medical subspecialists **should** recommend influenza vaccinations to their elderly and high-risk patients.<br><br>Nichol KL, Nordin J, Mullooly J, Lask R, Fillbrandt K, Iwane M. Influenza vaccination and reduction in hospitalizations for cardiac disease and stroke among the elderly. N Engl J Med. 2003 Apr 3;348(14):1322-32. |
| **MAY** | Possibility (some doubt): Very common for reporting results cautiously. | **Possibility:**<br><br>1. The cohort study had a small number of participants, unaccounted crossover between the groups, and large loss to follow-up, which **may** have affected the validity of the results.<br><br>Sambunjak D, Straus SE, Marusić A. Mentoring in academic medicine: A systematic review. JAMA. 2006 Sep 6;296(9):1103-15. |
| **COULD** | Possibility (more doubt): More cautious than CAN<br><br>Common with "whether"<br><br>Other Uses:<br><br>Past tense of CAN | **Possibility:**<br><br>1. It is possible that the presence of these mutant p53 proteins in human tumors **could** negatively affect the outcome of functional p53 restoration depending on how p53 function is restored.<br><br>Kastan MB. Wild-Type p53: Tumors Can't Stand It. Cell. 2007 Mar 9;128(5):837-40.<br><br>**With "whether":**<br><br>2. It remains to be determined **whether** mutations in *MC4R* **could** be one cause of long-term treatment failure.<br><br>Branson R, Potoczna N, Kral JG, Lentes KU, Hoehe MR, Horber FF. Binge eating as a major phenotype of melanocortin 4 receptor gene mutations. N Engl J Med. 2003 Mar 20;348(12):1096-103.<br><br>**Past tense of "can":**<br><br>3. Patients were contacted by telephone every 7 to 14 days so that investigators **could** monitor compliance and safety.<br><br>Rowbotham MC, Twilling L, Davies PS, Reisner L, Taylor K, Mohr D. Oral opioid therapy for chronic peripheral and central neuropathic pain. N Engl J Med. 2003 Mar 27;348(13):1223-32. |
| **MIGHT** | Possibility: Same strength as COULD | **Possibility:**<br><br>1. Reactive T cells **might** produce higher levels of interleukin 5, stimulating tissue cosinophilia and subsequent pruritus.<br><br>Byrd JA, Scherschun L, Chaffins ML, Fivenson DP. Eosinophilic dermatosis of myeloproliferative disease: Characterization of a unique eruption in patients with hematologic disorders. Arch Dermatol. 2001 Oct;137(10):1378-80. |

| | | |
|---|---|---|
| | | |

## 4.5.6 Strength of Claim
## Examples in Context

As Turner has noted,

> Generally those fields that have fewer variables or variables that can be controlled in the laboratory or tested or simulated mathematically are much more likely to use the present tense to give their conclusions. Those fields . . . involving human beings or natural process that are hard to isolate in life sciences and medicine are more likely to use model forms (may, etc.) to discuss results.

Thus research reports in biomedical engineering and bioinformatics, for example, will often contain stronger claims than, for example, clinical psychology. The best way to choose the right forms for your own writing is to emulate good writers in your own field. Try searching a collection of PDF files of published articles for modals and the other expressions listed above. Observe how each is used in context, just as the following discussion section is analyzed below.

In the following excerpts from a discussion section, the expressions for strength of claim are underlined. Note that some are exact statistical statements (e.g. significant), and others are more vague (e.g. nearly all). Also note that the authors tend to use different expressions in each part of the discussion section.

The article tested the benefits of providing children under 4 years old with zinc dietary supplements. The first excerpt comes from the very beginning of the discussion section, where the authors summarize the findings they have already presented in the results section. They use a variety of expressions to show the strength or weakness of each claim.

Sazawal S, Black RE, Ramsan M, Chwaya HM, Dutta A, Dhingra U, et al. Effect of zinc supplementation on mortality in children aged 1–48 months: a community-based randomised placebo controlled trial. Lancet. 2007 Mar 17;369(9565):927-34.

**Example:**

In our study, zinc supplementation did not result in a **significant** reduction in **overall** mortality in children aged 1–48 months in a population with high malaria transmission. However, **there was a suggestion that** the effect varied by age, with no effect on mortality in infants, and a **marginally significant** 18% reduction of mortality in children 12–48 months of age (p=0·045). This effect was **mainly** a consequence of fewer deaths from malaria and other infections. Any effect on mortality in this trial was in addition to a **possible** effect of vitamin A supplementation . . .

The second excerpt suggests several possible interpretations of one result, that zinc supplements did not have a measurable affect on infants less than 1 year old. Note that the authors use “might” and “could” frequently and alternate the two expressions for variety. The discussion is framed at the beginning and end with two other expressions: possible and suggest(ion).

**Example:**

There are several **possible** explanations for the absence of effects of zinc supplementation in children younger than 12 months. Infants **might** have acquired adequate zinc in utero . . . Alternatively, the absence of effect in this age group **might** be related to the low 5 mg dose used. . . Effects of zinc **might** be mediated through improvement in immunity . . . and this effect **could** be restricted in infants . . . [V]ariation in response to zinc supplements in infants in different populations **might** be expected. Our findings of no effect in infants need further investigation . . . because they **could** have important implications for targeting of children who would benefit from additional zinc. . . Nutritional and immunological differences **might** affect responses to infections and survival. . . Thus, the results of this large community-based placebo controlled zinc supplementation trial

**suggest** that . . . zinc supplementation did not have any effect on mortality in infants, but there **was a suggestion of** reduced mortality in children older than 1 year.

The last section of the discussion offers suggestions for future research. Note the use of "would" in the suggested hypothesis statement. This is a rewritten version of the Yes/No question: "Would a higher dose have a different effect?" As usual, "would" is combined with an implied "if." "If we did another study, would a higher dose. . .?" For more information on how to write research questions, see the Introductions chapter.

**Example:**
Feasible and sustainable methods of enhancing the bioavailable intake of dietary zinc need assessment. We also need to know whether a higher dose **would** have a different effect in infants, and to elucidate the mechanisms of the effects of zinc and any differences between boys and girls. Our results **suggest** a need for meta-analysis of all available studies both for mortality and morbidity to make evidence based recommendation for public health policy to improve mortality, morbidity, growth, and development.

Sazawal S, Black RE, Ramsan M, Chwaya HM, Dutta A, Dhingra U, et al. Effect of zinc supplementation on mortality in children aged 1–48 months: a community-based randomised placebo controlled trial. Lancet. 2007 Mar 17;369(9565):927-34.

# 4.6 Recommended Reading

See Chapter 4 of the textbook *Academic Writing for Graduate Students* for more detailed advice on modifying the strength of claims. Although the book is directed at graduate students, there are also a number of grammar and style tips on other topics that would be helpful even to those who have already earned their degrees.

Swales JM, Feak CB. *Academic Writing for Graduate Students, 2nd ed*. Ann Arbor: U of Michigan; 2004.

# 4.7 Checklists for Evaluating Your Writing

The following two checklists are excerpted from Adam Turner's *English Solutions for Engineering Research Writing* (2006). Although they were originally written for evaluating engineering journal articles, all the points are relevant to biomedical research writing.

## 4.7.1 Results Section Checklist

1. I do not merely describe all of the results, but interpret the important results for the reader. I use words like "significant, moderate, unexpectedly, surprisingly and interestingly," to interpret the results and not just give a list of results.
2. If appropriate, I have pointed out any problems or inconsistencies with the data (not the
3. same as limitations of the paper).
4. If my results are statistical, I have done all the necessary tests to determine the validity of the results.
5. If my paper does not have a separate "Discussion" section, I have included references that compare my findings with the results in previous research papers.
6. I have used the past tense to talk about the specific results of my paper but I have used the present tense to talk about descriptions of figures or tables and generalizations based on my results of general statements about my whole field.
7. My tables have titles on the top but my figures have captions on the bottom. □

## 4.7.2 Discussion/Conclusion Section Checklist

1. I discuss only the most significant findings and do not simply repeat the results section with more commentary.
2. I have noted any problems with the methods or data. I note the implications of these problems and how they might affect the validity of my conclusions.

3. My discussion section includes references from other papers to either support or compare my research.
4. I have explained why my results differ from previous research if applicable.
5. I have analyzed the structure of papers in my field to understand the relationship between the results, discussion and conclusion sections.
6. I have identified and clearly explained the importance of the findings for the field as a whole.
7. I have mentioned whether my results support or differ from previous research in the field. If they differ, I have attempted to explain why.
8. I have mentioned some possible areas for further research, the importance of the findings or the implications and possible applications of the research (not all are required in all fields).

# 5.0 The Journal Article Abstract

The abstract is the most important part of a journal article. It is the most widely read, and it includes all the main points. However, it may also be the most difficult to write. So much must be included within a limited number of words. This chapter will review the structure of abstracts, address issues specific to medical abstract writing, and present a number of language tips for writing abstracts in English.

## 5.1 Comparison of Abstracts and Journal Articles

The following chart shows similarities and differences between a journal article abstract and the main body of a journal article.

<table>
<tr><th>Abstract</th><th>Article</th></tr>
<tr><td>Audience: People searching in the library.</td><td>People doing similar research read and sometimes cite the paper.</td></tr>
<tr><td>Audience: People reading abstract collections.</td><td>Graduate students may be required to read the paper in survey courses.</td></tr>
<tr><td>Audience: All article readers.</td><td>Only a few practitioners read the whole paper.</td></tr>
<tr><td>Audience: Almost all readers only read the abstract (anecdotal estimate 95%).</td><td>Relatively few people read some or all of the article (anecdotal estimate 5%).</td></tr>
<tr><td>Purpose 1: Summarize the article.</td><td rowspan="2">Purpose: Participate in the academic community.</td></tr>
<tr><td>Purpose 2: “Sell” your paper.</td></tr>
<tr><td>Read first</td><td>Almost always read after the abstract</td></tr>
<tr><td>Written last</td><td>Almost always written before the final draft of the abstract</td></tr>
<tr><td>Short word limit</td><td>Longer word limit</td></tr>
<tr><td>May be translated into several languages</td><td>Is normally written in one language</td></tr>
<tr><td>Reader may have knowledge of the background of and justification for your study</td><td>Reader should learn the background of and justification for your study from the text</td></tr>
<tr><td>Reader should be able to understand your main findings</td><td>Reader should learn the details, limits, and implications of your results</td></tr>
<tr><td>Knowledgeable reader can understand the basics, but not critique or replicate your study (exception: clinical medicine)</td><td>Reader should be able to understand, critique, and replicate your study</td></tr>
<tr><td colspan="2">Agree on all details</td></tr>
<tr><td colspan="2">Use the same writing style, formality</td></tr>
<tr><td colspan="2">Both must meet the requirements of the journal guidelines</td></tr>
<tr><td colspan="2">Each can be read independently of the other text</td></tr>
<tr><td colspan="2">Follow the same structure</td></tr>
</table>

# 5.2 The Structure and Content of Abstracts

## 5.2.1 Structured Abstracts

All good abstracts have a structure. However, "structured abstracts" are those with a particular structure required by the journal editor. A structured abstract is divided into sections with headings in bold print, like the following example from the medical journal *BMJ*. Note that other journals may use different headings.

---

**Example:**

**Advice to use topical or oral ibuprofen for chronic knee pain in older people: randomised controlled trial and patient preference study**

**Objective** To determine whether older patients with chronic knee pain should be advised to use topical or oral non-steroidal anti-inflammatory drugs (NSAIDs).
**Design** Randomised controlled trial and patient preference study.
**Setting** 26 general practices.
**Participants** People aged ≥ 50 with knee pain: 282 in randomised trial and 303 in preference study.
**Interventions** Advice to use topical or oral ibuprofen.
**Primary outcome measures** WOMAC (Western Ontario and McMaster Universities) osteoarthritis index, major and minor adverse effects.
**Results** Changes in global WOMAC scores at 12 months were equivalent. In the randomised trial the difference (topical minus oral) was two points (95% confidence interval –2 to 6); in the preference study, it was one point (–4 to 6). There were no differences in major adverse effects in the trial or study. The only significant differences in secondary outcomes were in the randomised trial. The oral group had more respiratory adverse effects (17% *v* 7%,95% confidence interval for difference –17% to –2%), the change in serum creatinine was 3.7 mmol/l less favourable (0.9 µmol/l to 6.5 µmol/l); and more participants changed treatments because of adverse effects (16% *v* 1%, –16% to –5%). In the topical group more participants had chronic pain grade III or IV at three months, and more participants changed treatment because of ineffectiveness.
**Conclusions** Advice to use oral or topical preparations has an equivalent effect on knee pain over one year, and there are more minor side effects with oral NSAIDs. Topical NSAIDs may be a useful alternative to oral NSAIDs.

Underwood M, Ashby D, Cross P, Hennessy E, Letley L, Martin J, et al. Advice to use topical or oral ibuprofen for chronic knee pain in older people: randomised controlled trial and patient preference study. BMJ. 2008 Jan 19;336(7636):138-142.

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The structured abstract was originally developed for a unique audience—in this case, practitioners. It is designed for clinicians who don't have time to read the whole article and may often not be doing research at all. However, if you are a lab scientist, don't skip to the next section yet. The trend toward requiring structured abstracts is gradually spreading throughout the experimental sciences. Even if your field's key journals don't use structured abstracts yet, they may soon. It's a good idea to be familiar with how structured abstracts work.

Because the "conclusions" section of a structured abstract is separate, readers may even read only that portion of the abstract. On the other hand, the structured abstract contains more detail about methods and results than a normal abstract, so that it's possible to make a tentative critique of the quality and value of the study.

A clinical journal's author's guidelines usually list the required structured abstract headings. Sometimes there are variations for different types of articles. For example, *BMJ*'s guidelines allow for fewer headings for qualitative studies, and a completely different set of headings for quality improvement articles. In addition, the BMJ guidelines say, "If the standard headings do not suit the type of study, substitute something sensible such as 'population' as a heading instead of "participants" in an economics article. Please do not simply delete the heading."

Whichever set of headings you use, it is possible to write brief notes instead of complete sentences for some of the headings. For example, another article in the same journal issue included an abstract with only the word "Tanzania" after the heading *Setting*.

Lubell Y, Reyburn H, Mbakilwa H, Mwangi R, Chonya S, Whitty CJ, et al. The impact of response to the results of diagnostic tests for malaria: cost-benefit analysis. BMJ. 2008 Jan 26;336(7637):202-5.

It is also unnecessary to use the headings in the abstract as the subheadings in the body of the paper. For example, in the abstract above, the headings are as follows: *Objectives, Design, Setting, Participants, Interventions, Primary Outcome Measures, Results, Conclusions*. However, the body of the paper is divided into the following sections and subsections:

**Introduction**

**Method**

- Recruitment
- Quality control
- Assignment
- Participant flow and follow-up
- Intervention
- Masking
- Outcome measures
- Adverse effects
- Prescribing data
- Sample size
- Analysis

**Results**

- Participant recruitment
- Baseline characteristics
- Follow-up
- Primary outcome
- Adverse effects
- Secondary outcomes
- Adherence with treatment route

**Discussion**

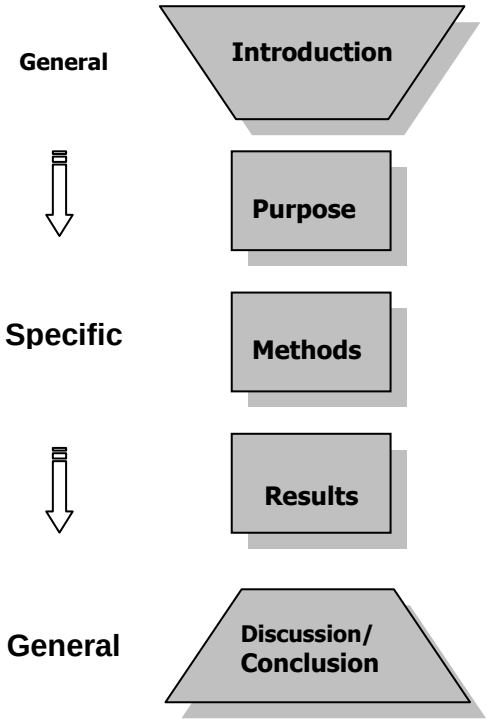
- Main findings
- Preferences
- Applicability to routine practice
- Statistical power
- Potential for bias
- Use of prescribed medication
- Meaning of the study

Structured abstracts tend to be longer than traditional abstracts. However, the journal typically has some kind of word limit. Keep in mind that the journal database MEDLINE will cut off anything longer than 4096 characters. You can count the number of characters automatically in MS Word by going to Tools > Word Count and viewing Characters (with spaces). In Korean: 도구(T) > 단어개수(W) > 문자 수(공백포함).

## 5.2.2 Unstructured Abstracts

Outside of journals for practitioners, such as physicians and nurses, most biomedical journals do not yet require structured abstracts. Instead, you as the author have the freedom to allocate the limited space as you choose. Nevertheless, there are some common practices for organizing the abstract of a research report.

First of all, abstracts present material in the same order as the body of the paper. However, some sections of the paper contribute more detailed information to the abstract, while other sections can almost be skipped. The typical experimental or engineering paper in biomedicine will use the most abstract space for results. However, in areas of biomedicine more related to social science, such as epidemiology and many subfields of nursing, the introduction may deserve more abstract space. If your paper presents a new research or clinical procedure, the method section of the abstract will be larger. The discussion/conclusion section is often dealt with only briefly because it cannot be summarized in a short space.




## 5.2.3 Structure of the Abstract Detailed

The following list (Turner, 2006) includes the various sections that may exist in a research report abstract. Keep in mind that most abstracts do not include all these sections, and they do not appear in a particular order. I recommend that you take three well-written articles from your own subfield and identify which of the following sections appear in their abstracts. Those are probably the sections that you will need when you write your own abstract.

| | |
|---|---|
| **1. Introduction** | |
| A. Background of the research | |
| B. Research problem or research questions | |
| C. Gap or lack of research in the field | More common in social sciences and almost required in dissertation writing to show that your thesis is a significant document. |
| D. Purpose of the paper | Many sciences and engineering abstracts do not have much background but start with the purpose of the research or even the method. |
| E. Description of the paper | Summarizes what the paper does. |
| **2. Methods** | Methods sections are generally longer in Dissertations. Smaller in other abstracts. |
| **3. Results** | Many scientific abstracts concentrate more on the results rather than the Introduction or Conclusion. |
| **4. Conclusion** | Main contribution of the paper. May be hard to distinguish |

| | |
|---|---|
| | from results. |
| A. Blueprint: introduction of topics or issues that will be discussed | More likely in papers that are not based on an experimental design and in the social sciences. |
| B. Recommendations | More common in social sciences, medicine and nursing. Recommendations to change policies, etc. |
| C. Implications | Importance of the results for the field as a whole. |

Turner A. English Solutions for Engineering Writing. Hanyang University Center for Teaching and Learning; 2007.

## 5.2.4 Example Unstructured Abstract

Below is an example of an unstructured abstract. It summarizes an article about people with asthma who cannot tolerate taking aspirin. The research focuses on identifying the genes connected to this intolerance. These researchers looked for a different genetic cause that others have not considered (the gap in the research). Note that they devote more than half of the abstract to methods and results. I have underlined some key words that clarify the organization of the text. Try reading only the underlined parts to see how clear the structure is, even though this is an "unstructured" abstract.

| **1. Introduction** | |
|---|---|
| Background of the research | Genetic predisposition is linked to the pathogenesis of aspirin-intolerant asthma (AIA). |
| Gap or lack of research in the field | **Most** candidate gene **approaches have focused on** leukotriene-related pathways, **while there have been relatively few studies evaluating** the effects of polymorphisms in prostanoid receptor genes on the development of AIA. |
| Research question | **Therefore, we investigated** the potential association between prostanoid receptor gene polymorphisms and the AIA phenotype. |
| **2. Methods**<br><br>(note the transition to the results in mid-sentence) | **We screened for** genetic variations in the prostanoid receptor genes *PTGER1, PTGER2, PTGER3, PTGER4, PTGDR, PTGIR, PTGFR*, and *TBXA2R* using direct sequencing, **and selected** 32 tagging single nucleotide polymorphisms (SNPs) among the 77 polymorphisms with frequencies >0.02 based on linkage disequilibrium for genotyping. **We compared** the genotype distributions and allele frequencies of three subject groups [108 patients with AIA, 93 patients with aspirin-tolerant asthma (ATA), and 140 normal controls]. **Through association analysis studies** of the 32 SNPs, . . . |
| **3. Results** | . . . **the following** SNPs **were found** to have significant associations with the AIA phenotype: -616C>G ($P$ = 0.038) and -166G>A ($P$ = 0.023) in *PTGER2*; -1709T>A ($P$ = 0.043) in *PTGER3*; -1254A>G ($P$ = 0.018) in *PTGER4*; 1915T>C ($P$ = 0.015) in *PTGIR*; and -4684C>T ($P$ = 0.027) and 795T>C ($P$ = 0.032) in *TBXA2R*. In the haplotype analysis of each gene, **the frequency** of *PTGIR* ht3[G-G-C-C], which includes 1915T>C, **differed significantly between** the AIA patients and ATA patients ($P$ = 0.015). |
| **4. Conclusion** | |
| Implications | **These findings suggest that** genetic polymorphisms in *PTGER2, PTGER3, PTGER4, PTGIR*, and *TBXA2R* play important roles in the pathogenesis of AIA. |

## 5.2.5 Other Types of Abstracts

There are a number of types of abstracts other than the standard journal article abstract. Here are three common ones.

### Abstracts for General Audiences

A simplified summary for more general audiences is often found introducing articles in journals like *Nature*, *Science*, and *Proceedings of the National Academy of Sciences*. The article may be quite technical, but the abstract is much simpler. Readers of the abstract are more likely to be from other academic disciplines, or even be laypeople (with no advanced formal education in science).

**Example:**

**Modeling the Heart—from Genes to Cells to the Whole Organ**

Successful physiological analysis requires an understanding of the functional interactions between the key components of cells, organs, and systems, as well as how these interactions change in disease states. This information resides neither in the genome nor even in the individual proteins that genes code for. It lies at the level of protein interactions within the context of subcellular, cellular, tissue, organ, and system structures. There is therefore no alternative to copying nature and computing these interactions to determine the logic of healthy and diseased states. The rapid growth in biological databases; models of cells, tissues, and organs; and the development of powerful computing hardware and algorithms have made it possible to explore functionality in a quantitative manner all the way from the level of genes to the physiological function of whole organs and regulatory systems. This review illustrates this development in the case of the heart. Systems physiology of the 21st century is set to become highly quantitative and, therefore, one of the most computer-intensive disciplines.

Noble D. Modeling the Heart—from Genes to Cells to the Whole Organ. Science. 2002 Mar 1;295(5560):1678-82. Review.

### Abstracts for Review Articles

Reviews and minireviews in most journals are aimed at a less general audience than *Science* and *Nature*, but more general than that of complete journal articles. They summarize and discuss the work of several studies. The whole article, not just the abstract, is meant for the general audience. Here is an example of the abstract of a review from a journal about the brain.

**Example:**

**Is There A Link Between Adult Neurogenesis and Learning?**

During the past several years, evidence has accumulated suggesting a relationship between newly born cells in the hippocampus and various types of learning and memory. However, most of the evidence is correlational and some of it does not agree. This review discusses both sides of this issue, considering the effects of learning on the production of new neurons in the dentate gyrus and the question of whether newly born cells participate in learning and memory.

Leuner B, Gould E, Shors TJ. Is there a link between adult neurogenesis and learning? Hippocampus. 2006;16(3):216-24. Review.

### Abstracts for Case Reports

Clinical case studies sometimes have an abstract. Because they are often quite short, some journals do not allow an abstract. Other journals require one. Here is an example of a case report abstract. Note how brief it is. For more information about case studies, see the chapter on clinical case reports.

**Example:**

**Bell's palsy associated with influenza vaccination: Two case reports**

The etiology of Bell's palsy is often unknown. We present herein two cases of adults who developed a Bell's palsy following the administration of an influenza vaccine. While the incidence is low, with the widespread

recommendation for annual influenza vaccines, patients should be apprised of the possibility of this complication and the benefit of early treatment.

Chou CH, Liou WP, Hu KI, Loh CH, Chou CC, Chen YH. Bell's palsy associated with influenza vaccination: Two case reports. Vaccine. 2007 Apr 12;25(15):2839-41.

## 5.3 Issues Unique to Abstracts in Biomedical Journals

Natural science, medicine and engineering represent the great majority of published academic research. However, it is biomedicine in particular that faces the most critical issues regarding quality of research publication for the following reasons:

1. Many studies address questions of human life or death.
2. Business (especially pharmaceutical) interest in publishing biased results exerts great pressure on editorial boards.
3. Within the sciences, particularly some areas of biomedical science, the pressure to publish is even more intense than in other fields.
4. The total time from submission to publication is relatively short.
5. Scholars around the world from various cultural and ethical traditions are participating in the publication process.

All of these factors apply pressure to the quality and accuracy of medical journal articles, and particularly the titles and abstracts, which are most widely read.

These results follow:

1. A great deal of research on medical journal article and abstract writing is being published.
2. Researchers are finding a large number of errors and ambiguities in biomedical articles, particularly clinical studies.
3. The field is ahead of others in developing strict standards for journal article and abstract writing.

The following three lists provide specific advice based on this recent research. The first is a list of criteria for abstracts of clinical papers suggested by the *Journal of the American Medical Association (JAMA)*. The second is even more specific. Its authors used the 30 questions to evaluate dermatology abstracts, but most of the questions should apply across medicine and nursing. The third is a checklist specifically for randomized controlled trials.

### Quality Criteria [for Abstracts of Articles Published in JAMA]

1. Abstract headings are consistent with structured abstract format.
2. Data in abstract are consistent with text, tables, and figures.
3. Data or information in the abstract are presented in the text, tables, or figures.
4. Years of study and length of follow-up are provided.
5. Results for Main Outcome Measures are presented in Results section (avoid selective reporting).
6. Results are quantified with numerators, denominators, odds ratios, and confidence intervals where appropriate.
7. Absolute differences rather than relative differences are presented wherever possible (e.g., "Mortality declined from 6% to 3%" rather than "Mortality declined 50%").
8. For randomized trials, analysis is identified as intent-to-treat or evaluable patient analysis.
9. For surveys, response rate is provided in the Results or Design.
10. For multivariate analysis, factors controlled for in model are briefly summarized.
11. Conclusions follow from information contained within the abstract.

List quoted from: Winker MA. The need for concrete improvement in abstract quality. JAMA. 1999 Mar 24-31;281(12):1129-30.

## Abstract Quality Scale

| Category | Criterion |
|---|---|
| Objective | Was any information on the objective given? |
| | Was the objective explicitly stated? |
| | Was the main objective distinguished from secondary ones? |
| Design | Was any information on the research design given? |
| | Were technical descriptors* used? |
| | If a follow-up study, was the duration given? |
| Setting | Was any information on the setting given? |
| | Was the level of clinical care (e.g., primary care) indicated? |
| Subjects | Was any information on the subjects given? |
| | Were common demographic characteristics given? |
| | Were technical descriptors* of subject selection (e.g., random sample) used? |
| | Was the number of subjects indicated? |
| | Were the response and refusal rates indicated? |
| | Was the number of dropouts and losses indicated? |
| | If the samples were matched, were matching characteristics given? |
| Intervention† | Was any information on the intervention given? |
| | Was a description given? |
| | Was the duration indicated? |
| Measurement of Variables | Was any information on the measures given? |
| | Were the variables explicitly given? |
| | Was the source of data given? |
| | If the measurements were subjective, was blinding (or nonblinding) of the observer mentioned? |
| Results | Were any results given? |
| | Were they directly related to the objective? |
| | Were the appropriate numeric data given? |
| Conclusions | Were any conclusions drawn? |
| | Were they directly related to the objective? |
| | Were they consistent with the results? |
| | Were the study's limitations mentioned? |
| | Were the study's implications mentioned? |

* Technical descriptors refer to those listed by the Ad Hoc Working Group for Critical Appraisal of the Medical Literature.
† Intervention category was quoted only for therapeutic trials.

Dupuy A, Khosrotehrani K, Lebbé C, Rybojad M, Morel P. Quality of abstracts in 3 clinical dermatology journals. Arch Dermatol. 2003 May;139(5):589-93.

### Items to Include when Reporting a Randomized Trial in a Journal or Conference Abstract

| Item | Description |
|---|---|
| Title | Identification of the study as randomized |
| Authors | Contact details for the corresponding author |
| Trial design | Description of the trial design (e.g. parallel, cluster, non-inferiority) |
| Methods | |
| Participants | Eligibility criteria for participants and the settings where the data were collected |
| Interventions | Interventions intended for each group |
| Objective | Specific objective or hypothesis |
| Outcome | Clearly defined primary outcome for this report |
| Randomization | How participants were allocated to interventions |
| Blinding (masking) | Whether or not participants, care givers, and those assessing the outcomes were blinded to group assignment |
| Results | |
| Numbers randomized | Number of participants randomized to each group |
| Recruitment | Trial status |
| Numbers analysed | Number of participants analysed in each group |
| Outcome | For the primary outcome, a result for each group and the estimated effect size and its precision |
| Harms | Important adverse events or side effects |
| Conclusions | General interpretation of the results |
| Trial registration | Registration number and name of trial register |
| Funding | Source of funding |

Hopewell S, Clarke M, Moher D, Wager E, Middleton P, Altman DG, et al.; CONSORT Group. CONSORT for reporting randomized controlled trials in journal and conference abstracts: explanation and elaboration. PLoS Med. 2008 Jan 22;5(1):e20.

## 5.4 The Language of Abstract Writing

Here are some of the characteristics of abstract language.

### 1. Often Uses the Third Person

In other words: he/she/it/they, not I/we/you

**Examples:**

It was found that . . .

Choi reported . . .

Oxygen was administered . . .

Patients with low immunity recovered . . .

### 2. Often Uses Passive Voice Verbs to Describe the Researchers' Own Actions

As discussed in more detail in the methods chapter of this book, traditionally, the passive voice has been used in science writing to describe the researcher's actions. The use of "we" + active verb is becoming more common in some subfields of biomedicine.

Passive: "It was found that . . ."

vs.

Active: "We found that . . ."

Note: Active voice, however, is used to describe phenomena in the study:

**Examples:**
The mice grew . . .

Patients responded . . .

Water evaporated . . .

## 3. Negative results and conclusions not included

Although longer conference abstracts may include null results, they are not typically included in a journal article abstract if other more positive results have been found as well. The exception is in clinical fields, where healthcare practitioners may make decisions about how to treat patients based on reading abstracts. In those cases, null results should be included. (See #5 in JAMA Abstract Quality Criteria.)

**Examples:**
- X Z was not found.
- X It was not possible to test for Y.

## 4. Avoids abbreviation, jargon, other language shortcuts that may lead to confusion

If you use an abbreviation, write out the meaning. If you are absolutely certain all your readers will understand, you can use the abbreviation. Consider those from other countries and new graduate student readers.

## 5. Avoids repetition

Sometimes repetition helps the reader follow your argument. Because there isn't enough room for repetition in the abstract, it's more difficult to read.

## 6. Avoids meaningless expressions

**Examples:**

- X Results are provided.
- X Discussion follows.

## 7. Avoids adjectives and descriptive details

## 8. Avoids illustration

This includes both literal pictures as well as examples.

## 9. Avoids footnotes

## 10. Avoids preliminaries

**Example:**
- X This paper discusses three issues.

## 11. Avoids superlatives

Instead of using words like "very" and "extremely," try to choose stronger nouns and verbs.

**Examples:**
- X very, extremely

### 12. Drugs listed with generic names

Use the international generic name for drugs. When the brand name is very well-known, it can be mentioned once in parentheses ( ).

**Examples:**
Fluoxetine hydrochloride (Prozac) toxicity in a neonate

Spencer MJ. Fluoxetine hydrochloride (Prozac) toxicity in a neonate. Pediatrics. 1993 Nov;92(5):721-2.

### 13. New terms are defined

**Examples:**
1-11 adapted from: Graetz N.Teaching ESL students to extract structural information from abstracts. In Ulijn, J.M. and A.K. Pugh (eds.) Reading for professional purposes. Leuven, Belgium: ACCO; 1985.

12-13 adapted from: Taylor D, Rose JB. Writing an abstract in the health sciences and social work. University of Toronto Health Sciences Writing Centre website. http://www.utoronto.ca/hswriting/abstract.htm . Retrieved May 2007.

## 5.5 Avoiding Ambiguity in Concise Writing

*Concise: expressing much with few words, clear (American Heritage Dictionary)*
*Ambiguity: more than one way of understanding is possible*

Word limits encourage concise writing. Concise writing is good. The problem is, when we try to be brief, we don't always express ideas clearly. There may be more than one may to interpret the same sentence. In more literary disciplines, ambiguity can be a positive trait of writing. It creates a sense of poetry in the text. However, in science writing, it is critical to avoid ambiguity as much as possible.

Here are some examples of ambiguity and suggested corrections. Note that there are no grammar errors in any of the original texts quoted below. Nevertheless, there is more than one way to interpret them.

**Source of Ambiguity:** **Relative clause not placed next to the word it modifies**

**Original:** Interleukin (IL)-21 is a member of type I cytokine family, which is produced by activated $CD4^+$ T cells and regulates growth, differentiation and maturation of lymphoid lineage cells.

**Problem:** **It seems that the family, not (IL)-21, is produced.**

**Possible solution:** Interleukin (IL)-21**, which is produced by activated $CD4^+$ T cells and regulates growth, differentiation and maturation of lymphoid lineage cells,** is a member of type I cytokine family.

**Problem:** **The emphasis is on the type I cytokine family, but this doesn't seem most important.**

Deleted: "is"

**Suggested solution:** Interleukin (IL)-21**,** a member of type I cytokine family**,** is produced by activated $CD4^+$ T cells and regulates growth, differentiation and maturation of lymphoid lineage cells.

Deleted: "which"

**Source of ambiguity:** **Unclear use of connecting words (and, but, or, etc.)**

**Original:** Most importantly, joint-draining lymph nodes from IL-21R-Ig-injected mice contained significantly fewer $CD4^+CD25^-$ cells expressing PD-1 and B7.1, $B220^+IgG_1^+$ cells, **and** $B220^-$Syndecan-$1^+$ cells than those from control $IgG_1$-administered mice.

| | |
|---|---|
| **Problem:** | **It is unclear how the text after the highlighted "and" connects to the first part of the text.** |
| **Possible solution:** | Most importantly, joint-draining lymph nodes from IL-21R-Ig-injected mice contained significantly **fewer** **1)** $CD4^+CD25^-$ cells expressing PD-1 and B7.1, **2)** $B220^+IgG_1^+$ cells, and **3)** $B220^-$Syndecan-$1^+$ cells **than** those from control $IgG_1$-administered mice. |
| **Problem:** | **The structure is clear, but numbering should be avoided when unnecessary. Also, the distance between "fewer" and "than" means the comparison is still hard to read. The last part looks like "B220-Syndecan-$1^+$ cells than those from control . . ."** |
| **Suggested solution:** | Most importantly, joint-draining lymph nodes from IL-21R-Ig-injected mice contained significantly **fewer** $CD4^+CD25^-$ cells expressing **both** PD-1 and B7.1, **fewer** $B220^+IgG_1^+$ cells, and **fewer** $B220^-$Syndecan-$1^+$ cells than those from control $IgG_1$-administered mice. |

# 5.6 Dealing with the Word Limit

One the most difficult aspects of writing an abstract is the strict word limit. Here are some strategies for shortening an abstract, or even the body of an article, that is not meeting the word limit.

## Step One: Tighten up your language

A. Eliminate meaningless phrases
B. Eliminate phrasal verbs & superlatives
C. Consider cutting prepositions, especially "of"
D. Consider changing noun phrases to verbs

### What's wrong with this abstract?

**X Example:**

This paper discusses research which was undertaken in the author's country. A theoretical framework is developed from a literature search and this is used by the authors as the basis of an analytical model. The researchers collected data within this framework and analysed it according to the precepts laid down by earlier researchers in the field. The data is used to demonstrate that our understanding can be significantly increased and this is discussed in the light of previous work. Conclusions are drawn and it is shown that these may be useful for practitioners.

Hughes W. Refereed journal papers: Practice and process. 2005. http://www.personal.rdg.ac.uk/~kcshuwil/publish/Glasgow2005.pdf . Retrieved November 2006.

Obviously, the sample abstract above contains no details. Although this is an extreme case (actually it's a joke, not a real abstract), many writers do make the error of using some of these expressions, such as "The data is discussed in the light of previous work." If it is not possible to summarize a number of complex points briefly, do not write a vague sentence. Instead, choose the most important point, and explain it clearly. If you are dealing with the discussion/conclusion, you may wish to drop the sentence altogether.

### Shortcuts to avoid

The list below includes several steps that will make your abstract shorter, but they are not acceptable. Do NOT . . .

- Cut articles (a/an/the): This is sometimes done in abstracting journals, but you shouldn't do it for your own articles.
- Cut "and" and other logical connectors critical to your meaning
- Create contractions (don't, can't, they'll, etc.)
- Create abbreviations that are not widely known (remember your international and graduate student readers)

### Step Two: Step back from your writing, then cut details, but not whole sections

**How to step back**

- Set the paper aside when possible, even for five minutes.
- Make a voice recording summarizing your research. Then listen and write down the main points.
- Summarize your research for a colleague. Then compare your summary to the abstract.
- Rank each bit of information from most to least important. Cut the least important bit.
- Imagine you lost your draft. Try writing the abstract again from the beginning.
- Write some notes about your audience. Write about who the readers are, what's important to them, and what questions they might ask when they read your paper. Then consider what would be best to include in the abstract for your readers.

## Final Step: Cut one or more sections of IMRD.

Leaving sections out of the abstract is quite common in some fields of study. In fact, Hyland (2004) found that over 95% of abstracts across scientific and non-scientific disciplines left out at least one part. According to Swales (2004), even the results of some "very complex or . . . theoretical" papers cannot be adequately represented in a short summary.

Hyland K. Disciplinary Discourses: Social Interactions in Academic Writing. Ann Arbor: U of Michigan; 2004. page 82.
Swales JM, Feak CB. Academic Writing for Graduate Students, 2nd ed. Ann Arbor: U of Michigan; 2004.

On the other hand, it's not possible to leave out sections when a structured abstract is required, and the trend in science seems to be moving toward more carefully crafted abstracts for the audience that doesn't read the whole paper. One study, focusing on biology only, is summarized below.

**Change in Percentage of Biology Abstracts**

**Containing Each Part of the I(P)MRD Structure 1980→1997**

| Introduction | Purpose | Method | Results | Conclusion |
|---|---|---|---|---|
| 13 → 32 | 57 →71 | 59 →63 | 97→100 | 20→40 |

1980, n=30; 1997, n=100.

Adapted from Hyland K. Disciplinary Discourses: Social Interactions in Academic Writing. Ann Arbor: U of Michigan; 2004. page 82.

In summary, mentioning all sections of the article is becoming more common with increased competition in the field and is now always required in clinical medicine, but in some fields, it may not be possible or necessary.

## 5.7 Common mistakes

Turner (2006) lists a few common errors in preparing abstracts for publication or conference proposals. They are excerpted below.

**1. Holding back significant points or information to try to get the reader to read the article.**
An abstract is not a mystery story but should contain all the significant points of the article.

**2. Including references such as (Kim et al., 2000) or [1] or [1] in the abstract.**
Only a very few conference abstracts ask for references.

**3. Including paragraphs**
Since abstracts are put in databases they don't usually have paragraphs. Even most 350 word Dissertation or Thesis abstracts don't have paragraphs. Individual university departments may be flexible, however.

**4. Wasting introduction sentences**
The lead sentence of an abstract should not be too general; it should include the topic of your paper. Here is an example of a wasted first sentence of an abstract. There is not enough information to give the reader a clear idea of what the paper is about.

"The Internet is very important these days."

**5. Using the same sentence for the first line of the abstract and the first line of the introduction.**
It is considered poor writing style.

Turner A. *English Solutions for Engineering Research Writing*. 2006.

## 5.8 Recommended Reading

Cummings P, Rivara FP, Koepsell TD. Writing informative abstracts for journal articles. Arch Pediatr Adolesc Med. 2004 Nov;158(11):1086-8.http://archpedi.ama-assn.org/cgi/content/full/158/11/1086 [Many good examples for a clinical article.]

*Journal of Neuroscience* website. http://www.jneurosci.org/misc/ifa_minireviews.shtml

Swales JM, Feak CB. *English in Today's Research World*. Ann Arbor: U of Michigan Press; 2000.

Taylor, D. and Rose, JB. Writing an abstract in the health sciences and social work. University of Toronto Health Sciences Writing Centre website. http://www.utoronto.ca/hswriting/abstract.htm

# 6.0 The Title and Keywords

## 6.1 The Title

Like abstracts, titles are difficult to write because of the word limit. The title is the most important part of the article, though. It is the only part that everyone is guaranteed to read and it should clearly communicate the main topic of your research report. Many people search titles in library databases, so important concepts in the paper should be mentioned whenever possible.

Here are a few basic tips for writing titles:

1. It is possible to drop an article (a/an/the) if it is the first word of the title. Other articles should usually be retained.
2. Avoid increasing the length of the title with expressions such as “an investigation of” or “research on.”
3. Try to limit the number of consecutive prepositional phrases (in, of, on, etc.). Most titles include some, but try to avoid long strings like this: [noun] of [noun] of [noun] of [noun].

### 6.1.1 Title Format

Here are the basic rules for formatting a title.

1. Capitalize all words except a/an/the and prepositions (e.g., for, in, from).
2. Capitalize the first and last words always (including a/an/the and prepositions).
3. The title does not have to be a complete sentence.
4. Generally, do not end the title with a period (.), but a question mark (?), although not common, is acceptable.

(Note that the rules for formatting titles in the list of references at the end of the paper are different from those above.)

Here are a few exceptions to the rules. In the first example, the first word of the title is “p53,” which is not typically capitalized. Therefore, it should not be capitalized in a title either.

**Example:**

**p53** Mutations in Human Cancers

Hollstein M, Sidransky D, Vogelstein B, Harris CC. p53 mutations in human cancers. Science. 1991 Jul 5;253(5015):49-53. Review.

In the following example, the word “Anti-inflammatory” is hyphenated, but it is still considered one word, so “inflammatory” is not capitalized.

**Example:**

Heme Oxygenase-1 Mediates the Anti-inflammatory Effect of Interleukin-10 in Mice

Lee TS, Chau LY. Heme oxygenase-1 mediates the anti-inflammatory effect of interleukin-10 in mice. Nat Med. 2002 Mar;8(3):240-6.

Authors may use periods or commas between two phrases in a title. The second phrase lists the number of patients or location and date for a disease outbreak, for example.

**Examples:**

Pancreaticoduodenectomy for Cancer of the Head of the Pancreas. 201 patients.

Yeo CJ, Cameron JL, Lillemoe KD, Sitzmann JV, Hruban RH, Goodman SN, et al. Pancreaticoduodenectomy for cancer of the head of the pancreas. 201 patients. Ann Surg. 1995 Jun;221(6):721-31.

Lack of H5N1 Avian Influenza Transmission to Hospital Employees, Hanoi, 2004

Liem NT, Lim W; World Health Organization International Avian Influenza Investigation Team, Vietnam. Lack of H5N1 avian influenza transmission to hospital employees, Hanoi, 2004. Emerg Infect Dis. 2005 Feb;11(2):210-5.

## 6.1.2 Title Structure

According to Zeiger, there are three common types of biomedical research reports. One group of papers focus on testing hypotheses. A second group includes papers that describe a new structure, such as a molecule or a gene. The final group focuses on a new or improved method, apparatus, or material.

Zeiger M. Essentials of Writing Biomedical Research Papers, 2nd ed. New York: McGraw-Hill; 2000.

### Hypothesis-testing Papers

Zeiger explains that hypothesis-testing papers can have both independent and dependent variables, or only dependent variables; thus there are two common structures:

1. Effect of [Independent Variable] on [Dependent Variable] in [Population/Animal/Material]
2. [Dependent Variable] in [Population/Animal/Material]

If the population is "humans," it can be omitted. However, if the population is only a certain group of humans, it should be specified.

#### Effect of [Independent Variable] on [Dependent Variable] in [Population/Animal/Material]

#### Examples:

Clinical **Efficacy of** Raloxifene **in** Postmenopausal Women

Agnusdei D. Clinical efficacy of raloxifene in postmenopausal women. Eur J Obstet Gynecol Reprod Biol. 1999 Jul;85(1):43-6.

**Effect of** Conjugated Linoleic Acid **on** Body Composition **in** Mice

Park Y, Albright KJ, Liu W, Storkson JM, Cook ME, Pariza MW. Effect of conjugated linoleic acid on body composition in mice. Lipids. 1997 Aug;32(8):853-8.

Sometimes, it is not necessary to use the whole pattern. This example has both dependent and independent variables. However, instead of "Effect of the anti-Fas antibody on mortality in mice," the exact effect is specified. The anti-Fas antibody kills the mice. Therefore, it is shorter and simpler to add the word "lethal" to the beginning of the title.

#### Example:

Lethal **Effect of** the anti-Fas Antibody **in** Mice

Ogasawara J, Watanabe-Fukunaga R, Adachi M, Matsuzawa A, Kasugai T, Kitamura Y, et al. Lethal effect of the anti-Fas antibody in mice. Nature. 1993 Aug 26;364(6440):806-9.

Similarly, in the next example, "in humans" was eliminated and "human" acts as an adjective describing the dependent variable, "endothelial cells."

#### Example:

Direct Proinflammatory Effect of C-Reactive Protein on Human Endothelial Cells

Pasceri V, Willerson JT, Yeh ET. Direct proinflammatory effect of C-reactive protein on human endothelial cells. Circulation. 2000 Oct 31;102(18):2165-8.

This title contains even more detail. In addition to the dependent and independent variables and the animal studied, it describes the findings. When results are presented in the title, it often takes the form of a complete sentence with a subject and verb.

**Example:**

Heme Oxygenase-1 Mediates the Anti-inflammatory Effect of Interleukin-10 in Mice

Lee TS, Chau LY. Heme oxygenase-1 mediates the anti-inflammatory effect of interleukin-10 in mice. Nat Med. 2002 Mar;8(3):240-6.

### [Dependent Variable] in [Population/Animal/Material]

Here are a few examples of titles for papers that test a hypothesis but have no independent variable.

**Examples:**

p53 Mutations **in** Human Cancers

Hollstein M, Sidransky D, Vogelstein B, Harris CC. p53 mutations in human cancers. Science. 1991 Jul 5;253(5015):49-53. Review.

Bioluminescent Indicators **in** Living Mammals

Contag PR, Olomu IN, Stevenson DK, Contag CH. Bioluminescent indicators in living mammals. Nat Med. 1998 Feb;4(2):245-7.

Distributed Hierarchical Processing **in** the Primate Cerebral Cortex

Felleman DJ, Van Essen DC. Distributed hierarchical processing in the primate cerebral cortex. Cereb Cortex. 1991 Jan-Feb;1(1):1-47. Review.

Functional Anatomy of the Mental Representation of Upper Extremity Movements **in** Healthy Subjects

Stephan KM, Fink GR, Passingham RE, Silbersweig D, Ceballos-Baumann AO, Frith CD, et al. Functional anatomy of the mental representation of upper extremity movements in healthy subjects. J Neurophysiol. 1995 Jan;73(1):373-86.

## Descriptive papers

For papers that newly describe a structure, Zeiger recommends that the name of the structure be the first word of the title. Descriptive titles can be in the form of a noun phrase (a noun with the words that describe it) or a whole sentence.

**Examples:**

Avian Influenza—A Challenge to Global Health Care Structures

Hien TT, de Jong M, Farrar J. Avian influenza--a challenge to global health care structures. N Engl J Med. 2004 Dec 2;351(23):2363-5.

A New Protein Containing an SH2 Domain That Inhibits JAK Kinases

Endo TA, Masuhara M, Yokouchi M, Suzuki R, Sakamoto H, Mitsui K, et al. A new protein containing an SH2 domain that inhibits JAK kinases. Nature. 1997 Jun 26;387(6636):921-4.

Review articles generally fall into the descriptive category:

**Examples:**

Intravenous Magnesium Sulfate Treatment for Acute Asthma in the Emergency Department: A Systematic Review of the Literature

Rowe BH, Bretzlaff JA, Bourdon C, Bota GW, Camargo CA Jr. Intravenous magnesium sulfate treatment for acute asthma in the emergency department: a systematic review of the literature. Ann Emerg Med. 2000 Sep;36(3):181-90.

Dopamine in Schizophrenia: A Review and Reconceptualization

Davis KL, Kahn RS, Ko G, Davidson M. Dopamine in schizophrenia: a review and reconceptualization. Am J Psychiatry. 1991 Nov;148(11):1474-86. Review.

*Panax Ginseng* Pharmacology: A Nitric Oxide Link?

Gillis CN. Panax ginseng pharmacology: a nitric oxide link? Biochem Pharmacol. 1997 Jul 1;54(1):1-8. Review.

### Methods Papers

When the main focus of the article is a new or improved method, or a device or material, it should be mentioned in the title. Most biomedical engineering papers will require this type of title. It will also be common in surgery.

#### Examples:

Engineering Hybrid Genes without the Use of Restriction Enzymes: Gene Splicing by Overlap Extension

Horton RM, Hunt HD, Ho SN, Pullen JK, Pease LR. Engineering hybrid genes without the use of restriction enzymes: gene splicing by overlap extension. Gene. 1989 Apr 15;77(1):61-8.

Pancreaticoduodenectomy for Cancer of the Head of the Pancreas. 201 patients.

Yeo CJ, Cameron JL, Lillemoe KD, Sitzmann JV, Hruban RH, Goodman SN, et al. Pancreaticoduodenectomy for cancer of the head of the pancreas. 201 patients. Ann Surg. 1995 Jun;221(6):721-31; discussion 731-3.

A Comparison of Four Models of Total Knee-replacement Prostheses

Insall JN, Ranawat CS, Aglietti P, Shine J. A comparison of four models of total knee-replacement prostheses. J Bone Joint Surg Am. 1976 Sep;58(6):754-65.

Heart Wall Motion: Improved Method of Spatial Modulation of Magnetization for MR Imaging

Axel L, Dougherty L. Heart wall motion: improved method of spatial modulation of magnetization for MR imaging. Radiology. 1989 Aug;172(2):349-50.

## 6.1.3 Informal Titles

The journals with the largest circulation tend to be much more oriented toward marketing and making a profit. One result is that some have transformed the titles of their articles into a more informal style. They often include jokes and word play that are difficult for English learners to understand. They also contain little information about the actual content of the articles. In fields of study such as literature and history, such titles are common, but in science, an uninformative title may prevent other researchers from finding your work in the library databases or recognizing its relevance. Do not copy this style of title. If you plan to submit an article to a journal that uses this type of title, write a regular title and let the editor rewrite it.

#### Examples of titles from the journal *Cell*:

The Sunny Side of p53

Autophagy Calls in the Garbage Man

N-WASP Generates a Buzz at Membranes on the Move

Neurons Set Their Sights on Jelly Belly

Do BRCA1 Mice Lead a Normal XISTence?

Primase Halts in the Name of Hunger

### 6.1.4 Recommended Reading

For more information about writing titles, see the "Titles" chapter in Mimi Zeiger's excellent book *Essentials of Writing Biomedical Research Papers*, which is available in English, Korean, and Japanese.

Zeiger M. Essentials of Writing Biomedical Research Papers, 2nd ed. New York: McGraw-Hill; 2000.

## 6.2 Choosing Keywords

In many journals, it is possible to submit a short list of keywords that will appear at the end of your abstract. The keywords are useful for library database searches and, along with the title, can help readers identify the main topics of the paper quickly.

Tip
Here are some strategies for selecting keywords:

- Choose only relevant words from title: Be careful not to choose general words like "function" or "investigation."
- Obey the word limit: Many journals have a limit between 3 and 10 words.
- Don't combine terms: Make sure that the word or phrase represents only one idea.
- Use MeSH (Medical Subject Headings) or your field's keyword list: Go to the US National Library of Medicine website (http://www.nlm.nih.gov/mesh/authors.html) for more information, or contact a medical librarian for assistance.

Use the following list excerpted from Hughes as a guide as you think of possible keywords. For example, if your research report describes an improved laboratory procedure, the name of the procedure might be a good keyword choice.

- Discipline: Useful in interdisciplinary journals or publishing outside the journals of your field.
- Methods
- Phenomenon
- Data source
- Location
- Unit of Analysis

Hughes W. "How should we choose our keywords?" *ARCOM Newsletter*. 2005 20 (2). http://www.arcom.ac.uk/publications/Newsletter-2005-21-1.pdf . Retrieved March 2007.

On the other hand, if you have developed a brand new procedure, theory, or device, or have discovered a new phenomenon or health condition, you probably should not use a new name as one of your keywords. No one would think of searching for it, and the word would not exist in the database keyword lists.

# 7.0 The Clinical Case Report

## 7.1 What is a case report?

A traditional case report is a brief story of the diagnosis and treatment of a patient with an unusual condition. It focuses on some phenomenon that is rare (or new) and worth knowing. It is often accompanied by photos or figures that give readers the chance to make their own decisions about whether the diagnosis was correct.

**Example of a brief case report:**

A 42-year-old man was blown 4–5m by the explosion of a lorry tyre [American English: truck tire] that he had cut with a knife. He complained of a small amount of blood on his gums from lacerations 4–5 cm long at the base of the gums bilaterally.

The injuries were probably caused by the 'blast' of the exploding tyre filling his mouth and forcing his cheek away from the gums. We explored the wounds and found full-thickness mucosal lacerations involving the muscle, which were sutured.

Injuries caused by exploding tyres can be been classified as direct injuries caused by metal rim fragments, and barotrauma as a result of high pressures damaging tissues, often in the head and face (as in this case). A range of injuries caused by fragments of the rim have been documented including maxillofacial injuries, long bone fractures and catastrophic head injury. Barotrauma can cause tympanic perforation and eye injury, as well as the more severe documented injuries including oesophageal rupture and pnuemomediastinum.

This patient was lucky to escape more serious injury and his case highlights the dangers of pressurised tyres and presumed 'minor' explosions. It also emphasises the need for thorough examination in the accident and emergency department.

Edward John Hannon. *(2007) British Journal of Oral and Maxillofacial Surgery, 45,* 189.

### 7.1.1 What makes case reports different from other types of journal articles?

1. Length
2. Rarity or novelty
3. Unlike a report on a study, there is no method or experimental results (other than any clinical tests for diagnosis).
4. Unlike a review of cases, not every article on the issue has to be cited (although articles on very similar cases should all be identified and read, and sometimes cited).
5. A case report tells the story of a practitioner's work, including actions and thoughts.
6. Case reports have existed for thousands of years, and across a wide variety of cultures.

### 7.1.2 Who should write case reports?

Practitioners should write them! Only those who spend their time with patients have the opportunity to observe interesting and unusual cases. This includes many people who don't usually write other kinds of articles for publication. Even if you think, "I am not a researcher," you should still occasionally write clinical case reports.

### 7.1.3 Why are case reports important?

According to Cohen, case reports have several key functions. Among them:

1. They can draw our attention to as yet unknown diseases.
2. They can identify adverse effects of drugs that were not caught during clinical trials, or effects on groups not tested in trials (such as children or pregnant women).
3. They can describe new surgical or other treatment methods.
4. They can describe interesting errors, device malfunctions, or patient difficulties with adherence, so

that the medical community can try to solve these problems.

### 7.1.4 Why should you write a case report?

1. If are a nurse, physician, or clinical researcher, and you have never published before, this is a good place to start.
2. Even if you are not a professor and never plan to publish regularly, you can contribute to the world's medical knowledge and help cure others beyond your own practice.
3. Writing case reports contributes to medical history. We have case reports from ancient times, in both the East and the West.

## 7.2 The Language of a Case Report

In the following example, I underlined the language that indicates the phenomenon is rare. (Note: This example is a bit extreme. Most case reports do not use so much language for rarity in such a short text.)

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**Example:**
Primary malignant . . . lymphomas of . . . are **very rare**. In the Department of . . ., this diagnosis has been made **in only ten patients during the last fifty years**. Retrospective analysis showed that one of these cases showed a **very uncommon** . . . A review of the recent literature yielded **only two reports** of . . . : both of these reports paid **little attention** to clinical details. L. . . . reported fourteen cases, . . . but in this report, too, **clinical data are not given**. In the present report we shall describe the chemical . . . findings in a case of . . . lymphoma . . . with an **uncommon** clinical course.

Swales JM. Genre Analysis: English in Academic and Research Settings. Cambridge: Cambridge U Press; 1990. p.147

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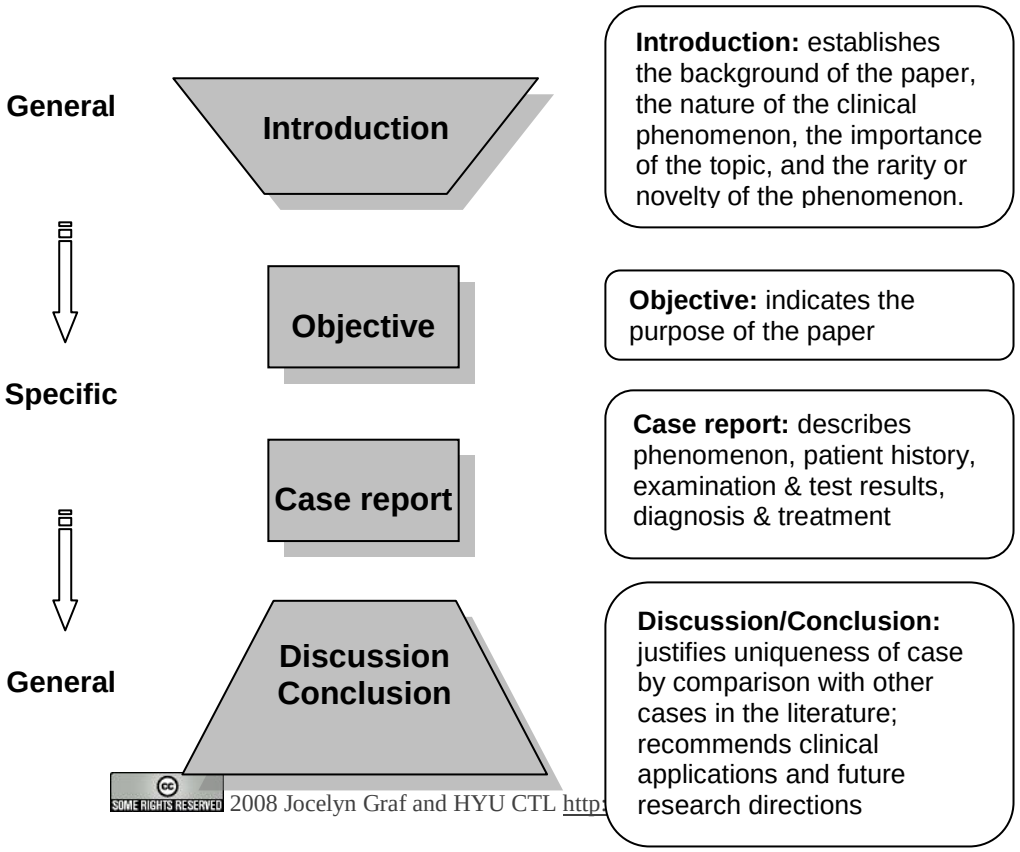
## 7.3 The Structure of a Case Report

The general organization of a case report is similar to the structure of a journal article that reports on an experiment. However, the middle sections—the experimental method and results—should be replaced with the case report. Some journals require an abstract. Others do not give space for an abstract.



**Example case report**

The following example describes the health problems of a patient after having a particular device (the DES) implanted in a coronary artery. The DES is better than previous devices in some ways. However, because of this patient's health problems, the author is questioning whether the DES is safe. The case report is divided into sections to demonstrate its structure.

| | |
|---|---|
| Background information | **Letter to the Editor: In-stent thrombosis after discontinuation of antiplatelet therapy 2 years after DES implantation: A case report**<br><br>To the Editor:<br>The recent introduction of drug-eluting stents (DES) has revolutionized the percutaneous treatment of coronary artery disease. In fact, the local release of antiproliferative drug has significantly reduced the incidence of in-stent restenosis [1,2]. |
| Statement of the problem | However, despite large randomized trials have been conducted on DES, several concerns have emerged on their long-term safety profile. In fact, due to the delayed re-endothelization, the benefits in terms of restenosis might be seriously threatened and counterbalanced by a higher risk of in-stent thrombosis, particularly after discontinuation of oral antiplatelet therapy. |
| Main topic | We describe a case of a patient transferred to our hospital for anterior STEMI. |
| Patient history | Two years before hospitalization he underwent PCI of LAD with multiple DES implantation (Cypher® stent (Cordis/Johnson & Johnson, USA) 3.0– 18 mm in the proximal segment, and TAXUS®Libertè™ stent (Boston Scientific, USA) 2.5–20 mm in the mid segment). Double antiplatelet therapy was stopped 1 year after the procedure. He reported discontinuation of aspirin, due to epigastric burning, 7 days before hospital admission. |
| Test results Diagnosis | Coronary angiography showed a thrombotic occlusion located at the proximal edge of the TAXUS stent (black arrow, Fig. 1A). |
| Treatment | After crossing the occlusion with 0.014 wire, TIMI 3 flow was restored, showing diffuse in-stent thrombosis (black arrow, Fig. 1B). After initial balloon inflation, an additional bare metal stent was implanted (Libertè 2.5–20 mm) proximally to the TAXUS stent to cover a residual dissection. |
| Patient outcome | TIMI 3 flow was restored, without evidence of distal embolization (Fig. 1C). Echocardiographic examination showed a large apical akinesia with a large enzymatic infarct size (peak CK of 3500 U/L, and peak CKMB of 452 U/L). The patient was discharged 4 days after the procedure without any postprocedural complication. |
| Connection to the literature | This case report further supports recent concerns [that have] emerged [about] the new disease ("late in-stent thrombosis") after the introduction of DES [3–5]. |
| Clinical application | All interventional cardiologists must be aware of the long-term dependence of patients from antiplatelet therapy even longer than 1 year after DES implantation. We should seriously reconsider the concept that a "benign restenosis" [is] not worth a "malignant in-stent thrombosis". |

De Luca G, Carbone G, Maione A, Gregorio G. (2007) *International Journal of Cardiology, 116,* 399–400.

## 7.3.1 What should be included in the main section of the case report?

Here's a simple list of recommended parts of a case report. This list was written as a guide for medical students writing case reports for medical school (Kogan & Shea, 2003), but the same components could be used in a published case report.

### History

- chief complaint
- chronological history
- symptom characterisation
- pertinent positives/negatives
- past medical history
- family/social history
- review of systems

### Physical examination

- patient description
- pertinent positive/negative examination findings

### Assessment

- summary statement
- problem list
- differential diagnosis with clinical reasoning
- diagnostic/therapeutic plan

Kogan JR and Shea JA. (2003). An assessment measure to evaluate case write-ups in a medicine core clerkship. *Med Educ. 37*(11):1035-6.

### Content That Should Not Be Included

(Cohen, 2006)

According to Cohen, the following should NOT be included in a case report:

1. Information that may identify the patient:
   A. Initials, date of birth (year is enough)
   B. Specific dates, e.g., hospital admission date
   C. Also, blackout identifying features in photos
2. Routine information that does not contribute to the diagnosis
   A. Daily vital signs
   B. Transfer from one hospital department to another
3. Extensive literature review
   A. Don't include exhaustive review of normal cases
   B. Do include review of all similar (unusual) cases
   C. Do include selective review of cases that can be contrasted with yours

### Content That Should Be Included

(Cohen, 2006)

Almost all case reports should include enough information for readers to make their own diagnosis. For example, if a patient presents with a skin problem after taking a particular medication, the reader may wonder whether the skin problem actually had another cause, such as a food allergy or exposure to a chemical at work. Therefore, include the following information:

1. Patient history
2. Drug allergies and use, including traditional and non-prescription medicine
3. Occupation, diet, and other information (when cause of condition is unknown)

4. Photos and other figures presenting the most interesting results of physical examination and lab tests
5. Limitations of the clinical assessment

In addition, as in all biomedical research reports, the text should mention that the patient has given consent for photos and other data to be published.

## 7.3.2 Variations of a traditional case report

Besides the basic report on a single patient, there may be many possible variations of a case study. In the following abstract from a longer case study, two cases are presented. The goal is to compare very mild and very severe cases of the same condition, and compare their treatments and outcomes. The abstract describes how the disease complicated each woman's experience with childbirth. I have underlined key points.

SUMMARY. Charcot-Marie-Tooth disease is a rare hereditary motor and sensory demyelinating polyneuropathy with potentially severe and debilitating peripheral symptoms. Respiratory muscles and vertebral anatomy can be affected, both of which may have significant impact on any planned or unplanned anaesthetic intervention during labour. **We describe two cases** at opposite ends of a wide spectrum of disease severity. **The first case illustrates an approach to the management of a mildly affected patient** who was permitted to labour normally, but nevertheless needed a detailed antenatal plan in order to allay her anxiety and prepare for potentially complicated labour analgesia and operative delivery. Spontaneous delivery of a healthy infant did not require anaesthetic intervention during labour. **The second woman had severe scoliosis and marked respiratory impairment** and required non-invasive ventilatory support for one week before scheduled caesarean section. A single-shot spinal anaesthetic was used as a spinal catheter could not be sited. This produced a high block for which a brief period of respiratory assistance was required. Perioperative management and subsequent high dependency care are discussed.

J. J. Greenwood, W. E. Scott. (2007) Charcot-Marie-Tooth disease: peripartum management of two contrasting clinical cases. *International Journal of Obstetric Anesthesia, 16,* 149–154.

## 7.4 Choosing a Topic for a Case Report

(excerpted from Cohen, 2006)

In addition to contrasting two cases, there are many other variations of case reports. Cohen has provided a list of topic ideas. Although a few are specific to the field of pharmacy, most are relevant to all clinicians.

According to Cohen, "Publishable patient case reports include cases that:

- Advance medical science and spawn research;
- Describe rare, perplexing, or novel diagnostic features of a disease state;
- Report therapeutic challenges, controversies, or dilemmas;
- Describe a new surgical procedure;
- Report how a drug can enhance a surgical procedure;
- Teach humanistic lessons to the health care professional;
- Review a unique job description of a health care professional that improves patient care;
- Report new medical errors or medication errors;
- Discover a device malfunction that results in patient harm;
- Describe adverse effects and patient toxicity of a radiopaque agent;
- Describe life-threatening adverse events;
- Describe dangerous and predictable adverse effects that are poorly appreciated and rarely recognized;
- Describe rare or novel adverse drug reactions;
- Describe a therapeutic failure or a lack of therapeutic efficacy;
- Describe rare or novel drug–drug, drug–food, or drug–nutrient interactions;
- Report unlabeled or unapproved uses of a medication;
- Explore the use of pharmacogenomics to manage diseases;
- Use life-saving techniques not previously documented;

• Use pharmacoeconomic principles that improve patient care;
• Uncover barriers to patient adherence;
• Discover an interaction between a drug and a laboratory test that yields a false-positive or false-negative result;
• Describe the effect of drugs in pregnancy and lactation;
• Detect novel pharmacokinetic or pharmacodynamic principles; and
• Use technology to improve patient outcomes."

Cohen, H. (2006). How to write a patient case report. *Am J Health-Syst Pharm. 63,*1888-92.

## Tip

**Steps to publishing a case report** (adapted from Brodell, 2000)

1. A patient with an interesting condition presents to your practice.
2. Identify a "take-home" message or teaching point from the case. Why is this case important?
3. Choose a journal appropriate for publishing the case report.
4. Obtain the journal's "guidelines for authors."
5. Enlist a colleague to help share the workload.
6. Perform a literature search of journals, textbooks, and electronic media.
7. Compile all source articles in a file.
8. Write up the case and discussion in the required format using citations to identify sources of information.
9. Email or upload your manuscript with cover letter to the journal.
10. Obtain reviewers' comments and advice for revision.
11. Revise paper using reviewers' comments.
12. If the article is not accepted by the journal, submit article to a second journal.

Brodell, RT. (2000). Do more than discuss that unusual case. Write it up! Postgraduate Medicine, 108(2).

# 8.0 Correspondence with Editors

Correspondence with research journal editors includes submission letters and responses to reviewers.

## 8.1 The Submission Letter

When you want to submit a manuscript for publication in a journal (or book of collected articles) it is necessary to include a submission letter. Of course, these days, the "letter" is actually an email, or a section of text copied and pasted into an online form. Nevertheless, the text should still follow formal business letter style.

### 8.1.1 General Guidelines

1. Check the journal website for any specific guidelines on the submission process and the contents of the submission letter. Some journals require that the authors sign a letter containing certain legal language about human or animal subjects, conflicts of interest, or submission to other journals. If so, copy and paste these sentences into your letter.

2. Type the letter in a document separate from your manuscript. Otherwise, the editor will have to erase it in order to prepare your manuscript for publication.

3. These are the contents of a typical submission letter. Of course, it isn't necessary to include those that don't apply to your situation.

a. Title of the manuscript
b. Journal title
c. Section of the journal in which the manuscript belongs (letters, book reviews, articles, etc.)
d. Conference where an earlier version of the manuscript was presented
e. Human or animal subject guidelines followed
f. Funding, patents, and conflicts of interest
g. Indication that the manuscript has not been submitted or published elsewhere
h. Indication that all authors contributed significantly to the manuscript
i. List of attached documents specified in the author guidelines
j. Brief thanks to the editor
k. List of all authors (with their scanned signatures, if required)
l. Authors' affiliations: job title, university, department and/or lab name for each author
m. Complete contact information for the corresponding author: postal and email addresses, phone and fax numbers

In some fields of study, it is customary to provide a short summary of the paper and how it fits the journal's scope. The latter is not so much for the editor's information. Instead, it forces the authors to think about whether the paper really fits in the journal. The most famous journals receive far too many submissions to publish, so they can automatically throw out a manuscript if the author cannot explain why it belongs in the journal.

According to the journal *Cell*'s Information for Authors:

> Each submission should be accompanied by a cover letter, which should contain a brief explanation of what was previously known, the conceptual advance provided by the findings, and the significance of the findings to a broad readership. A cover letter may contain suggestions for appropriate reviewers and up to three requests for reviewer exclusions. The cover letter is confidential to the editor and will not be seen by reviewers."
>
> Cell Information for Authors. http://www.cell.com/misc/page?page=authors#RAformats. Retrieved on 3 February 2008.

Because the journal *Cell* is quite general, the editors may not know who would be most qualified to review the manuscript. Therefore, they allow authors to recommend a list of potential reviewers. If your lab is in competition with another lab and you do not want them to know your results before publication or you are afraid they will try to slow your publication, you can ask to have those researchers excluded from the list of potential reviewers.

Less commonly, other information may be included in the submission letter. If you are submitting an article for publication for the first time without your advisor as a co-author, you may wish to mention your advisor's name and the school and department where you earned your PhD. Alternatively, if another senior colleague has advised you to submit to a particular journal, you may mention this. However, in larger fields of scientific study, where everyone does not know each other, this is probably inappropriate.

Additionally, you may have received a generally positive review from another journal, but your paper was rejected because it did not fit the journal's scope. For example, the article was much too long or the topic of the paper was too theoretical or too practical for the journal's readers. Perhaps the journal does not publish studies that use your methodology. In such cases, reviewers or editors sometimes recommend that you submit the paper to another particular journal. You can mention this recommendation in your submission letter.

Finally, if you have used the same data for more than one analysis and have published or plan to publish more than one paper from the data, this should be mentioned in the submission letter. There is no strict rule for what percentage or what types of material from previous papers can be republished. In some fields of study, data should never be published more than once. In other fields, the same large dataset can be analyzed again and again in different ways to create new papers, and even shared among scholars from different labs. However, most fields fall somewhere in the middle. Consult a senior scholar for more advice. If you are honest about the content of previous papers and create genuinely new analysis for every paper, you should not have any trouble when you disclose the reuse of data. Attach a copy of the additional papers and highlight the sections that are reused.

## 8.1.2 Electronic Submission

Submissions are now generally done via email or a submission website. When using a submission website, fill in the required information as requested. Provide any additional information in the submission letter and paste it into the electronic form. If it is required to scan signatures of the authors and there is no form provided, use the submission letter format.

On the other hand, if there is no submission website with blanks to fill in, it is necessary to send a normal email. Very short submission letters could be sent as email. However, many journals specify that they would prefer an attachment. In this case, you can write the submission information in the format of a traditional business letter and attach it along with other requested documents to a brief email that simply includes the following:

- name of journal and manuscript title
- list of attachments (one attachment should be "Full Submission Letter")
- brief thanks
- name of corresponding author with contact information

## 8.1.3 Comparison of Two Sample Letters

Here is an example of part of the submission guidelines for a journal.

**Example of submission guidelines**
**From the *Asia Pacific Journal of Clinical Nutrition* Instructions for Authors:**

**Covering letter**
Papers are accepted for publication in the journal on the understanding that the content has not been published or submitted for publication elsewhere; a statement indicating the paper's originality should be included. This must be part of the covering letter. Authors must also state that the protocol for the research project has been approved by a suitably constituted Ethics Committee of the institution within which the work was undertaken and that it conforms to the provisions of the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000). All investigations on human subjects must include a statement that the subject gave informed consent and patient anonymity should be preserved. Any experiments involving animals must be demonstrated to be ethically acceptable and where relevant conform to National Guidelines for animal usage in research.

**Submission** The manuscript and other required documents including a completed Copyright Assignment Form (see below) should be emailed as attachments to: apjcn-apcns@umail.hinet.net Professor Mark L. Wahlqvist Editor-in-Chief: Asia Pacific Journal of Clinical Nutrition

http://hec.server101.com/APJCN/Authorinstruct.pdf

Two examples follow. The first contains several errors. The second is a corrected version.

**X Example with Errors:**

Cover Letter

08/10/07

Dear Professor Mark L. Wahlqvist,

First of all, I want to thank you for taking the time to review my manuscript. I understand that this is a very long and difficult process for you. So, I have taken careful consideration and have done my best to improve my manuscript to meet your revisions.

We submit the manuscript entitled "Food security, selection, and healthy eating among various age cohorts in a coastal community of South Korea." This study was presented at the Association of Clinical Nutrition meeting last year, but has never been published nor submitted to any other journal.

Our study protocol conforms to the human subject guidelines of the Hanyang University Institutional Review Board and to the provisions of the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000). Subjects provided informed consent and their anonymity should be preserved.

Our study was funded by the Brain Korea 21 fund. We have no conflicts of interest.

Sincerely,

*Chan-ho Park*

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O: 02-2220-0000
HP: 016-0000-0000

Dr. Sun-woo Kim. MD
Hanyang University, Guri

Dr. Hee Seop Choi, PhD
Hanyang University, Seoul

## Errors

1. The title “Cover Letter” is not needed.
2. The date is ambiguous. It may be August 10 or October 8. Use a form that can be understood internationally, such as “8 October 2007.”
3. The greeting should include only the title and family name of the editor: “Dear Professor Wahlqvist.” It should be followed by a colon (:) (American) or no punctuation (British).
4. The first paragraph is inappropriate for several reasons. It should be cut entirely.
    a. The appreciation goes on in too much detail, which may feel awkward to a North American or European reader.
    b. Also, the expression “have done my best” sounds like children’s language in this context. It is expected authors should do their best, but it is unnecessary to mention it.
    c. It wouldn’t be a good idea to tell the editor that “this is a long and difficult process.” He or she may feel that the writer is saying that the editor is not qualified to do this work easily. A better expression would focus on time, not difficulty. Example: “Thank you for putting so much time into the improvement of my manuscript.”
    d. There are some language errors as well. “taken careful consideration” requires “of [something]”. “Meet revisions” also doesn’t make sense. The correct expression would be “to meet your requirements” or “in light of your recommendations.”
    e. The use of “I” is incorrect, because there are three authors.
    f. The introductory phrase “first of all” is too informal. Just “first” is more appropriate.
    g. Using “so” at the beginning of a sentence is informal style and should be limited to email with close friends. A better choice: “therefore.” (Note: the same rule applies to “and,” “or,” and “but.”)
5. The title of the journal is missing. If this editor manages several journals, this may be a problem. Also, it would be best to mention the section of the journal in which the article belongs (letters, book reviews, articles, etc.), if the journal has sections.
6. The letter needs a closing. Here is one option: “Thank you for your consideration. We look forward to your response.”
7. Periods (.) are not necessary after the authors’ names.
8. “Dr.” is not needed before the authors’ names. The degrees listed after the names provide the same information. “Dr.” and “Professor” are titles usually used for addressing another person. Do not use them to describe yourself.
9. The fax and phone number plus email and mailing addresses of the corresponding author should appear either under the corresponding author’s name or in the body of the letter.
10. The phone number should include the country code.
11. Avoid using abbreviations such as “HP” (hand phone), which are unique to Korea. Instead, write out “Mobile” and “Office.”
12. All authors’ names should be listed in the submission letter, and all of them should sign it. If there is electronic submission, the journal may require a separate document with signatures to be scanned and sent.

**O Corrected Example:**

08 October 2007

Dear Professor Wahlqvist:

We submit the manuscript entitled “Food security, selection, and healthy eating among various age cohorts in a coastal community of South Korea” for publication in the “Research Articles” section of the *Asia Pacific Journal of Clinical Nutrition*. This study was presented at the Association of Clinical Nutrition meeting last year, but has never been published nor submitted to any other journal.

Our study protocol conforms to the human subject guidelines of the Hanyang University Institutional Review Board and to the provisions of the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000). Subjects provided informed consent and their anonymity should be preserved.

Our study was funded by the Brain Korea 21 fund. We have no conflicts of interest.

Thank you for your consideration. We look forward to your response.

Sincerely,

*Chan-ho Park*

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*Sun-woo Kim*

Sun-woo Kim, MD
Hanyang University, Guri

*Hee Seop Choi*

Hee Seop Choi, PhD
Hanyang University, Seoul

# 8.2 The Response to Reviewers

A response to reviewers is a reply to each comment that your reviewer(s) wrote about your manuscript.

When you submit a manuscript for publication, there are four possible responses from the journal editor:

### 1. Acceptance with minor revisions

Almost no papers are accepted without any revisions. However, in a few cases, you may be able to make just a few small changes. If you receive this response, make the revisions and return the manuscript immediately for publication. Include a response to reviewers that lists each change made. Very minor grammatical changes can also be marked in the text itself. Turn on the "track changes" feature so that your changes will be automatically highlighted. In Microsoft Word, click "Tools"→ "Customize" → "Toolbars" → "Reviewing." (도구 → 사용자 지정 → 도구 모음 → 검토)

### 2. Acceptance with major revisions

This situation is quite common. A long response to reviewers should accompany your revised manuscript. Detail each major change.

### 3. Rejection, but with invitation to resubmit

The authors should not give up in this case. The paper seems to be worth publishing, but the editor cannot promise anything because it depends on the quality of the revision. Carefully consider the advice of the reviewers and if you feel comfortable taking much of their advice, go ahead and rewrite the paper and submit again. Often, the editor will ask for a shorter version of the paper. Try to meet the editor's word limit.

### 4. Rejection

There are two main reasons a paper will be rejected. One is that the paper does not fit in the journal or the journal simply has a long waiting list for publication. In this case, follow any recommendations of the editor and locate a better journal.

The other reason a paper may be rejected is that the basic methodology of the study or basic theoretical argument is invalid according to the standards of the field. If you realize that your study was truly flawed, it may be impossible to save the manuscript, unless it is a simple matter of doing additional procedures, increasing the sample size, etc. On the other hand, it is possible that the study would be considered valid in a different subfield. For example, a qualitative study may not be objective enough for one journal, but another journal regularly publishes qualitative studies.

In theory, it is possible to argue with the editor about a rejection. However, it is usually unsuccessful, so the best response for junior scholars is generally to submit to a different journal.

## 8.2.1 How to organize the response to reviewers

1. The response to reviewers is a letter. Format it like a business letter, with a greeting and closing, date, etc.

2. Copy and paste each comment of one reviewer into a fresh document. Type your answer after each one.

3. If several reviewers made the same comment, it is not necessary to type a full response to each reviewer. Group the comments by several reviewers at the beginning of the document. Alternatively, respond only to the first reviewer. After the second reviewer's similar comment, simply type, for example, "Refer to our response to Reviewer 1 Comment 5."

4. If your response contains many citations, include a reference list at the end, just like the reference list of a research article.

## 8.2.2 Types of Responses to a Reviewer's Point

**1. Simple agreement to a reviewer's suggestion.**

A reviewer may suggest that you add information, run additional statistics, do an additional procedure, or expand a sample size. If you agree with the reviewer's suggestion, follow these steps:

a. Refer to the page and/or line number of the text changed to support the reviewer.
b. Highlight the changed text in a different color.
c. Copy and paste the added text into the response to reviewers (unless it is very long).
d. Use the phrase "we agree." Don't add a lot of extra commentary to the agreement. (**X**: "Thank you for your suggestion. It was very helpful.")
e. If the reviewer suggested running additional statistics or doing an additional procedure, describe what you did in detail in the response to reviewers.
f. It is not always necessary to include the results of the additional procedure in your paper, if they seem unimportant to your argument and just prove the point you have already made. It is enough to put the results in your response to reviewers. (Ask a senior scholar for advice about this if you are uncertain.)

**2. The reviewer does not understand part of the paper and makes an unhelpful suggestion. (In other words, you are certain that you are right and the reviewer is wrong.)**

Politely restate the points that the reviewer did not understand. Try to explain it more simply and with more context, assuming that the reviewer may not have the same background knowledge that you have. Don't be afraid to reject bad advice. If you are uncertain about the quality of the advice, consult with a senior scholar.

**3. The reviewer makes a good suggestion, but you already decided not to follow that plan for a good reason.**

There are many reasons that you may not follow reasonable advice. For example, the word limit may prevent you from exploring a topic in more detail in your discussion section or adding many new citations. Often the suggestions can be used for designing a follow-up study. If you plan to follow the advice in a later project, indicate so.

Tip:
It is common for a reviewer to criticize parts of your paper. If you are a junior scholar, do not assume that the reviewer is wrong. Speak with a senior colleague who understands your research well, and get another opinion before rejecting a reviewer's suggestion. Rejecting advice too easily may prevent you from publishing your paper (Sung-Tae Hong, personal communication).

## 8.2.3 Examples from a Real Response to Reviewers

The following excerpts come from a response to reviewers posted on the internet. The research is about levels of mercury (Hg) exposure through eating various types of fish. The manuscript was written by research staff from the U.S. FDA (Food and Drug Administration) and EPA (Environmental Protection Agency). Because this work was done by government staff, the reviewers' comments and authors' responses were made public.

**The reviewer suggests that the author use a different method.**

**Comment:** "The model uses a simplified relationship to estimate mercury blood levels from intake rather than incorporating a pharmacokinetic model to estimate blood levels. There is a simple one compartment model that provides reasonable predictions of mercury blood concentrations from acute and chronic intake information (e.g., Stern, Reg. Tox. Pharmacol. 25: 277-288, 1997; Ginsberg and Toal, Risk Anal. 20: 41-47, 2000). This pharmacokinetic model has the advantage of employing a range of parameter inputs that will create a distribution of blood levels for any intake level that will better represent population variability than the current FDA approach. That approach does not really take into account inter-individual variability in pharmacokinetics."

**Response:** The model is simplified relative to the Stern model in that it assumes steady state kinetics. Given the fact that most toxicological analyses (including the RfD derivation) make the assumption that chronic exposure is the relevant dose metric, we think this is appropriate for current purposes. However, it is not true that population variability is not represented – a distribution is employed which is derived from the Sherlock et al, 1984 study. This distribution is somewhat narrower than the Stern model – this result is attributable to the assumption in the Stern model that blood levels are directly proportional to dose and body weight. It is likely that this assumption causes the Stern model to overestimate pharmacokinetic variability.

The authors show their agreement with part of the reviewer's comments.

Before disagreeing, the authors provide a reason. "Given the fact that" introduces the reason.

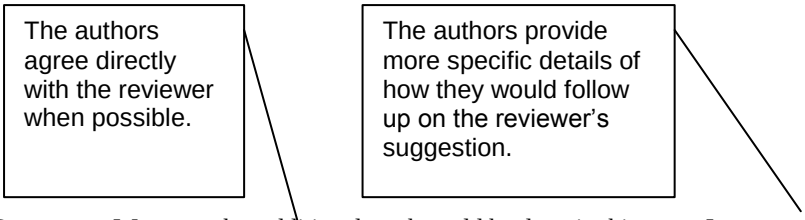
"We think this is appropriate" is a polite way to disagree. "For current purposes" limits the value of the authors' method to this study, implying that the reviewer's method could also be useful in other situations.

The authors now defend the value of their method, citing a paper that explains in more detail.

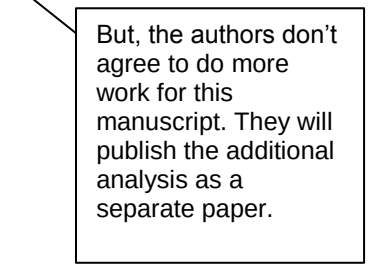
In the end, the authors disagree with the reviewer, but provide polite detailed reasons for their perspective. Beyond defending their own method, they describe the problems with the reviewer's suggested method. This allows the editor to decide whether the authors' perspective is worth publishing.

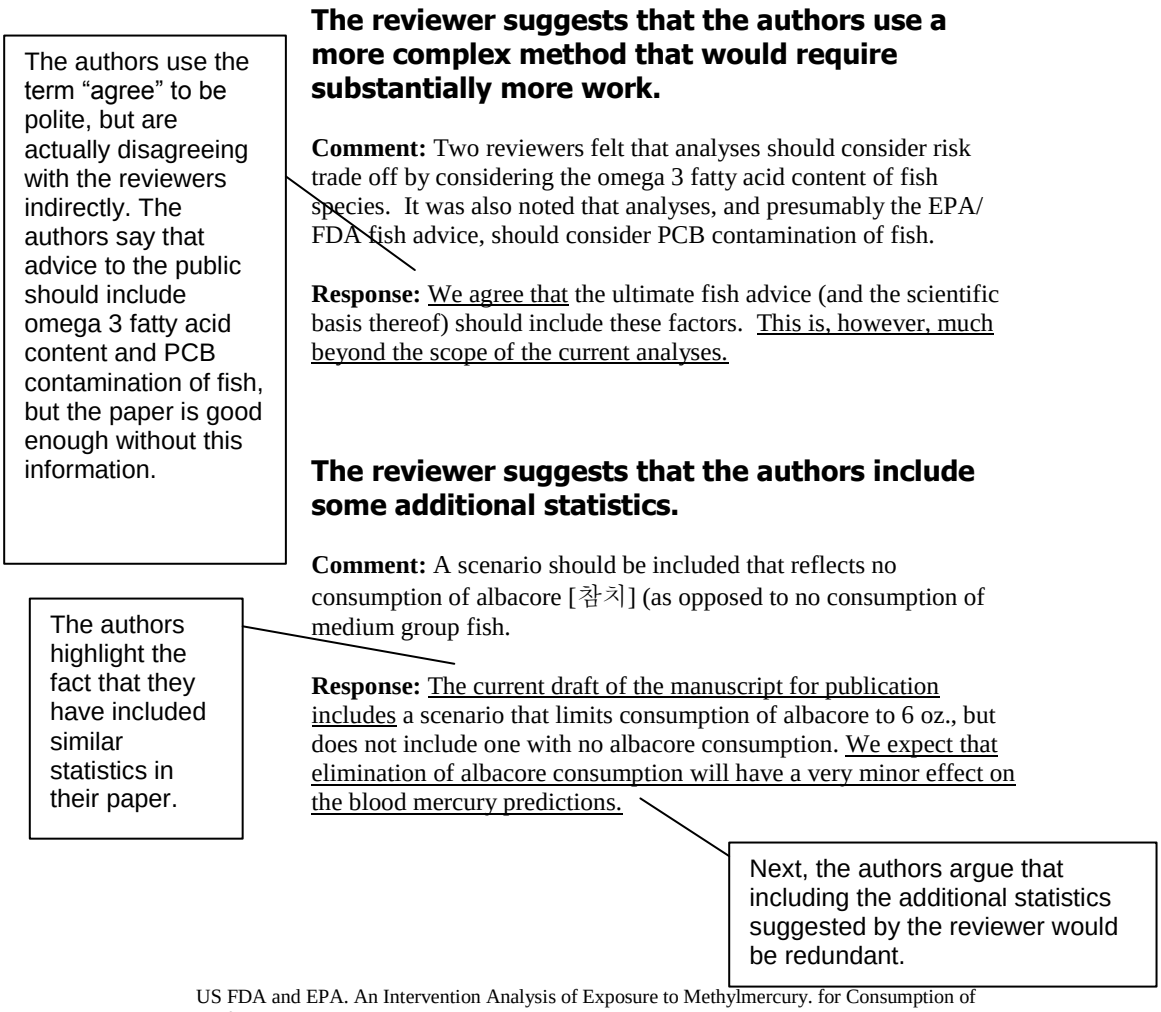
## The reviewer suggests that the authors do additional work.

**Comment:** "Regarding model limitations, the authors note in their *Risk Analysis* paper that species consumption patterns for each consumer may be more highly correlated than is specified in the current model. Some additional exploration with sensitivity analyses would be useful."




**Response:** We agree that additional work could be done in this area. In particular, the 30 day fish consumption frequency data can be used to capture the variation among individuals of the variation in seafood consumption habits. It does appear that some frequent seafood consumers eat one particular species consistently, while others eat a wide variety. These data may provide a basis for differentiating the degree of interindividual vs intraindividual variation on a species by species basis. We are working on a model that is more closely integrated with the NHANES survey.






US FDA and EPA. An Intervention Analysis of Exposure to Methylmercury. for Consumption of Seafood. To view the entire response to reviewers, scroll down to Part III: http://www.fda.gov/ohrms/dockets/ac/03/briefing/4010b1-12-%20EPA.htm . Retrieved in October 2007.

## 8.2.4 Finding Useful Expressions from Sample Letters

When writing your response to reviewers, you may wish to collect common expressions from sample letters online or borrowed from senior colleagues. Here is an example. Follow the internet link below to see more examples. The underlined portions can be copied and pasted into your own writing, if they are appropriate to your context.

This is an excerpt from a response to reviewers in nursing. It is very well-written. In particular, every answer is concise and to the point. ("P" stands for "page" and "L" stands for "line.")

**Example:**

> The introduction was rewritten to address the reviewer's concerns. The question is now clearly stated on P3L2-6, the Needleman reference is removed, and the problem is discussed in greater length on P3-4.

Nursing Research. Sample Response to Reviewers Comments. http://www.nursing-research-editor.com/authors/OMR/20/OMRAuthorResponses.pdf . Retrieved in October 2007.

## 8.2.5 Dealing with Problematic Situations in the Review Process

Here are some potential problems and recommended solutions.

1. Without adding any comments, one of the reviewers simply recommends the paper for rejection or acceptance without revision.

Neither of these is good for you. Usually in this case, the reviewer was lazy and did not give you a proper review. In almost 100% of manuscript submissions, there is some way to improve the first draft before publication.

Publishing the paper without a thorough review risks the possibility that you will publish an error that others will notice and critique in a letter to the editor or even in another journal article. More likely, if readers recognize a major error, they will avoid citing your paper. To avoid this embarrassment, take your paper to a senior colleague you trust to give you an informal review if you feel that the reviewers did not provide sufficient advice.

2. The reviewer does not understand the paper, or focuses only on one section that he or she understands.

This is an embarrassing situation for the reviewer. Avoid attacking the reviewer's errors. However, it is appropriate to disagree with the reviewer's points and provide evidence for your perspective. For smaller journals, you may also wish to contact the editor and explain that the reviewer seems to be coming from another field of study and you would like an additional review. You may even suggest the names of some reviewers who know your field well. Before doing this, check with a senior colleague to verify that your analysis of the situation is correct.

3. The reviewer tries to proofread the paper, focusing on grammar instead of content.

Sometimes grammar errors can make sections of your paper unclear. In this case, it is appropriate for the reviewer to point out parts of the paper that are difficult to read. Whenever possible, send your manuscript to the Writing Lab before submission. We will point out ambiguous sentences so that you can revise them and the reviewer can focus on your ideas, not your language.

Other times, there may be no major English errors, but the reviewer is lazy and focuses on grammar instead of content. This is quite common. Sometimes the grammar is virtually perfect, but the reviewer still tells the author to correct grammar errors. Don't be discouraged about your English and don't necessarily believe the reviewer's opinion about your English. Simply get some assistance and return the revised paper.

4. Two or more reviewers give opposing recommendations on revising the paper, and it is impossible to satisfy everyone's expectations.

This is quite common and, although inconvenient, should not be a cause for great concern. First, think through the different perspectives carefully. Is one perspective well thought out while the other is not a careful analysis? If so, simply follow the better advice. Respond politely to the other reviewer's suggestions, providing reasons for rejecting each suggestion.

Do the two reviewers seem to look at the paper from the perspectives of different research areas? If so, consider how these two research areas fit with the goals and audience of the journal. Does one seem removed from the main audience of the journal? For a specialized journal, the editor is likely to represent the mainstream views of that research area and support the reviewer with similar opinions. Then, you have two options: reshape your paper to fit the conventions of the journal or provide a good argument to the editor of why you will follow the conventions of another field of study.

If both reviewers' perspectives seem worth considering, show your paper to a senior colleague, then contact the editor for further advice. After doing this much work, the editor will be very motivated to publish your paper if possible and will usually try to help you resolve the situation. Keep in mind that the editor will not necessarily require you to follow all the advice of the reviewers, particularly if space is too limited.

5. The reviewers recommend that the paper be accepted after extensive revisions and provide long lists of suggestions.

This is not a problem! Actually, this is the best possible situation. Many of the suggestions will probably improve your manuscript. Those that don't can be politely rejected. In the end, your paper will likely be published.

## 8.2.6 Business Letter Format

### Greetings

Dear [Title] [Family Name]:

Dear Dr. Brown:

Dear Professor Brown:

In formal writing, use a colon (:), not a comma, in American English. For British English, no punctuation is needed.

Do not include the full name in the greeting. Also, do not include the word "Editor."

Do not address the letter to the journal (X: Dear Journal of Pediatrics). If you don't know the name of the editor, look it up, and if you still cannot find it, use "Dear Sir or Madam."

### Closings

Capitalize the first word of the closing, but not any additional words. Leave one line before and three lines after (for a handwritten signature) or one line after (for only a printed name).

American English: Just use "Sincerely" for all formal letters. It is followed by a comma (,).

British English: Yours sincerely, yours truly, and several other expressions are possible. A comma (,) is optional.

Note: It is not necessary to use the editor's own English dialect (British, Australian, etc.) in your correspondence. For your own convenience, choose a standard and use it consistently in every letter. This will allow you to copy and paste unique details into a form letter that you can use again and again.

#### Names

When submitting to a journal outside of Asia, write your name with your given name first and then your family name in the cover letter, but type names according to the journal style in the manuscript.

Unlike in Korea, it is generally uncommon to capitalize all the letters of a family name (e.g., Maria BROWN). Although you may wish to do this in local correspondence, it is not recommended in international correspondence.

### Dates

Use a form of the date that is clear internationally. "9/10/07" is September 10 in North America and October 9 in Europe. One solution is "9 October 2007."

## 8.2.7 Tips for Professional Email Correspondence

1. Create a professional email signature that includes your phone number, email address, and current job title or department and university name. You may also want to include your mailing address. Use it every time you send an email, even for people who already know you. Example:

    Jocelyn Graf
    Assistant Director
    English Writing Lab
    Hanyang University
    Seoul, Korea
    jocelyngraf@gmail.com
    Office: (82) 1-111-1111

Mobile: (82) 2-2222-2222

2. If your email name is not professional, create an extra email account with a more formal name. Check it often or set it up to deliver to your main email box. In Western culture, cute or funny names are not as acceptable as in East Asian culture. They may also be confusing for English learners from other parts of the world.
3. Use a relatively formal style for all professional correspondence, even if someone answers you in an informal style.
4. Never use emoticons ^^, CAPITAL LETTERS, or exclamation points (!) in any professional email.
5. Follow submission guidelines about which file types to use and whether to zip files.
6. When someone sends you an email that contains information, but you do not have to respond, do so anyway. Otherwise, the sender will wonder whether you received it. A simple answer, such as "Thank you," is enough.
7. Use a relevant, specific subject line. Never use subject lines such as "hello", "manuscript," or "question" that appear to be spam. Better options are "Manuscript Submission to Nature" or "Request for Confirmation of Submission."

## 8.2.8 How to Address a Formal Email or Business Letter

1. In the first contact with someone, use a formal greeting. "Dear" plus the individual's title (Mr., Ms., Dr., etc.) and the family name.

2. In North America, there are not many titles. Individuals who are not doctors, religious leaders, or politicians usually go by "Mr." or "Ms." Even if someone's business card says "Director," do not address the individual as "Director Smith."

3. For women without a special title, such as "Dr.," use "Ms." Do not use "Miss" or "Mrs." unless a woman specifically requests it.

4. When contacting professors and university staff, use "Professor" if you are not sure whether the individual has a Ph.D. (or other doctoral degree).

5. Even if writers sign their names informally, continue to use their formal titles until they ask you to call them by a given name or nickname. For example, if a professor signs her email to you as "Sarah," you should still reply to her as "Professor Smith."

6. Do not include the given name in the greeting.

   X: Dear John Smith:
   X: Dear Mr. John Smith:

   Definitely do not use the given name alone with the title. Only young children use this form in North American culture.

   X: Dr. Mr. John:

   Exception: If you are not certain whether someone is a man or woman because the name is unfamiliar, use the whole name after the title. This is also a good strategy when you do not know which name is the family name and which is the given name.
   Dear Jin Yi:
   Dear Lakshmi Kumar:
   Dear A.J. Washington:

   If you build a professional relationship with this person and still do not have this information, call the department and ask the secretary or look for more information online. If necessary, you can ask the individual directly in the second email.

## 8.2.9 Recommended Reading

These two articles provide more detailed advice about writing responses to reviewers:

Millett D. Dealing with reviewers' comments? J Orthod. 2006 Jun;33(2):69-70.
Available from: http://jorthod.maneyjournals.org/cgi/reprint/33/2/69

Cummings P, Rivara FP. Responding to reviewers' comments on submitted articles. Arch Pediatr Adolesc Med. 2002 Feb;156(2):105-7.
Available from: http://archpedi.ama-assn.org/cgi/content/full/156/2/105

Here is an excellent article that describes the whole process of publication from an editor's perspective:

Samet JM. Dear author—Advice from a retiring editor. Am J Epidemiol. 1999 Sep 1;150(5):433-6.
Available from: http://aje.oxfordjournals.org/cgi/reprint/150/5/433