A close-up, sepia-toned photograph of a person's hands and torso. The person is wearing a light-colored lab coat over a dark shirt. They are holding a pen and writing in a spiral-bound notebook. The notebook has some text printed on its cover, including 'DR. ANTONI ESTEVE FOUNDATION' and 'NOTEBOOKS'.

Developing skills in scientific writing

John Giba

Developing skills in scientific writing

John Glba



DR. ANTONI ESTEVE
FOUNDATION

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of this book lies with the author.

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Passeig de la Zona Franca 109. E-08038 Barcelona, Spain.
+34 934335320
fundacion@esteve.org
<http://www.esteve.org>

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The Esteve Foundation was founded in 1983 with the aim of stimulating progress in pharmacotherapy through scientific communication and discussion.

To promote international cooperation in pharmacotherapy research, the Foundation organizes international multidisciplinary meetings where small groups of researchers discuss their work. These proceedings are published in various formats.

The Foundation also organizes local meetings about more issues. These proceedings are published as monographs or notebooks, or as journal articles. The Foundation helps organize conferences, seminars, courses, and other activities to support the advancement of biomedical science. The Foundation presents a biennial Research Award for the best paper published in the field of pharmacotherapy by a Spanish author.

The Foundation is involved in numerous publications, including the *Pharmacotherapy Revisited* series of books, which compile the seminal articles that have helped set the course of progress in specific disciplines.

*To my mother, Peg Kiraly, for the gifts of life and love.
To my wife, Núria Fernàndez Bayó, and to my daughter, Júlia Giba Fernàndez,
for being there to share these gifts with me.*

John Giba
Sentmenat, October 2013

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Foreword

Effective communication is essential in science, yet many scientists have little or no formal training in scientific writing. Unfortunately, the rigorous demands of the curricula for scientific studies leave little time or energy for specific training in communication skills.

Scientists from countries where English is usually confined to the language classroom face the additional challenge of writing in a language in which they rarely feel confident. Courses in English as a foreign language focus on the essentials for everyday communication. Advanced courses on English for academic purposes tend to focus on the arts, including only a few token texts about "Science" in its most general conception. So, scientists are left to struggle with the specifics of English in their own fields, gleaning what they can from the articles and books they need to read for their daily work.

However, the scientific literature abounds with poor writing, and it is sometimes difficult to find articles that could serve as models for clear

communication. Too many authors try to impress readers with flowery language using big words in long, convoluted sentences, obscuring their message and placing an unnecessary burden on the reader.

Fortunately, more and more writers are coming to realize that complex ideas can be expressed in plain simple language. Likewise, a broad consensus about the importance of good writing is developing among journal editors; many journals' instructions remind authors of general precepts like clarity and concision, and some even provide more specific advice about style.

This book explains the principles of good writing in the biomedical sciences, showing us the paths to clear communication and pointing out pitfalls along the way. More importantly, it provides ample opportunities to assimilate these principles through controlled practice. "For the things we have to learn before we can do them, we learn by doing them." (Aristotle, *Il.1103a33*)

*Dr. Ramon Brugada
Dean of the School of Medicine
Universitat de Girona
Girona, March 2014*

Preface

In science, as in every other field of life, communication is crucial. The advancement of science depends on the sharing of knowledge and the critical exchange of complex ideas through congresses and publications. Contributions to these forums must be expressed clearly so that others can evaluate their validity and importance. An individual scientist's or team's success ultimately depends on communication skills, because funding depends on grant proposals and publications.

Speaking and writing, like analytical thinking itself, are “transversal skills”. Too often educators focus exclusively on imparting knowledge rather than on developing skills. I am grateful that my teachers in secondary school recognized the importance of effective communication. No matter what specific knowledge we were supposed to assimilate, we had to demonstrate our competence in the material by expressing our own ideas. Thus, we learned to develop and organize our ideas through writing and rewriting. Likewise, my professors at university demanded clear exposition in both written and oral communication. My education provided me with the basic tools I would need to take on the challenges of any career path I would choose to follow.

As so often happens in life (or at least in *my* life), my ultimate choices were determined by circumstance and happenstance. The vicissitudes of life brought me to Catalonia, a country that has been my home for over half my life. Holding only an undergraduate in degree in psychology, speaking neither of the native tongues, and having no specific knowledge I could capitalize on, it seemed that my only option was to work as

an English teacher in one of the many unofficial “academias” that had become established to fill an important void created by shortcomings of the official educational system. My vague plans for graduate studies in my field and a career in psychology were “temporarily” shelved, and I discovered the joys of learning and living a new culture.

Teaching English as a foreign language taught me much about my mother tongue. Learning two new languages enabled me to appreciate the difficulties my students faced, especially given that I was living the languages I was learning while they were trying to fit learning my language around their busy lives. Fortunately, just when learning to teach English and attaining competence in the native tongues no longer challenged me, a new door opened. Scientists from the *Escola Superior d’Agricultura* at Barcelona Tech needed someone with a scientific background to translate their papers into English. These papers were well thought out, so it was purely a question of language. Working together with the authors made it possible for me to rise to this challenge, and I continue to enjoy collaborating with new generations of scientists doing exciting work in new directions at this institution today.

Then, in 1992, the *Unitat de Diagnòstic per la Imatge d’Alta Tecnologia* (UDIAT) was founded in Sabadell, and the visionary young radiologists chosen to lead the project wanted an American for English conversation practice. These friends and their colleagues at the UDIAT and Corporació Sanitària i Universitària Parc Taulí (CSUPT) have taught me so much about medicine, health-

care, and life. Conversation classes led to other types of collaboration, such as helping prepare posters and conferences as well as translating and correcting papers. I came into contact with biomedical professionals from various fields and institutions. Some of these were established researchers with extremely competent writing skills, while others were just starting out in the world of academic medicine; all had various degrees of deficits in English. Through the years, I have had the privilege of working on thousands of papers in diverse fields through translating, rewriting, editing, proofreading, and helping with submissions and resubmissions. This direct collaboration with authors who have different levels of competence in writing and language has given me a unique understanding of the difficulties Spanish writers face when writing English.

Another door opened when Dr. Ramón Ribes, the brilliant author of a series of books on English for different medical professionals, invited me to participate in medical English courses he was organizing. Around the same time, Dr. José Nicolás provided me with the opportunity to organize and conduct a module in scientific English for some of the Master's programs offered through the medical schools at the University of Barcelona and Autonomous University of Barcelona. These new challenges forced me to think hard about biomedical professionals' language needs, about what they needed to learn and

the best ways to help them learn it. Preparing for these courses, working with knowledgeable, dynamic professors (Ramón Ribes, Kai Vilanova, Fernando Navarro, Juanjo Sanz, Brian McCarthy, and Anna Alguersuari) and interacting with students have all been incredibly enriching.

After several successful courses, Dr. Ribes gave me the opportunity to coauthor books on medical English, and I was forced to put my knowledge down on paper. As Benjamin Disraeli said, "The best way to become acquainted with a subject is to write a book about it". Researching, writing, and rewriting these books (*Surgical English*, Springer 2009; *Inglés Médico y Sanitario*, LID 2010; *Preparing and Delivering Scientific Presentations*, Springer 2011) helped me consolidate my knowledge. I also became aware that although there are many excellent books on scientific writing, most are directed at native English speakers or students and professionals working in English-speaking countries who have near-native fluency. Moreover, very few provide readers with exercises that would enable them to put theory into practice.

The present book aims to help biomedical professionals develop skills in scientific writing. It illustrates the principles underlying good writing, but most importantly it provides you with controlled exercises to put these principles into practice. I hope that this will help you to assimilate them and incorporate them into all your writing.

John Giba
Sentmenat, March 2014

Acknowledgments

I thank the Esteve Foundation for their staunch support. Under Dr. Fèlix Bosch's leadership, the Foundation has done much to promote good communication among biomedical professionals. Not only are the elaboration, publication, and distribution of this book directly sponsored by the Foundation, but also the ideas, material, and exercises stem from the training seminars *Biomedical English, Scientific Communication: Getting Started, and Developing Skills in Scientific Writing* organized by the Foundation. Special thanks to Elisabet Serés for her invaluable help throughout the publication process.

Introduction

In any form of communication, the message is paramount. Making it as easy as possible for your readers to grasp your message is what good writing is all about. Although you need to have a fairly clear idea about what your message is before you sit down to write, the process of elaborating a manuscript can help clarify your ideas and hone your message. Clear writing reflects clear thinking, yet this clarity of thought is actually achieved through writing and especially through rewriting. Many people think that good writers have innate gifts that enable them to put thoughts on paper effortlessly. But the truth is, even the most talented and experienced writers need to work hard to write well, and several drafts are nearly always necessary to ensure that a text is well organized, coherent, and easily understood.

On the other hand, all scientists can learn to write competently. Writing is a skill; like other skills, it can be learned, improved, and refined. Skills are based on knowledge. You can acquire knowledge about scientific writing from reading extensively and critically in your field. Moreover, you can learn specific strategies for clear writing from expert writers and educators. But knowledge alone is not enough. Developing skills requires putting knowledge into practice. Whereas it is useful to know the rules of usage and some guidelines about composition, it is only by applying them that you can hope to master them. In the end, the only way to learn to write is by writing and rewriting.

This book contains a variety of exercises to help you assimilate knowledge about the principles of good writing through controlled prac-

tice. I hope that the experience you gain in doing these exercises will help you to improve your skills in writing scientific English and to become a competent and confident communicator of your ideas. After a brief chapter outlining the importance of *Structure and organization*, we work toward a definition of the *Principles of scientific style*. The next part of the book deals with specific points of style, which are presented in four major sections. The first, *Precision: Avoiding ambiguity*, focuses on the importance of terminology and mechanics in ensuring that your message is understood. The second and third, *Simplicity: Avoiding unnecessary complexity* and *Concision: Making every word count*, highlight strategies to eliminate noise that can distract readers from your message. The fourth, *Fluidity: Keeping the thread*, deals with approaches to ensure coherence and cohesion to make it easier for readers to follow your arguments. A final chapter, *The overview*, underlines the importance of making sure that the trees do not impede your readers from seeing the forest.

This organization represents my attempt to impose order on the many points I consider important. Of course, many of these could be placed in two or more of the sections I have defined for this purpose. Indeed, the divisions are, to a certain degree, arbitrary, and the concepts dealt with in each section are interconnected and overlapping. Likewise, I have aimed for balanced coverage of the material, though inevitably different readers will find that the treatment given to certain topics is excessive while that given to others falls short of their expectations.

Each major section begins with a short explanatory text. Each subsection includes brief descriptions of principles or rules as well as illustrative examples followed by practical exercises. These exercises make up the core of the book. Do them after you read the texts or before you read the texts, in the order they appear in the book or in any order you choose, but do them—this is the only way you can truly benefit from them.

The final chapter contains a variety of exercises to give you additional practice in the points covered in the previous sections. Unlike the exercises in previous chapters, those in the final chapter are not limited to a specific point. These exercises aim to give you practice in recognizing all types of errors that can hinder communication.

The book ends with 14 appendices containing material that can be consulted for help with the exercises, for self-study or revision, or even for guidance in writing up your own work.

A final word of advice: do not become frustrated with the intricacies and idiosyncrasies of the English language. Learning a foreign language is a lifelong task, and gains in your knowledge of general English may have little impact on your ability to write scientific English. Paradoxically, learning scientific writing in English can help you to improve your general English. Remember that your interlocutor, your readership, and your audience are interested in anything interesting you have to say. If you strive to overcome barriers to communication, you are sure to succeed.

List of exercises

1. Structure and organization

- Exercise 1: Decide whether these statements about the organization of an IMRaD paper are true or false.
- Exercise 2: Put the sentences from this introduction in the most logical order.
- Exercise 3: Put the sentences from this materials and methods section in the most logical order.
- Exercise 4: Decide in which sections of an article the following statements would be most appropriate.

2. Scientific style

2.1. Principles

- Exercise 5: Work toward defining the principles of scientific style.
- Exercise 6: Identify the problem and suggest an approach to fixing it.

2.2. Clarity

Precision: Avoiding ambiguity

- Exercise 7: Use your imagination to rewrite the following sentences and make them more specific.
- Exercise 8: Multiple choice: choose the best alternative to fill the gaps.
- Exercise 9: Complete the following sentences using the correct word.
- Exercise 10: Decide whether the words in *italics* are used correctly in the following sentences. Suggest an alternative for incorrect usages.
- Exercise 11: Correct the mistakes due to the influence of Spanish in these sentences.
- Exercise 12: Find and correct the false friends in the following sentences.
- Exercise 13: Find and correct the vocabulary mistakes in the following sentences.
- Exercise 14: Identify the words in these sentences that are too informal and replace them with others in a more appropriate register.
- Exercise 15: Correct the mistakes in the use of articles in these sentences when necessary.
- Exercise 16: Put the verb in parentheses in the correct form to agree with subject.
- Exercise 17: Underline the correct form of the verb.
- Exercise 18: Correct the use of Latin plurals in these sentences.
- Exercise 19: Complete the following sentences with the correct preposition indicating place or direction.
- Exercise 20: Complete the following sentences with the correct preposition of place.
- Exercise 21: Complete the following sentences with the correct preposition of time.
- Exercise 22: Complete the following sentences with the correct preposition: at, in, or on.
- Exercise 23: Complete the following sentences using in, into, on, onto, to, or toward.
- Exercise 24: Complete the following sentences with the correct verb-dependent preposition.
- Exercise 25: Complete the following sentences with the correct adjective-dependent preposition.
- Exercise 26: Complete the following sentences with the correct noun-dependent preposition.
- Exercise 27: Find and correct the errors in prepositions in the following sentences.

Exercise 28: Complete the following sentences using a relative pronoun. If it is possible to omit the pronoun, put an asterisk after it.

Exercise 29: Punctuate the following sentences according to whether they contain defining or non-defining relative clauses.

Exercise 30: Place the modifier in the best position.

Exercise 31: Rearrange the following sentences so that the participle clause functions correctly.

Exercise 32: Rearrange these sentences so that it is clear what the modifiers are modifying.

Exercise 33: Complete the sentences using the infinitive or gerund as appropriate.

Exercise 34: Choose the best verb pattern.

Exercise 35: Correct the mistakes in the use of verb patterns in these sentences.

Exercise 36: Choose the modal verb that best completes the sentence.

Exercise 37: Use Google to decide which of the following arrangements of words is preferable.

Exercise 38: Place commas where necessary in the following sentences; justify your actions with one of the seven rules from the list below.

Exercise 39: Decide whether the following sentences are correctly punctuated with introductory commas. Underline the introductory element and correct any mistakes.

Exercise 40: Add introductory commas where they are needed in the following sentences.

Exercise 41: Identify the nonessential words, phrases, or clauses in the following sentences and add the appropriate punctuation.

Exercise 42: Decide whether the essential and nonessential elements in the following sentences are punctuated correctly. If they are incorrect, correct them.

Exercise 43: The following sentences have essential and nonessential words, phrases, and clauses in them. Put in the necessary punctuation.

Exercise 44: Each of the following sentences needs either a comma or a semicolon. Put in the necessary punctuation.

Exercise 45: Add hyphens to the following sentences where necessary.

Exercise 46: Correct the use of hyphens in the following sentences.

Exercise 47: Put in commas, semicolons, colons, and parentheses wherever they are needed in the following sentences.

Exercise 48: Choose the answer with the correct use of capital letters to complete the sentence.

Exercise 49: Correct the use of capital letters in these titles where necessary.

Exercise 50: Correct the mistakes in the use of apostrophes in these sentences.

Exercise 51: Correct the punctuation in the following sentences where necessary.

Exercise 52: Correct the use of numbers in these sentences.

Exercise 53: Correct the errors in spelling due to similarities with other valid words.

Exercise 54: Correct the errors in spelling due to Spanish influence.

Exercise 55: Correct the errors in spelling due to double consonants.

Exercise 56: Correct the spelling mistakes in the following text. Mixed spelling mistakes.

Exercise 57: Identify and eliminate the ambiguity in these sentences.

Simplicity: Avoiding unnecessary complexity

Exercise 58: Replace the unnecessarily complex words and phrases in these sentences with simpler ones.

Exercise 59: Rearrange these sentences so that the verb carries the message.

Exercise 60: Rewrite these sentences to avoid using a double negative.

Exercise 61: Change these sentences to the active voice where desirable.

Exercise 62: Break up these long, complex sentences to make a more intelligible text.

Exercise 63: Expand these noun strings to make their meaning clearer.

Exercise 64: Eliminate the unnecessary complexity from these sentences.

Concision: Making every word count

- Exercise 65: Eliminate the unnecessary repetitions in these sentences.
- Exercise 66: Eliminate the empty words and phrases from these sentences.
- Exercise 67: Replace the wordy expressions in these sentences with shorter alternatives.
- Exercise 68: Make these sentences more concise.

Fluidity: Keeping the thread

- Exercise 69: Analyze the way these texts are linked.
- Exercise 70: Underline examples of how the authors use transitions to make the text cohesive.
- Exercise 71: Analyze the order in which information is presented in these texts.
- Exercise 72: Rewrite this paragraph to improve the flow of information.
- Exercise 73: Rewrite these sentences so that the elements are parallel.
- Exercise 74: Correct the inconsistencies in terminology in the following texts.
- Exercise 75: Decide whether these sentences are written in US or UK English.
- Exercise 76: Correct the mistakes in the use of UK or US English in the following sentences.
- Exercise 77: Correct the use of abbreviations in the following texts.
- Exercise 78: Rewrite these sentences to make it easier to follow the thread.

3. The overview

Titles

- Exercise 79: Rewrite the following titles to make them more concise.
- Exercise 80: Suggest how these titles might be improved.
- Exercise 81: Select the best title for these abstracts.

Abstracts

- Exercise 82: Answer the questions about what is wrong with the following abstracts.
- Exercise 83: Organize the following sentences into an abstract with the subsections Background, Methods, Results, and Conclusion.

Summary statements and conclusions

- Exercise 84: Correct the mistakes in the conclusions of the following abstracts.
- Exercise 85: Write a conclusion based on the information provided.

4. Putting it all together: Additional exercises

- Exercise 86: Find and correct the mistakes due to the influence of Spanish in these sentences.
- Exercise 87: Change these sentences to make them shorter and simpler.
- Exercise 88: List specific ways to ensure the following characteristics in a scientific manuscript.
- Exercise 89: Improve these 100 sentences however you can.
- Exercise 90: Correct and shorten the abstracts to conform to the journal's requirements.

The answers to all exercises are available at <http://www.esteve.org>

1

Structure and organization

It is structure that we look for whenever we try to understand anything.

Linus Pauling

Communication is all about transmitting your message to your audience, so it is crucial to keep both your message and your audience in mind at all times. Writing and rewriting can help you define and refine your message, and the way you structure and organize your information has an enormous impact on how successful you are at transmitting your message to your audience.

Some of the most important decisions a writer faces involve what to include and what to leave out. These decisions should be guided by the intended audience—different groups of readers will be interested in different details. For instance, when writing for a general medical audience you need to include more background information than you do when writing for an audience composed of members of your specialty or subspecialty, for whom such details would be superfluous. On the other hand, members of your subspecialty will appreciate detailed information about methods and procedures that might overwhelm and distract readers from other backgrounds. The journal's aims and scope will give you a picture of its readership and help you to decide what to include in your manuscript and how to focus your message.

When you have decided on the focus and depth of the information to include in your manuscript, you must decide how to organize and structure the information you want to present. In scientific journal articles, the journal specifies the format, nearly always a variant of the IMRaD (Introduction, Materials & Methods, Results, and Discussion) design. In grant applications, the agency managing the funds specifies the format, but the basic structure tends to be similar across agencies. In each case, the text is conveniently divided up into major sections where readers can expect to find a predetermined type of information. In each of these sections, you need to provide all the necessary information but only the appropriate information. Moreover, you need to structure the information you provide in each section to make it as easy as possible for readers to grasp your message, creating subsections within sections, marking them clearly with headers when convenient, and organizing paragraphs and sentences in a logical order. Your goal should always be to arrange the information in the document to make it as easy as possible for readers to follow the thread of your arguments and comprehend your message.

IMRaD structure for research papers

Most papers reporting original research follow the IMRaD structure: Introduction, Methods, Results, and Discussion. Each section contributes to the overall story by answering one or more questions:

- *Introduction*—What problem, question, or hypothesis did you study? Why should it interest readers?
- *Methods*—What did you do to answer the question?
- *Results*—What did you find?
- *Discussion*—What is the meaning and value of your results?

This format works well for studies in which the experiments are planned in advance or performed in a pre-defined order. Examples of this type of studies include randomized controlled trials, intervention trials, and observational studies. Nevertheless, authors reporting other types of studies are often forced to adapt their texts to this format.

The introduction

The introduction has two goals: first to spark the readers' interest in your paper and second to provide a context to prepare them to understand it.

- 1) STRUCTURE: The introduction should be organized like a funnel (Fig. 1). Begin by providing general background information on the topic of the paper (A - The Known). Continue by focusing on what remains unknown (B - The Unknown). Show the reader that there are important missing pieces of the puzzle that need to be filled in. Narrow your discourse to the

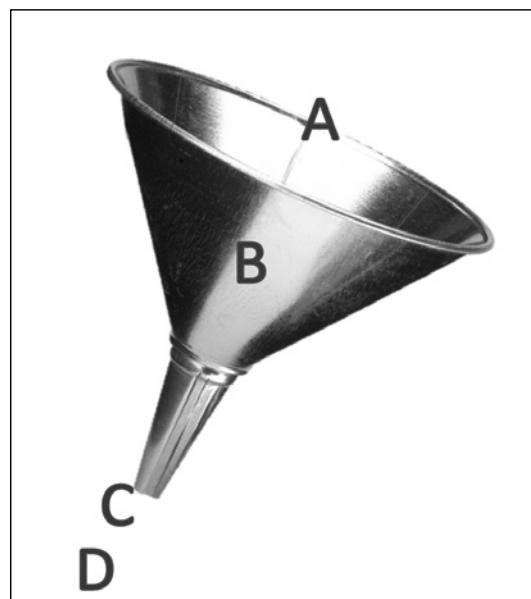


Figure 1. Organization of the introduction. A) The Known. B) The Unknown. C) The Question. D) Experimental Approach.

question (C – The Question), which is the topic of your paper. Finally, it is sometimes useful to include a brief description of your experimental approach (D - Experimental Approach) to smoothly guide the reader to the next section of your paper.

- 2) TENSE: Most introductions use a variety of tenses. The present tense is used for established facts. *Prokaryotes store their DNA only in the cytoplasm. Untreated, diabetes can cause many complications.* The present tense is also used when a specific paper or result is the subject of the sentence. *Gallant et al.² showed that the drug is safe at low doses. Peters et al.'s study details the pharmacokinetics of...* The present or present perfect tense is used to talk about past research results that

are still valid. Several studies have shown that drug X is effective against Gram-negative and Gram-positive bacteria.²⁻⁵ Recent genome-wide association studies investigating bipolar disorder have detected a number of susceptibility genes.⁴⁻⁸ The past tense is used to refer specifically to methods used in previous studies. Kuralt *et al.*³ used reverse transcription PCR to detect swine flu virus in cats. The past tense should also be used for statements about past conclusions that are no longer true. *It was thought that most heat was lost through the head.* The hypothesis is introduced with the past tense but can be stated in either the present or conditional tense. *We hypothesized that CRH plays a crucial role in...* *We sought to determine whether higher doses would be more effective...*

3) SIGNALING TOPICS: Useful language for signaling topics in the introduction include:

- *The effect of A on B is well known.*
- *X is associated with Y and Z, but the relationship between Y and Z is poorly understood.*
- *Recent developments in X have underlined the need for...*
- *Little is known about the mechanisms underlying...*
- *To date there has been little agreement on what...*
- *The data from experimental models are inconclusive...*
- *We aimed to determine whether...*
- *We sought to elucidate...*
- *We hypothesized that...*
- *We tested the hypothesis that...*
- *To answer this question,...*

The methods

1) STRUCTURE: The methods section is also called the “materials and methods”, “patients and methods”, “study design”, or “experimental” section. The goals of this section are to enable readers to *a)* understand how the

experiments were performed, *b)* understand how the results and conclusions were obtained, *c)* reproduce the study, and *d)* determine whether the results and conclusions are valid based on the strength of the methods and study design. To accomplish these goals, the methods section should answer the questions *Who? What? When? Where? and How?* in your study (Table 1).

2) TENSE: The methods section is written mostly in the past tense; the present tense is only used to introduce figures and tables. It is crucial to organize the material to help readers understand what you did. You will usually have to divide the methods into subsections and mark them clearly with subheadings. It is also crucial to define all the variables, experimental studies, and groups clearly in this stage of the article. The methods section is the only section in where the passive voice still predominates, although you should not be afraid to use the active voice when it comes naturally. Remember, you should include only the details that are truly relevant.

3) SIGNALING TOPICS: Useful language for signaling topics in the methods section include:

- *To establish whether...*
- *Blood samples were obtained from the antecubital vein...*
- *The institutional review boards at each participating center approved the study protocol and waived the need for consent.*
- *We prepared X according to the procedure used by Allan *et al.* (1987)...*
- *...as described previously,¹² we...*
- *...described elsewhere.¹⁵*
- *Eligible women who matched the selection criteria were identified by...*
- *Patients with a history of heart disease were excluded...*
- *The design of the questionnaires was based on...*
- *We recorded the following variables for each patient admitted to the ICU:...*

Table 1. Some questions that often need to be answered in the Methods section.**Who**

Who were the patients/subjects? Who collected and reviewed the data? Who did the statistical analyses? Who reviewed the protocol for ethics approval?... As elsewhere in your manuscript, provide only the absolutely necessary details. For example, it may be important that the data were collected by an individual that was blinded to the patients' group assignments, but not that this person trained at a prestigious institution. Likewise, it might be useful to mention that images were interpreted by a neuroradiologist with 10 years' experience in advanced MRI techniques (because this may affect the results), but not that the statistical analyses were done by a statistician.

What

What was the experimental design? What specific methods were used? What type of study was it? What were the inclusion and exclusion criteria? What interventions were carried out? What were the endpoints/dependent variables of the study? What was the cutoff for statistical significance? What control studies were performed? What statistical tests were used and what programs did you use to carry them out?...

When

When were specimens collected? When were the analyses performed? When was the study initiated? When was the study terminated?...

Where

Where were the specimens analyzed? Where were the study participants enrolled? Where was the study performed?

How

How were samples collected, processed, and stored? How is the data reported? How were the patients/subjects recruited and/or selected? How was the sample size determined? How were study participants assigned to groups? How were response and endpoints measured?...

- *The primary outcome variables were...*
- *In patients readmitted to the emergency department, only the first admission was included in the analysis...*
- *Publications were only included in the analysis if...*

The results

1) STRUCTURE: Try to summarize the data (facts and figures) obtained in your study in tables and figures. These key elements will support your results, in other words, the statements you make in the text to explain what the data show. However, you should not report every finding in the results section. Rather you should limit your reporting to those that answer the question posed in the Introduction, although it is alright to include unexpected findings that are truly interesting. You need to organize the information you present in the

results section very carefully. As always, you should aim for a logical order that helps readers make sense of your findings and grasp your message. To a certain degree, the order in which you present your results depends on what you want to emphasize. You can follow the order you used in the Methods or you can report them in chronological order; alternatively you can group them by topic or by experiment. You might find it best to go from general to specific, a common form in clinical studies that include multiple groups receiving different treatments, or from most to least important.

Avoid mentioning details of the experiments that yielded the results; this information belongs in the methods. Likewise, avoid commenting on the results or stating conclusions; this information belongs in the discussion. You rarely need to cite references in the results section, as you are reporting your own work in this specific study.

Table 2. Reporting guidelines.

- Consolidated Standards of Reporting Trials (CONSORT: www.consort-statement.org/)
- Strengthening the Reporting of Observational Studies in Epidemiology (STROBE; www.strobe-statement.org/)
- Metaanalyses of Observational Studies in Epidemiology (MOOSE; *JAMA* 2000;283:2008–12)
- Enhancing the Quality and Transparency of Health Research (EQUATOR; www.equator-network.org/)
- Preferred Reporting Items for Systematic Reviews and Metaanalyses (PRISMA; www.prisma-statement.org/)

Specific guidelines for reporting results in several kinds of studies are available online (Table 2). Following these standards for reporting can help you develop an accurate and complete results section.

- 2) TENSE: The past tense predominates in the results section. The present tense is used to refer to tables and figures. *The baseline hemodynamic variables are reported in Table 1. Figure 2 shows the time profile of geometric mean values for total lymphocytes from all dosage groups.*
- 3) SIGNALING TOPICS: Useful language for signaling topics in the results section include:
 - *Table 1 presents the results obtained from the preliminary analysis of X...*
 - *There was a significant positive correlation between...*
 - *The pigs' blood pressure increased with each challenge (Table 1).*
 - *There were no significant differences between...*
 - *The response rate was 20% at six months and 54% at twelve months.*
 - *We found (no)... We observed (no)...*
 - *Table 2 reports/shows...*
 - *Figure 1 shows representative images of the hippocampus from each experimental group.*
 - *Within 72 h, representative cytokines, chemokines, and adhesion molecules had increased significantly (Fig. 4).*

The discussion

- 1) STRUCTURE: In the discussion, you need to explain the meaning of your results and to discuss what contribution they make to the existing evidence. Structure your discussion like an inverted funnel, the opposite of the introduction section (Fig. 2). Begin with one or two very specific sentences to answer the question posed in the introduction (A - Answer to the question); be sure to use the same key terms you used in stating the question in the introduction. It may be useful to precede the answer to the question with an introductory statement (one or two sentences, maximum)

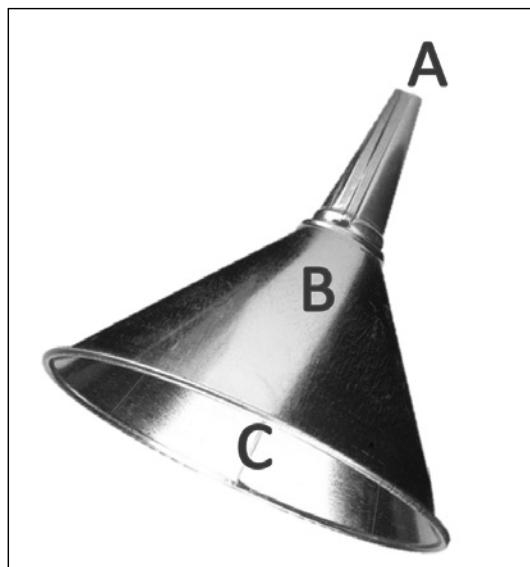


Figure 2. Organization and discussion. A) Answer the question. B) Interpretation and discussion of the results. C) Contribution of the study.

to add context to the section, since the introduction and the discussion are so far apart.

The next step is to explain how your results support your answer (B - Interpretation and discussion of results). The funnel should broaden as you discuss and interpret your results. You need to help readers situate your study in the literature and help them gain perspective on how your results fit in with what was already known. You should discuss whether your results are consistent with previously published studies, and if they are not, you should discuss why. It is important to mention the real and potential limitations of your study.

Finally, you need to emphasize the contribution your study makes to the field and its implications for future studies (C - Contribution of the study. Summary statement). It is crucial to end the article with a strong statement. Too often writers end on weak note with a cliché like “more studies are required to...”. Instead, you should include a summary statement with a take-home message for the reader and a call for action if your conclusion allows it.

2) TENSE: The discussion is the section where the widest variety of tenses is used. These may include the past, present perfect, present, conditional, and even future tenses. Use

the past tense when referring to what was done and the present for making conclusions. *We found that oxidative DNA damage and errors in repair DNA synthesis mainly contribute to rare spontaneous mutations; this suggests that...* Use the future tense to indicate future directions for research. *We will publish our final results next year. This approach will enable large samples to be screened.*

3) SIGNALING TOPICS: Useful language for signaling topics in the discussion section include:

- *The results of this study show/indicate that...*
- *This experiment did not detect any evidence for...*
- *This study confirms that X is associated with...*
- *However, the findings of the current study do not support the previous research.*
- *The results of our study not only...*
- *This inconsistency/discrepancy may be due to...*
- *A possible explanation for this might be that...*
- *Our results corroborate...*
- *This finding is in line with that reported by Fulano et al.,²⁷ who reported that...*
- *Unlike other groups,^{16, 17, 31} we found no correlation between...*

Exercise 1

Decide whether these statements about the organization of an IMRaD paper are true or false.

- 1) Always begin your introduction with a specific statement of the goals of your study.
- 2) Your introduction needs to justify why you did your study.
- 3) Your introduction should provide as much background information as possible, including a minireview of the literature on your subject.
- 4) The methods section talks about what YOU did, so you should never cite other authors.
- 5) The experimental design of the study must be clearly explained in the methods section.
- 6) It is always strictly necessary to use the same subsections in both the methods and results.
- 7) Always provide full details about manufacturers and suppliers of equipment and materials.
- 8) The text of the results section should highlight information from tables and figures that is directly related to the objectives of your study.
- 9) You should never mention results that are not directly related to the objectives of your study, no matter how interesting they may seem.

Continue

- 10) Always use the same terms for key concepts in the methods and results sections.
- 11) The order of the columns and rows of a table are not important.
- 12) A thorough discussion should mention most studies that are related to yours in any way.
- 13) The discussion should never deal with “interesting” results of your study that are not directly related to your objectives.
- 14) You should be sure not to omit discussing any of your results in the discussion section.
- 15) Always end your discussion with some kind of conclusion.

Exercise 2

Put the sentences from this introduction in the most logical order.

Predictors of postoperative ARDS in patients undergoing non-high risk surgery

- 1) More than 30% of ARDS patients die before discharge.
- 2) Moreover, the influence of ventilator and fluid management on whether ARDS develops is unknown.
- 3) We hypothesized that patients with known risk factors for end-organ dysfunction receiving large volume resuscitation and nonprotective ventilator management would be more likely to develop postoperative ARDS.
- 4) The risk factors for postoperative ARDS in patients undergoing other types of surgery are not well defined.
- 5) We aimed to determine preoperative risk factors for ARDS in patients undergoing surgery other than cardiac, thoracic, vascular, or trauma surgery and to define the role of ventilator and fluid management in the development of postoperative ARDS.
- 6) Acute respiratory distress syndrome (ARDS) is defined as the rapid onset of hypoxia (Pa/FIO_2 ratio ≤ 300) and bilateral infiltrates in the absence of left atrial hypertension.
- 7) Patients undergoing cardiac, thoracic, vascular, or trauma surgery have increased risk of developing postoperative ARDS.

Exercise 3

Put the sentences from this materials and methods section in the most logical order.

Material and methods

- 1) We selected cases in which new-onset atrial fibrillation was detected at EKG or Holter monitoring.
- 2) We reviewed the medical histories of 150 consecutive patients admitted to our stroke unit between January 1, 2005 and December 31, 2005.
- 3) We also recorded the time from admission to detection of atrial fibrillation.
- 4) All patients underwent EKG and 80% also underwent Holter monitoring.
- 5) SPSS (v.10.2) was used for all statistical analyses.
- 6) We recorded the time from admission to Holter placement and the number of EKGs obtained within three days of admission.
- 7) Criteria for admission to the unit were noncomatose patients with cerebrovascular event suggested by clinical presentation and confirmed by neuroimaging with onset < 48 h who had no concomitant disease or disabling disorders that would limit their ability to undergo rehabilitation.
- 8) We excluded patients with intracranial bleeding.
- 9) We used Fisher's exact test to analyze the EKG data and the McNemar test to analyze EKG and Holter data in patients who were monitored with both techniques.

Exercise 4

Decide in which sections of an article the following statements would be most appropriate.

- 1) This report represents one of the largest single-institution series of patients with breast papilloma.
- 2) To evaluate agreement between methods, we used the Wilcoxon signed-rank test, Spearman correlation, and Bland-Altman analysis.
- 3) We sought to test whether ischemic lesion size on CT angiography depends on the CT angiography acquisition protocol.
- 4) Currently there are no objective clinical tools that can accurately discriminate aggressive from indolent prostate cancer.
- 5) To find the best parameter for channel design, we designed three channels of different heights: 10 μ m, 50 μ m and 100 μ m.
- 6) Semen analysis was performed according to published guidelines of the World Health Organization.⁶
- 7) Further studies are required to elucidate the nature of a higher degree of polyunsaturation in the NMR-visible lipid pool upon eLDL loading.
- 8) After 4 weeks, plasma HDL-C in the SUB885C group was 39% higher than in the controls (1.1 \pm 0.3 mmol/L versus 0.8 \pm 0.3 mmol/L, $p < 0.05$).
- 9) TLX has been proposed to function primarily as a transcriptional repressor of target genes through its physical interactions with transcriptional corepressors including epigenetic modifiers like lysine-specific histone demethylase 1 (LSD1).¹²⁻¹⁵
- 10) Our findings corroborate reports that aprotinin administration increases the risk of postoperative AKI.^{1,3,13-15}

2

Scientific style

If any man wish to write in a clear style, let him be first clear in his thoughts.

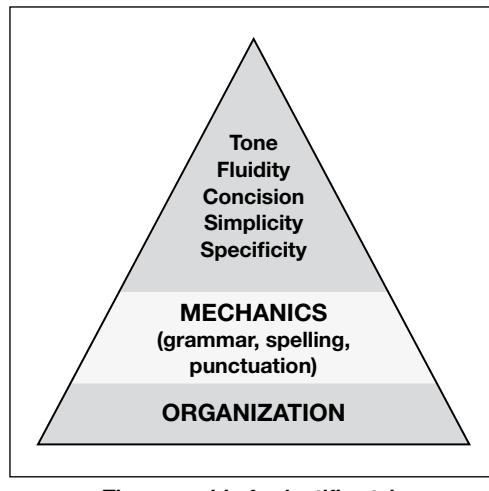
Johann Wolfgang von Goethe

2.1. Principles

Principles and rules are intended to provide a thinking man with a frame of reference.

Carl von Clausewitz

The main goal of scientific writing is to inform: a) to communicate your results and conclusions to others working in your field, b) to record what you have done, so others can check your work and evaluate your results and conclusions, and c) to educate those who are getting started in your field or working in related fields. This last point is important; it is not enough for other



experts in your specific area of interest to understand your text. Well-written scientific texts present complex information in a way that enables relatively knowledgeable readers to understand it as easily as possible. Efficient organization and impeccable mechanics are fundamental to this task, but a series of other principles must also be applied to ensure clarity and comprehension.

The following exercise aims to get you thinking about scientific style. It can be quite challenging, so be sure to give yourself plenty of time. On the other hand, if you have severe difficulties with one of the sentences, do not hesitate to move on to the next one.

Exercise 5

Each of the following sentences violates at least one principle of scientific style (related to the text written *in bold italics*). Examine each sentence and use your imagination to decide how it could be improved. Then try to define the principle illustrated in each group of five sentences. If you find this second part of the task too challenging, you can look at the list of principles on page 15 and do it as a matching exercise.

I.

EXAMPLE: A *number of patients* had *significant headaches*. Twenty patients had headaches ≥ 7 on the visual analogue scale.

- 1) We *exposed 20 animals* to *high levels of* chloromethane.
- 2) Cardiac output was *drastically compromised*.
- 3) *With* the administration of amiodarone, the frequency and length of runs of tachycardia decreased.
- 4) An *elderly patient* presented with *abnormal heart sounds*.

II.

EXAMPLE: The ambulance team must *have the capability* to provide basic emergency care interventions. *The ambulance team must be able...*

- 1) *The vast majority of* patients had *suffered* traffic accidents.
- 2) The incidence of type II diabetes is increasing in *the pediatric population*.
- 3) We studied *16 male and 14 female patients* with congestive heart failure.
- 4) *Monitorization of the patients' vital signs* was carried out by *the nursing team*.

III.

EXAMPLE: A protocol for weaning patients from mechanical ventilation is *absolutely essential*. A *protocol for weaning patients from mechanical ventilation* is *essential*.

- 1) CT *was performed and* revealed *the presence of* massive subarachnoid hemorrhage.
- 2) Bilirubin causes the urine to become *a dark brown color*.
- 3) The purpose of a Rapid Response Team is to support *the* hospital personnel *outside of* the ICU and *the* ED.
- 4) *Two distinct* studies are *currently underway* to explore this phenomenon.

IV.

EXAMPLE: Meningiomas are more common in women and are multiple in up to 40% of cases. *This* is more usual in patients with neurofibromatosis 2. *Meningiomas are more common in women and are multiple in up to 40% of cases*. *Multiple meningiomas are more usual in patients with neurofibromatosis 2*.

- 1) *Cognitive impairment* is common in ICU patients. *These neuropsychological deficits* can persist long after discharge. *Neurocognitive deficits* can affect patient's *ability to perform tasks of daily living*. This decreased quality of life...
- 2) At our *center, haemopexin* levels are often *utilised* to diagnose *hemolytic anaemia*.
- 3) When *heart rate increases, there is usually an increase* cardiac output, too.
- 4) She spoke at the *critical patient rights protection regulations consensus conference*.

V.

EXAMPLE: *It is well known that* trauma patients can develop post-traumatic stress syndrome. *Trauma patients can develop post-traumatic stress syndrome.*

- 1) These results *clearly demonstrate* an *unambiguous improvement* over existing treatment options.
- 2) Our results *could suggest* that this treatment *might possibly have some* benefit in the treatment of a *select group* of patients.
- 3) When a *urologist* interprets the PSA, *he* takes many factors into consideration.
- 4) A 20-year-old *male Gypsy* presented with a knife wound.

VI.

EXAMPLE: The *ionogram* showed renal dysfunction. *The serum electrolytes showed renal dysfunction.*

- 1) In *general medicine* you inject acts faster than medicine you swallow.
- 2) Nearly half of our patients had *cardiopathies*.
- 3) Abused *infants* often *corroborate* their caretakers' lies.
- 4) *Looking through the microscope, islands of trophoblastic cells* were surrounded by extensive necrosis.

Note that the principles in the following list are interrelated and can overlap.

Principles of Scientific Style

- a) Keep writing as simple as possible—avoid unnecessary complexity.
- b) Ensure that the ideas flow smoothly—eliminate obstacles to comprehension.
- c) Maintain the right attitude—be forthright and humble, show respect for others.
- d) Be concise—make every word count.
- e) Be specific—don't make readers guess important details.
- f) Be accurate—use the correct terms and mechanics (spelling, grammar, and punctuation).

Exercise 6

Identify the problem and suggest an approach to fixing it.

EXAMPLE: Our innovative approach revolutionizes the treatment of... *This is a problem of attitude (arrogance). Better to begin* Our approach improves the treatment of...

- 1) Fludrocortisone is absorbed rapidly from the GI tract with a peak plasma concentration within 1.5 hours.
- 2) Vasopressors are indicated following the initiation of cardiopulmonary resuscitation.
- 3) The trigeminal nerve is the largest of the cranial nerves. CN5 provides the tactile, proprioceptive, and nociceptive afference of the face and mouth. The fifth cranial nerve activates the muscles of mastication, the tensor tympani, tensor veli palatini, mylohyoid, and anterior belly of the digastric.

Continue

- 4) Anesthetists must complete a four-year residency program after medical school.
- 5) This is the first study to show beyond the shadow of doubt that...
- 6) A nurse will be responsible for taking your temperature and blood pressure. She should always inform you of her findings.
- 7) Multiple organ failure was associated with death in all cases.
- 8) We aimed to study the appearance of pseudoangiomatous stromal hyperplasia (PASH) on mammography (MG), computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography (US) and to detail the differential diagnosis with angiosarcoma (AS)... At MG and US, AS was impossible to distinguish from PASH.
- 9) Complete surgical resection of the lesion was done.
- 10) Her gallbladder was resected by a surgeon.

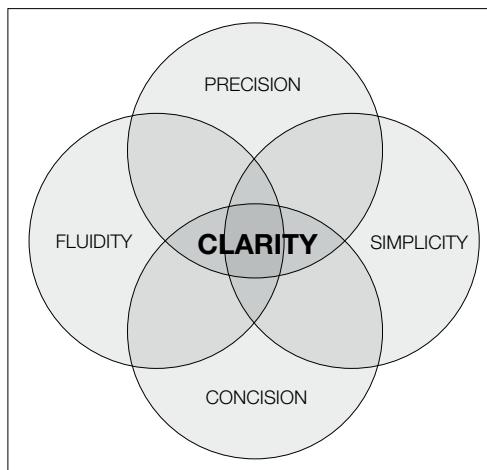
2.2. Clarity

In language, clarity is everything.

Confucious

The defining characteristic of good scientific writing is clarity. Clear writing reflects clear thinking.

The following diagram shows four basic aspects of scientific style that have an impact on clarity. Although we will deal with each aspect separately, bear in mind that they are interrelated and there is considerable overlap among them.



Working to make your text more precise will help to ensure it flows smoothly. On the other hand, working to make your text flow smoothly can help you find ambiguities and thus make your text more precise. Similarly, working to make your text concise can help to eliminate unnecessary complexity. On the other hand, simplifying a text nearly always shortens it.

Each of the following sections in this book deals with one of these characteristics, presenting strategies and advice for tackling common problems and pitfalls that can prevent you from achieving that characteristic and thus from achieving your final goal of being clear.

Precision: Avoiding ambiguity

A writer should have the precision of a poet and the imagination of a scientist.

Vladimir Nabokov

An ambiguous message is a message that can be interpreted in more than one way. Fiction writers use ambiguity to their advantage; leaving a few details to the readers' imaginations can help make their stories seem more realistic. However, scientific communication has a very low tolerance for ambiguity. It is not enough for readers to be able to grasp the intended meaning. Readers should not have to consider multiple interpretations. The burden of clarity rests on the writer's shoulders. To make sure your message gets through, you need to say what you really mean and make sure that there are no other possible interpretations for what you write.

To this end, you must be careful about the words you use and the way you use them. Make sure your terminology is correct, specific, and consistent. Make sure your word order does not allow confusion. Make sure your spelling, grammar, and punctuation are impeccable. Figure 3 shows the major elements involved in precision.

All these tasks are easier when you keep things simple (see *Simplicity: Avoiding unnecessary complexity*).

Choosing the right words

It is crucial to use the correct words and to use words correctly. Always consult a dictionary, especially if you have consulted a thesaurus. Be aware that few words mean exactly the same thing; even when the denotation is the same, the connotations can be quite different. Likewise, try to use the right register: scientific writing is relatively formal.

Vague words are open to interpretation; specific words help make sure your meaning is understood. It can be difficult to detect vague words, because we always understand the meaning of

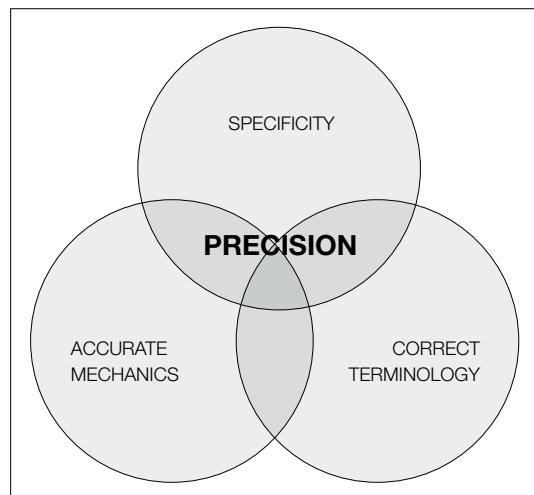


Figure 3. Aspects related to precision.

our own text perfectly. One good way to put yourself in your reader's shoes is to put your text aside for as long as possible and then reread it. Another way to detect imprecision is to have others read your texts before you send them off.

Note also that different terms for the same concepts often coexist and are sometimes used interchangeably. For example, the terms "arterioureteral fistula" and "ureteroarterial fistula" are used with about the same frequency in the literature. Some authors prefer "arterioureteral fistula" because the primary symptom is hematuria caused by blood flowing from the artery to the ureter. Other authors prefer "ureteroarterial fistula" because these fistulas nearly always result from primary ureteral disease due to the iatrogenic effects of irradiation and/or surgery for urogenital malignancies. Regardless of which term you choose to use in your article, you need to use it consistently throughout (see *Fluidity: Keeping the thread*).

Remember, too, that the terminology evolves. As knowledge advances, new classifications are proposed. New terms based on better understanding of different phenomena are rarely adopted by all authors immediately. In fact, the older terminology may coexist with the new for long periods of time. For example, in about 2005, a committee of experts proposed the term “acute kidney injury” to replace “acute renal failure”, yet many articles published in 2012 continued to use the older term. Similarly, better understanding of the histology underlying the clinical conditions referred to as “congenital cystic adenomatoid malformation” led to the coining of a more appropriate term, “congenital pulmonary airway malformation” in 1977. The old term, however, predominated in the literature through 2012, and it is only in the last couple years that the newer term is becoming more common than the older one, although it is far from replacing it. It can therefore be difficult sometimes to choose the best term. Although your choice should be guided by the articles you cite, remember that you have the final decision and the final responsibility for your choices. Avoid perpetuating erroneous or misleading terms, but be aware that others may be more familiar with classic terms.

Strive to become an expert at obtaining information about words from the internet. Nowadays, the first step in internet searching is usually Google. Google has many useful tools to help you find the appropriate words to say what you really mean. Google translate is sometimes the best place to start if you have no idea how to say something in English. Check the results by searching for the results (place them between quotation marks) in the web or in Google Scholar (see also *Using Google as a concordancer*). Google also allows

you to check the meaning of words and phrases by typing “define:” followed by the term you want to check. If you are looking for the right word for an object or anatomical structure, you can check possibilities by searching for images.

Multilingual websites are also useful for checking terminology across languages. You can search for a term in your native tongue in Wikipedia and then click on the equivalent page in English. The United States’ National Library of Medicine and National Institutes of Health maintain Medline Plus® to provide patients and their families with information about diseases, conditions, and related issues in both English and Spanish. The University of Maryland Medical Center maintains a bilingual (English-Spanish) medical encyclopedia with similar information. The World Medical Association and the World Health Organization also publish a wide variety of materials in multilingual formats.

Many errors in vocabulary and usage come from confusing similarities among English words and from misleading similarities with words in your mother tongue. The following exercises aim to give you practice in choosing the best word for each occasion.

Being specific

Writing in general rather than specific terms forces readers to try to fill in the gaps. By being specific, you can help make sure readers understand the actual message you mean to convey. Note, however, that there is nothing wrong with general terms *per se*. Some of the sentences in the exercise below might be correct in certain contexts, for example, immediately after or before we have defined or specified their elements.

Exercise 7

Use your imagination to rewrite the following sentences and make them more specific.

EXAMPLE: The patient presented with a lesion on her leg.

A 25-year-old woman presented with a laceration on the outer aspect of her left thigh.

- 1) Patients with altered Glasgow Coma Scale score were excluded from the analysis.

- 2) A considerable number of the samples were contaminated.

- 3) Bacteria were isolated from body fluids, so antibiotics were administered.

- 4) We observed a large increase in the cells expressing more Orai1.

- 5) After administration of the new angiotensin-converting enzyme inhibitor, regional hemodynamic parameters were altered.

- 6) The skin lesions grew and changed color over time.

- 7) Most of the animals developed complications.

- 8) We report the case of a child who suffered abdominal lesions after ingesting a foreign body.

- 9) Experimental subjects underwent various tests to ensure they were healthy.

- 10) Modifications to the pH were associated with the death of microorganisms.

Being correct

Make sure that you use the right words (i.e., those that convey your idea correctly and precisely). Finding the right words to express what

you really mean can be difficult due to similarities in form and meaning, together with the seemingly arbitrary nature of accepted collocations.

Exercise 8

Multiple choice: choose the best alternative to fill the gaps.

- 1) After working as a _____ doctor for four years, Mary decided she wanted to specialize in rehabilitation medicine.
 - a) primary
 - b) familiar
 - c) familial
 - d) family
- 2) Are you _____ with bootstrapping techniques?
 - a) familiar
 - b) aware
 - c) conscious
 - d) experimented
- 3) The _____ Committee approved the protocol.
 - a) Ethic
 - b) Moral
 - c) Ethics
 - d) Ethical

Continue

4) Determining whether extra-abdominal ____ is present is important in staging primary malignant liver tumors.

- extent
- affection
- extension
- affectionation

5) ____ Mediterranean fever mainly affects people of Jewish, Arabic, or Armenian descent.

- Family
- Hereditary
- Familiar
- Familial

6) The white ____ is composed mainly of glial cells and myelinated axons.

- matter
- material
- substance
- mater

7) It would not be ____ to deprive patients with a life-threatening condition of a potentially beneficial treatment.

- ethic
- morale
- ethics
- ethical

8) The ____ of disease coding scheme records the number of positive regional nodes at pathological examination.

- extent
- extend
- scope
- range

9) If nonsteroidal anti-inflammatory drugs fail to relieve pain, ____ them with opioids.

- substitute
- replace
- supplant
- change

10) The ____ was good in all patients; some developed complications but none died or had permanent sequelae.

- evolution
- recovery
- outcome
- result

Exercise 9

Complete the following sentences using the correct word.

1) *irradiated/radiated*

The pain ____ to his left jaw and arm.

The prostate and involved lymph nodes were ____.

2) *review/revise*

Please ____ my paper as soon as possible; I need to ____ it and respond to the reviewers' comments by Friday.

3) *implemented/implanted*

Pacemakers are normally ____ under local anesthesia.

After the protocol was ____ , the rate of infections in the ICU decreased by 30%.

4) *beside/besides*

She stood ____ me through all my troubles.

____ being obese, he is diabetic.

5) ***foreword/forward***
 Dr. Joyce wrote the _____ to her book on neural control of involuntary effectors.
 I will _____ your message to the statistical editor.

6) ***principal/principle***
 In _____, an electrical potential is applied across a lipid bilayer membrane and the resulting currents are measured.
 The _____ cause of dental caries is *S. mutans*.

7) ***continually/continuously***
 He was fitted with a Holter device to monitor his heart _____.
 We tested the patient's reflexes _____ over the three-day period.

8) ***administer/administrate***
 The drug's effects are much more rapid when you _____ it intravenously.
 The university decided to _____ the laboratory directly.

9) ***unsafe/insecure***
 The toddler was _____ unless she had her teddy bear.
 The drug was considered _____ for children.

10) ***notice/realize***
 I didn't _____ that he was only 5 years old—he is so tall for his age.
 Did you _____ that he already reads quite well?

11) ***located/localized***
 MRI _____ the lesion in the lumbar spine.
 Topical application of formalin-soaked-pledgets is effective for controlling _____ bleeding secondary to radiation cystitis.

12) ***ileum/ilium***
 Osteomyelitis of the _____ is uncommon.
 Crohn's disease that affects the _____ can increase the risk of gallstones.

13) ***delayed/postponed***
 The meeting was _____ because the surgeon had an emergency call.
 The diagnosis was _____ because the medication masked the symptoms.

14) ***fewer/less***
 We have done _____ procedures this month than last.
 We have made _____ money than last month.

15) ***excise/resect***
 The infiltrative nature of the tumor and its difficult location made it impossible to _____.
 If they _____ one lobe of her liver, she has a good chance of full recovery.

16) ***patent/permeable***
 The blood-brain barrier becomes more _____ during inflammation.
 The common carotid artery was occluded, but the internal and external carotid arteries were _____.

17) ***various/varying***
 _____ studies have corroborated these results.
 Studies on the efficacy of the treatment have yielded _____ results.

Continue

18) *is/represents*
 Obesity _____ a major health problem in many developed countries.
 The dotted line _____ the mean concentration in the control group over time.

19) *absorption/adsorption*
 When calculating the dosage of some drugs in patients undergoing continuous renal replacement therapy, it is important to take _____ onto filters into account.
 Dietary fiber can help bulk up runny stools through _____ of excess fluid.

20) *reabsorption/resorption*
 In bone _____, osteoclasts break down bone and release the minerals into the blood.
 Vitamin-D-dependent _____ of calcium takes place in renal distal tubules.

Exercise 10

Decide whether the words *in bold italics* are used correctly in the following sentences. Suggest an alternative for incorrect usages.

- 1) a) We found no difference between **both** groups.
 b) **Both** groups of animals were administered isoflurane anesthesia.
 c) Which of **both** scales is more accurate?
- 2) a) **While** they were attending the congress, I was reorganizing the laboratory.
 b) Everything changed **while** I was away.
 c) Dr. Johnson responded to the reviewers **while** Dr. Sanchez redid the statistical analysis.
- 3) a) Five years after diagnosis, she is free **of** disease.
 b) Reagents for coagulation tests are made **of** rabbits' brains.
 c) These catheters are made **of** BD Vialon™ biomaterial.
- 4) a) Two studies are **underway** to test the safety of the drug in healthy volunteers.
 b) An investigation is **underway** to determine who was responsible for the accident.
 c) There is an **underway** discussion about the best way to wean patients from ventilators.
- 5) a) Axoplasmic transport occurs **along** the life of a neuron and is essential to its growth and survival.
 b) Most axonal proteins are synthesized in the cell body of the neuron and are transported **along** axons.
 c) Microtubules running **along** the length of the axon provide the main cytoskeletal tracks for transport.
- 6) a) Cystatin 6 is likely **implied** in the proliferation of pancreatic cancer.
 b) These findings **imply** that locally produced estradiol might be protective against Alzheimer's disease.
 c) Preliminary indications of decreased tissue accumulation **implied** from pharmacokinetic and pharmacodynamic characteristics of isepamicin favor once-daily dosing.
- 7) a) Our **experience** over ten years shows the procedure is feasible and safe.
 b) After four years of extensive **experience**, the drug was tested *in vivo*.
 c) Most patients undergoing chemotherapy for breast cancer **experience** nausea.

- 8) a) Cell cultures were examined on a daily *basis*.
 b) On the physical examination, dry rales were detected in the *basis* of the lung.
 c) We could not rule out an underlying connective tissue disorder on the *basis* of the lung pathology alone.
- 9) a) On arrival to the emergency department, the patient appeared perfectly *rational*.
 b) The pharmacodynamics and pharmacokinetics of mycophenolic acid provide a basis for *rational* monitoring strategies.
 c) What is the *rational* for dosing every 8 hours versus every 24 hours?
- 10) a) The *personal* at our center are highly qualified.
 b) Please keep your *personal* opinions to yourself.
 c) She had a *personal* dispute with one of the laboratory assistants.
- 11) a) Creatinine results from the breakdown of creatine phosphate in muscle and is usually produced at a fairly constant *rate*.
 b) All the signals were simultaneously recorded by a 12-bit analogical-to-digital converter, sampled at a *rate* of 200 Hz, and stored on a personal computer.
 c) Drug action relies on route of administration, *rate* of absorption, and manner of distribution.
- 12) a) Candidates must demonstrate *competence* in statistical analysis.
 b) Patients' *competence* and the availability of caretakers will be taken into account for decisions about discharge.
 c) The *competence* for the grant is fierce.
- 13) a) Patients who *carry* a central venous catheter must be monitored to detect the growth of bacteria, fungi, or yeasts.
 b) Arterial injuries at the elbow *carry* a high risk of muscle necrosis.
 c) Screening can identify unaffected individuals who *carry* a copy of the gene for an autosomal recessive disease.
- 14) a) The foot ulcer had completely *cured* by the six-month follow-up.
 b) The quest for a *cure* remains elusive.
 c) Three days' antibiotic treatment is usually sufficient to *cure* a simple bladder infection in women.
- 15) a) The probability of *missing* important findings increases with fatigue.
 b) Data about the drugs' effects in children are *missing*.
 c) Please state explicitly how you handled *missing* data.
- 16) a) Our group has published over 100 articles *since* 2007.
 b) *Since* you wrote the introduction, you can write the discussion, too.
 c) *Since* the patient died, she rarely operates.
- 17) a) Samples were considered *adequate* when they contained enough material to enable the analyses.
 b) Metabolic inhibition using lyophilized reagents and reference strains is the most *adequate* technique for nonspecialized laboratories.
 c) Washing hands with soap and water provides *adequate* prophylaxis in most cases.

Continue

18) a) We assessed physicians' **adherence** to hand-washing protocols.
 b) The primary inclusion criterion was strict **adherence** to the low-carbohydrate diet.
 c) An **adherence** in a joint can restrict movement and cause pain.

19) a) We have a protocol to ensure **security** when moving elderly patients.
 b) Most biologists who changed fields cited lack of job **security** as a major reason.
 c) We have taken all necessary precautions to ensure the **security** of our network.

20) a) The biologic half-life of methadone **varies** from 18 to 100 hours.
 b) Estimates of the prevalence of autism **vary** widely.
 c) The cost of genetic testing and counseling **varies** with the complexity of the case.

21) a) We could not decide *if* we should apply for the grant.
 b) We could not decide *if* to apply for the grant.
 c) We could not reach a decision about *if* we should apply for the grant.

22) a) *As* Bedford et al.³⁴ we found a higher incidence of nephrotoxicity with continuous infusion.
 b) *As* Bedford et al.³⁴ reported, the incidence of nephrotoxicity is higher with continuous infusion.
 c) *As* was reported by Bedford et al.³⁴ the incidence of nephrotoxicity is higher with continuous infusion.

23) a) *During* the 1990s, a concerted effort was directed at mapping the human genome.
 b) Scientists from around globe worked on the project together *during* five years.
 c) *During* this period, many exciting discoveries were made.

24) a) The woman *that* taught me how to use bootstrapping works in Barcelona.
 b) All genetic information is contained in the sequence of the four nucleotides *that* make up DNA.
 c) Adenine, *that* pairs with thymine in DNA, binds to uracil in RNA.

25) a) Student's t-test or the Wilcoxon rank-sum test was used to compare *continuous* variables.
 b) Anesthesia was maintained by *continuous* infusion of ketamine and propofol.
 c) *Continuous* administration of low-dose capsules yielded the same benefits as *continuous* infusion.

Exercise 11

Correct the mistakes due to the influence of Spanish in these sentences.

- 1) We could go to the fast-food restaurant. There's no air conditioning and you have to eat standing up, but it's very comfortable because it's just across the street from the hospital.
- 2) Sterile cloth drapes are easy to manipulate and resistant.
- 3) I'm sure we can count on the physicians, but I'm not so sure about infirmary.
- 4) Autoimmune diseases are a subset of immunomediated diseases.
- 5) The pleuroesophageal recess is the interface of the subcarinal portion of the mediastinum and the right lower lobe.
- 6) The effectivity of the treatment has been questioned.
- 7) The specificity of the test vacillates between 67% and 89%.

- 8) Lymph-node affection at initial diagnosis is this most reliable predictor of poor evolution.
- 9) After recanalization, the vessel was permeable.
- 10) A cell doubles itself when it divides.

Exercise 12

Find and correct the false friends in the following sentences.

- 1) The patient had a familiar history of high tension.
- 2) The diagnostic of tendonitis could not be discarded on the simple X-ray.
- 3) A unique malignant fibrous histiocytoma was seen in the posterior part of the left auricle.
- 4) The scientific rested in his office all night revising the literature.
- 5) You can get a copy of my last book at the library for €36.
- 6) I'd better not shake your hand—I'm constipated.
- 7) We performed TRUS biopsy using two preservatives over the probe.
- 8) Breast MRI is very sensible but not very specific.
- 9) Lobular pneumonia is usually caused by *Streptococcus pneumoniae*.
- 10) We had to call security because ten of her parents crowded into the room, molesting the girl in the other bed.

Exercise 13

Find and correct the vocabulary mistakes in the following sentences.

- 1) Arthrosis can affect any joint.
- 2) She was eventually diagnosed with ulcerous colitis.
- 3) It is impossible to detect osteoporosis with osseous gammagraphy.
- 4) At least 12 lymphatic ganglia should be resected to search for potential tumoral affection.
- 5) Helicoidal CT scans can detect acute pulmonary thromboembolism.
- 6) Congenital cardiopathies are the most common type of congenital anomaly.
- 7) We describe a new technique to study the physiopathology of myocardiocytes.
- 8) The hematoencephalic barrier prevents some chemotherapy drugs from entering the brain.
- 9) There were some suspicious findings on her mammography so we should do an echography exploration.
- 10) My wife was embarrassed—she had an abortion in the sixth month.

Using the right register

Scientific writing should be formal. Do not use contractions or colloquial language.

Exercise 14

Identify the words in these sentences that are too informal and replace them with others in a more appropriate register.

- 1) The tumor was a bit hyperintense with respect to the liver parenchyma.
- 2) We detected lots of metastases in her lungs.
- 3) Anyway, increased clearance would not explain the enhanced effects of quinidine on repolarization in women.
- 4) We looked into the use of immunoassay and high performance liquid chromatography for therapeutic monitoring of vancomycin.
- 5) Plenty of theories have been proposed to explain these phenomena, but none have gotten wide support.
- 6) Although the resolution of fluorescence *in situ* hybridization is pretty good, it is limited by the resolution of the microscope used.
- 7) The operation was put off because the patient developed respiratory failure.
- 8) After the procedure, she got better fast.
- 9) Anyhow, a lot of other authors have pointed out flaws in the design of this study.
- 10) It is impossible to get rid of all contaminants in the laboratory.

Grammar

Correct grammar is essential to communication. Meaning is determined both by the words we use and the way we put them together. Consider the simplest of examples: *Mary hit John* means something very different from *John hit Mary*. This section deals with problematic areas like the use of articles, subject-verb agreement, prepositions, relative clauses, adverb placement, danglers, and verb patterns.

Articles

The basic principles guiding the use of articles are easy to grasp, but particular uses differ between languages. If you have difficulties with the following exercise, you would benefit from a general review of articles in a good grammar book.

Exercise 15

Correct the mistakes in the use of articles in these sentences when necessary.

- 1) The lab manager made them the promise that he would help them learn the technique.
- 2) Without a shadow of doubt, Dr. August is the better of the two candidates.
- 3) We lost the respect for her when she lost the control of herself and threw the beaker with the contaminated sample on the ground.
- 4) In short term, there was no significant difference between the two groups; however, in long term, the Group A had the better survival than the Group B.
- 5) The prevalence of diabetes in Spain may be as high as a fourteen percent.

- 6) They did not take an opportunity to present the results at the congress.
- 7) When I was a student, I hated the chemistry.
- 8) He is good man; it was pleasure to do the business with him.
- 9) I was late for the work because I went to a bank.
- 10) She made a effort to finish her review before the deadline.
- 11) She has a MSc in the technical writing.
- 12) Dr. James is in meeting—I'll go and get him.
- 13) A laboratory needs the professionals from many different backgrounds.
- 14) The MRI scanners have revolutionized radiology.
- 15) The breast cancer causes about 40,000 deaths a year in United States.
- 16) The burnout is a major problem in the emergency departments.
- 17) He was interviewed in newspaper, on radio, and on TV.
- 18) I explained how an enzyme is inactivated at a molecular level.
- 19) In the India, the teleradiology is likely to become a billion-dollar industry.
- 20) The university is cutting back on travel expenses for researchers.

Subject-verb agreement

The basic idea of subject-verb agreement is simple: singular or uncountable subjects take a singular verb, and plural subjects take plural verbs. However, putting this idea into practice is sometimes tricky. These guidelines can help you make sure your subjects and verbs agree in number.

COMPOUND SUBJECTS

When the subject consists of two or more singular or plural nouns or pronouns connected by “and”, you need to use a plural verb.

- *Watson and Crick are having a party to celebrate publishing their article in Nature.*
- *Plain-film X-rays, US, CT, and MRI are the main imaging modalities in our department.*

Note, however, that when the nouns connected by “and” refer to the same person or thing, you need to use a singular verb.

- *“Accidents and Emergencies” is a common British term for the emergency department.*
- *The secretary and treasurer of our society has resigned.*

When the subject consists of two or more singular nouns or pronouns connected by “or” or by “nor”, you need to use a singular verb.

- *The lab manager or his assistant has to sign the request.*
- *Neither the lab manager nor his assistant has signed the request.*

When the subject consists of a combination of a singular noun or pronoun and a plural noun or pronoun connected by “or” or “nor”, you need to make the verb agree with the element that is nearer the verb.

- *The first author or her coauthors are going to speak at the press conference.*
- *Her coauthors or her husband is coming with her.*
- *Neither the author nor her coauthors have any conflicts of interest.*

INTERVENING PHRASES

Information placed between the subject and the verb is a common source of error. You should make sure the verb agrees with the subject, regardless of what comes between them.

- *One of the residents is always on call.*
- *Nurses who work in the emergency department are under incredible stress.*

This principle also applies to expressions that might seem to suggest “and”, for example: with,

together with, including, accompanied by, in addition to, or as well as.

- *The head of the department, as well as her team members, is satisfied with the result.*
- *The talk, including all the photos of the speaker's lab, was boring.*
- *The researcher with all the grants works across the hall from me.*

PRONOUNS

Anybody, anyone, each, each one, either, everyone, everybody, neither, nobody, no one, somebody, and someone are singular, so you need to use a singular verb.

- *Each of these findings was confirmed at histological analysis.*
- *Everybody wants to work with Dr. Harmon.*
- *Neither of the two options is viable.*

Nouns following “each” or “every” need a singular verb.

- *Every article she has published is excellent.*
- *Each option has advantages and disadvantages.*

TRICKY NOUNS

Some nouns that refer to objects made up of two parts (e.g., scissors, trousers, eyeglasses) are considered plural. But note that when we use “a pair of” together with these nouns to refer to these objects, they take a singular verb.

- *Her glasses are very fashionable.*
- *Those tweezers are made of stainless steel.*
- *A pair of goggles is lying on the countertop.*

Some nouns that look plural are uncountable or singular.

- *Shingles is caused by the same virus that causes chicken pox.*
- *Rickets is usually caused by a lack of vitamin D and calcium.*
- *Mumps (epidemic parotitis) is a viral disease.*

Other nouns that look plural can be singular or plural depending on their meaning in context. These include but are not limited to nouns that end in -ics, which are singular when used to refer to a field of knowledge but plural when used to refer to a specific concrete application of that knowledge.

- *Logistics is the management of the flow of resources.*
- *The logistics of the procedure are extremely complicated.*
- *The homologous series of straight-chained alkanes begins with methane, ethane, propane, butane, and pentane.*
- *It is not often possible to state whether two metabolic time series are significantly different.*

Do not confuse Latin and Greek singular and plural forms (see Appendix IV).

- *Mitochondria are the powerhouses of the cell.*
- *The crises were precipitated by a series of emotional shocks.*

NUMBERS AND AMOUNTS

Be careful expressing numbers, as these can be singular or plural depending on their context. A subject that refers to a single measurement, amount, or time takes a singular verb, whereas a subject that refers to a number of individual items normally takes a plural verb.

- *Forty thousand dollars is the mean amount awarded to second-year fellows.*
- *Even in the Euro zone, dollars are often used to express costs in studies.*
- *Three 100 mg doses in eight hours is too much.*

Fractions and percentages can be singular or plural depending on the noun that comes after them.

- *Nearly two-thirds of the fluid in mammalian organisms is contained in the intracellular compartment.*
- *Nearly two-thirds of the patients report a substantial improvement after the procedure.*

- About 50% of the rats have recovered.
- About 50% of the population is at risk.

The expression “the number of” always requires a singular verb, whereas the expression “a number of” always requires a plural verb“.

- *The number of applicants has doubled in three years.*
- *A number of genes are involved in the pathogenesis.*

All, any, most, none, some can be either singular or plural, depending on the meaning we want to convey.

- *All the glory goes to the one who publishes the idea first.*
- *All the patients survived without sequelae.*
- *None (i.e., not one) of the antibiotics was able to kill more than 50% of the bacteria = None (i.e., not any) of the antibiotics were able to kill more than 50% of the bacteria.*
- *None (i.e., no amount or no part) of the unbound drug was detected in urine after 48 h.*

COLLECTIVE NOUNS

These words refer to a group of people or animals. These nouns normally take a singular verb. However, especially in British English, they can take a plural verb when the members of the group are seen to be acting as individuals. In the latter case, it is always possible to insert “members” in the sentence to avoid someone considering you have made a mistake in subject-verb agreement.

- *The committee has unanimously chosen Dr. Bryson for the position.*
- *The committee are taking their seats at the head table* ⇒ *The members of the committee are taking their seats at the head table.*

THERE IS/THERE ARE

In phrases that begin with “there is” or “there are”, the subject comes after the verb.

- *There is a large hyperintense lesion in the left lobe of the liver.*
- *There are three types of biological safety cabinets.*

However, when the construction “there is” or “there are” is followed by a compound subject, it usually sounds more natural when the verb agrees with the first item in the list.

- *There is a large solid lesion and several small cystic lesions in the right breast.*
- *There is a mole or some clustered freckles just below the antecubital fossa.*

Remember that sentences containing “there is” or “there are” can often be improved by rephrasing.

- *There are many viruses that can cause disease in humans* ⇒ *Many viruses can cause disease in humans.*

MISCELLANEOUS GUIDELINES

Adjectives used as nouns take the plural form of the verb.

- *The poor have no access to healthcare.*

When a sentence has both a positive and a negative subject, the verb should agree with the positive subject.

- *The attending physician, not the researchers, is responsible for recording adverse events.*
- *The immune mediators, rather than the endotoxin itself, were the key to understanding the reaction.*

Plural titles take a singular verb.

- *Lewis Thomas's book The Lives of a Cell is a collection of musings on biology and life.*

Mathematical expressions take singular verbs.

- *Ten times three is thirty.*

Exercise 16

Put the verb in parentheses in the correct form to agree with subject.

- 1) Analgesics (ACT) in various ways on the peripheral or central nervous system.
- 2) Bioinformatics (BE) among the fastest growing fields today.
- 3) Mumps (epidemic parotitis) (BE) a viral disease.
- 4) I'm afraid the news (BE) not very encouraging.
- 5) Diabetes (BE) more common among overweight people.
- 6) The statistics about teenage pregnancy (BE) depressing.
- 7) Molecular cytogenetics (USE) techniques like fluorescence *in situ* hybridization to study specific regions of the genome.
- 8) Transgenics (BE) increasing being used as experimental models in biomedical research.
- 9) The logistics of the experiment (BE) extremely complex.
- 10) Our series (BE) the largest published before 2000; since then, two larger series (BE) published.
- 11) A number of methods (BE) used in our lab.
- 12) A total of 800 mL serous fluid (BE) drained from the pleural space.
- 13) A total of 465 patients (BE) enrolled at the five centers.
- 14) Shingles (BE) caused by the same virus that causes chicken pox.
- 15) Neither the obstetrician nor the midwife (BE) able to turn the baby from the breech position to avoid a caesarian.
- 16) Whether the doctor or the nurses (RUN) the ward is a matter of opinion.
- 17) The acoustics in the auditorium (BE) so bad that nobody could understand half of what Dr. Johnson was saying.
- 18) Bioethics (DEAL) with ethical controversies developing due to advances in biology and medicine.

Exercise 17

Underline the correct form of the verb.

- 1) Dr. Jones [has, have] stated three good reasons why we need to redesign the first experiment.
- 2) William and Tim [does, do] the preliminary analyses.
- 3) The original tissue or these specimens [was, were] contaminated.
- 4) Either her analyses or your summary [is, are] full of errors.
- 5) One of her colleagues [is, are] going to present the preliminary results of the study.
- 6) Gould et al.²³ [points out, point out] several methodological errors in Jensen's study.
- 7) The woman with all the grad students [works, work] in my department.
- 8) The residents, as well as the chief, [thinks, think] it'd improve their training.
- 9) The article, including all the tables and figures, [takes, take] about three hours to read.
- 10) Either approach [yields, yield] valid results.
- 11) Either Dr. Leavitt or Dr. Darnell [is, are] going to be listed as the first author.

- 12) Every one of those articles [was, were] published before Martin et al.'s landmark study.
- 13) Nobody [know, knows] whether this approach would be cost effective.
- 14) [Is, Are] the news good or bad?
- 15) Her goggles [was, were] splattered with blood.
- 16) [Has, Have] the forceps been sterilized?
- 17) That pair of pajama pants [is, are] threadbare.
- 18) The statistics [is, are] promising: it looks like we are onto something.
- 19) Statistics [is, are] one of the most important analytical tools we have.
- 20) The Ethics Committee [has, have] waived the requirement for informed consent.
- 21) The committee [expresses, express] diverse opinions in private.
- 22) The chief, together with her assistant, [welcomes, welcome] the new residents.
- 23) All of the samples, even the spoiled one, [is, are] in the freezer.
- 24) A hundred euros [is, are] the price of a kit that can do 4000 colormetric microplate assays.
- 25) There [was, were] seven candidates for the position. Now there [is, are] only one left!

Exercise 18

Correct the use of Latin plurals in these sentences; note that some sentences are correct.

- 1) A stent was placed in the left intraventricular foramina.
- 2) Infective episodes included three aplastic crisis due to parvovirus.
- 3) Both bronchi were widened and scarred.
- 4) Please include any acknowledgments, references, figure legends, tables, and appendix in the main document after the body of the text.
- 5) Three emboli were removed by aspiration.
- 6) Most virus are too small to be seen with an optical microscope.
- 7) We report seven new locus for genes involved in age-related macular degeneration.
- 8) Note how the parietal pleura and the visceral pleura connect at the hila of the left lung.
- 9) The only exclusion criteria was hypertension.
- 10) The vasculitis are inflammatory diseases of the walls of blood vessels.
- 11) Staphylococci is a Gram-positive bacteria that divides along multiple axes, resulting in grape-like clusters.
- 12) Gadolinium-based contrast mediums should not be used in patients with severe renal failure.
- 13) Bulla are fluid-filled sacs under a thin layer of skin that measure at least 1 cm in diameter.
- 14) We obtained gravimetric readings from absorbent pads placed in both axilla.
- 15) Multiple stenoses were found in 34% of the patients.
- 16) The alveolus are the terminal ends of the respiratory tree.
- 17) In the gastrointestinal tract, stomata are created in esophagus, stomach, small bowel, or large bowel.
- 18) Does apoptosis contribute to disease progression in heart failure or is it a phenomena observed only in end-stage heart failure?
- 19) Petechia on the soft palate are associated with streptococcal pharyngitis.
- 20) The cultured cells are seeded onto exogenous extracellular matrices that are made from bio-compatible and biodegradable polymers.
- 21) About 15% of cells have at least two nucleus.

Continue

- 22) Ganglia are bundles of somata and dendrites that act as relay points between different neurological structures.
- 23) There were multiple metastasis in the brain.
- 24) The spleen and the liver are abdominal viscera.
- 25) Two fungi are responsible for most cases of athlete's foot.

Prepositions

Prepositions are essential for showing the relationships between elements, but preposition use varies among languages. Even closely related languages like the Romance languages often differ in their choice of prepositions in some cases.

Learners of English often find preposition use to be idiosyncratic, and knowing which preposition to use is often a challenge even for very advanced learners.

Exercise 19

Complete the following sentences with the correct preposition indicating place or direction (along, to, toward, on, onto, in, or into). Some sentences may have more than one possible correct answer. Remember that a few verbs of motion take only "on" rather than "onto."

- 1) Oxygenated blood returns _____ the heart through the pulmonary veins.
- 2) Insulin is released _____ the blood.
- 3) Neurotransmitters are stored _____ the synaptic bouton and are released _____ the synaptic cleft.
- 4) The patient is placed _____ the table in the prone position.
- 5) When bacterial biofilm forms _____ the surface of a medical implant, even high doses of antibiotics cannot remove it completely.
- 6) The right marginal vein courses _____ the right cardiac border and may drain _____ the right atrium.
- 7) Microvilli are fingerlike projections seen _____ the surface of some cells.
- 8) B cells develop immunocompetence _____ the bone marrow.
- 9) The sample is pipetted _____ the slide.
- 10) To ensure an optimal signal, place the sensors _____ an area of the skull with few muscle fibers.
- 11) We went _____ the national congress.
- 12) The catheter is inserted _____ the femoral artery.
- 13) Infection developed after a surgical sponge was accidentally left _____ her abdomen.
- 14) Dr. Karper's team is advancing _____ an understanding of the pathways involved.
- 15) Vega and colleagues reported a trend _____ reduced LDL-receptor-mediated clearance of LDL.
- 16) An HMG CoA reductase inhibitor can lower the plasma cholesterol concentration _____ or near acceptable levels.
- 17) The patient went _____ an irreversible coma.
- 18) The cardiology resident noticed an abnormality _____ the EKG.
- 19) The spermatozoa swam _____ the ovary extracts, even though they were extremely diluted.
- 20) Two substrate molecules attach _____ the active site of the enzyme.

Exercise 20

Complete the following sentences with the correct preposition of place (above, across from, around, at, behind, below, between, by, close to, in, inside, near, next to, on, opposite, outside, over, under, within). Some sentences may have more than one possible correct answer.

Exercise 21

Complete the following sentences with the correct preposition of time (after, ago, at, before, between, by, during, for, from, in, on, since, to, until, up to, within). Some sentences may have more than one possible correct answer.

- 1) T cells were discovered the 1970s.
- 2) Dr. Bern reported the preliminary results at the European Congress two years .
- 3) We included all consecutive patients admitted to the ICU January 1, 2011 and December 31, 2012.
- 4) A total of 16 adverse events were recorded the study period.
- 5) The solution was heated homogeneous.
- 6) The effects of carisoprodol begin 30 minutes of oral administration and last four to six hours.
- 7) The two oligonucleotides were first incubated with RPA (30 nm) 5 min in DNA annealing buffer supplemented with 1 mm ATP.
- 8) The parent compound, cisplatin, is excreted in the urine and accounts for 13% to 17% of the dose excreted one hour administration of 50 mg/m².
- 9) All variables were recorded again the end of the observation period.
- 10) 1981, a new glucocorticoid receptor antagonist known as RU 38486 was synthesized.
- 11) the fall and winter, men's estrogen levels increased and testosterone production decreased.

Continue

12) incubation for 5 min, Rad52 (40 nm) and/or Rad59 (80 nm) were added to initiate the reaction.

13) All patients provided informed written consent agreeing to participate in the experiment.

14) The study was discontinued the fifth day because the preliminary results suggested that the risks outweighed the benefits.

15) A greater proportion of adverse events occurred night than the day.

16) All patients who have not died or relapsed the end of the follow-up period will be considered disease-free.

17) She was in a coma April 3 June 19.

18) The FDA approved the new drug application May 4, 2011.

19) More than 25 million people have died of AIDS it was discovered 1981.

20) Saturdays, Sundays, and holidays, the department is staffed by residents and an attending physician is on call at home.

Exercise 22

Complete the following sentences with the correct preposition: at, in, or on.

1) The PET/CT scanner is located another building.

2) The pharmacology department is the sixth floor.

3) Dr. Paul is the operating room.

4) We didn't plan to spend a long time the seminar.

5) Tell them to wait for me the entrance to the ICU.

6) Do they live the city or the country?

7) Dr. Finstadt arrived the electrophysiology suite well in advance.

8) The patient was being carried a stretcher.

9) After talking the phone for half an hour, I developed a terrible pain my neck!

10) that time, I was a grad student, just learning how things worked.

11) The use of electronic devices is forbidden some parts of the hospital.

12) There were so many fingerprints the screen that we could hardly see the image.

13) A fragment of the catheter had broken off and become lodged the left pulmonary artery.

14) A nurse will inform you shortly; in the meantime, please wait the waiting room.

15) If Dr. Michaels doesn't learn to write better reports, she'll be out the street.

16) I use my cell phone when I'm the ward, but never while I'm the operating room.

17) Please hurry up! I want to get there time to see the opening lecture.

18) She's always very punctual—she's always time.

19) The lab is located Seventh Avenue.

20) Dr. Thomson works the field of cell biology, while Dr. Fernandez works molecular biology.

Exercise 23

Complete the following sentences using in, into, on, onto, to, or toward. More than one answer may be correct in some.

1) Dr. Kaiser has returned the university where he did his postdoc.

2) We are working a better understanding of the role of prostaglandins inflammation.

3) She was put a stretcher and taken away an ambulance.

4) Sensory nerves convert external stimuli internal stimuli.

5) My office is the East Wing.

6) Advance the catheter the heart, but stop about 5 cm before you reach it.

8) Take any bus that heads the university.

9) Are the department chiefs still the meeting?

10) "Please hang . Dr. Browning is another line right now."

11) Dendrites carry impulses the body of a neuron.

12) Dr. Gould walked the stage and began his lecture.

13) The drunk vomited the bed the examination room.

14) Dr. Rimini thanked us for listening and told us to carry with our work.

15) Are you planning going the session?

16.) While being transferred a nursing home, the patient fell the floor.

17) Dr. Walker got trouble over his comments the resident.

18) The term ascites refers fluid the peritoneal cavity.

19) I'll take you the conference center.

20) She left her goggles the counter.

DEPENDENT PREPOSITIONS

Appendix V gives a list of some common dependent prepositions.

Exercise 24

Complete the following sentences with the correct verb-dependent preposition.

1) Diuretics can interfere calcium absorption.

2) We analyzed the factors associated with failure to adhere the regimen.

3) Women diagnosed with osteoporosis were invited to participate the study.

4) One shortcoming of our study is we had to rely patients' self reports.

5) In most cases, cholangiography cannot distinguish recurrent primary sclerosing cholangitis other conditions.

6) In most cases, cholangiography cannot distinguish recurrent primary sclerosing cholangitis and other conditions.

7) Monoclonal antibodies excel the identification of antigens because cross-reacting antibodies are absent.

8) A 52-year-old man complained a severe precordial crushing sensation with pain radiating to the left shoulder.

9) Compared to intensive care physicians, nurses were more likely to comply hand-washing recommendations.

10) All the reviews commented the small sample.

11) The right and left coronary arteries arise the aorta.

Continue

12) The critical care team responded the code.

13) The vascular wall consists several layers (tunica adventia, tunica media, and tunica intima).

14) The patient refused to consent a blood transfusion.

15) This is an emergency that calls immediate surgical intervention.

16) It can take up to a month to fully recover shingles.

17) Common normal anatomic variants can easily be mistaken pathology on plain-film X-rays.

18) The patient will have to choose a metallic valve and a biologic valve.

19) The treatment will depend the patient's underlying condition and comorbidities.

20) Systemic risk factors may also contribute treatment failure.

Exercise 25

Complete the following sentences with the correct adjective-dependent preposition.

1) The tablet is coated a pH-sensitive acrylic polymer so the drug is released in the distal ileum and colon.

2) All the *Streptococcus pneumoniae* isolates in this study were sensitive cefixime.

3) All patients aged 18 years or older were eligible the study.

4) The findings were consistent chronic traumatic encephalopathy.

5) A low red blood count is characteristic anemia.

6) Clinicians need to be familiar these signs.

7) One Howell unit of heparin is approximately equivalent 0.002 mg of pure heparin.

8) Patients with AIDS are susceptible opportunistic infections.

9) The attending physician is legally responsible the patient's care.

10) This peptide activates smooth muscle via a mechanism similar ERK-mediated phosphorylation.

11) Reticulocyte RNA and functional minigene splicing assays in heterologous cells revealed that this mutation was associated a complex pattern of aberrant splicing.

12) One month after the intervention, only 3% of patients were dissatisfied the outcome.

13) Rats in the control group were exposed filtered room air.

14) This experiment was based earlier experiments reported elsewhere.

15) The statistics used were not suitable the type of data analyzed.

Exercise 26

Complete the following sentences with the correct noun-dependent preposition.

1) Vitamin supplements are no substitute a balanced diet.

2) The main advantage endovascular repair was a lower rate of perioperative complications.

3) The reason readmission was not noted in half of the patients.

4) None of the patients had adverse reactions the drug.

5) There is a need further studies with more patients.

6) Patients with valvular defects should be administered antibiotics as prophylaxis _____ endocarditis.

7) Myxedema can develop due to long-term hypothyroidism as a result _____ untreated Hashimoto's disease.

8) Major surgery results in period of cell-mediated immunosuppression that can have a negative impact _____ the patient's recovery.

9) This sharp decrease _____ streptomycin production was accompanied by a decrease intracellular accumulation _____ ppGpp.

10) It is essential to understand the difference _____ cell-mediated and humoral immunity.

Exercise 27

Find and correct the errors in prepositions in the following sentences.

1) She was diagnosed of pericarditis and was admitted in the hospital.

2) The treatment consisted in daily wound care and watchful waiting.

3) The choice of antibiotic depends of which organism is causing the infection.

4) We aimed to determine the frequency, sites, and patterns of atypical metastases of prostate cancer.

5) If the pain worsens, substitute paracetamol for tramadol.

6) Divide the work up between all the residents.

7) We describe a technique for detecting cancer cells based in the interaction between a chemotherapy agent and cell membrane components.

8) At the six-month follow-up, all patients of the treatment group showed a significant decrease of total serum cholesterol.

9) We suspect the source of bleeding is a severed artery—please call to the vascular surgeon.

10) The abdominal CT revealed a foreign body into the jejunum.

Relative clauses

A relative clause is a kind of subordinate clause (containing a subject and verb) that usually functions as an adjective. Relative clauses are usually introduced by a relative pronoun (that, which, who, whom, or whose) or by a relative adverb (where, when, why), although the relative pronoun can be omitted when it is the object of a defining clause (see below).

Relative clauses are categorized as defining (also called restrictive) when the information they provide is essential to the meaning of the sentence or as non-defining (also called nonrestrictive) when they merely provide additional, parenthetical information.

Defining clauses are never separated from the rest of the sentence by commas. The relative pronoun *that* can only be used in defining clauses.

- *Biologists that (or who) start successful companies earn more money than biologists that (or who) work for government agencies.*
- *SNPs that (or which) are not in protein-coding regions may still affect gene splicing, transcription factor binding, or the sequence of non-coding RNA.*

The relative pronoun can be omitted when it functions as the object of the relative clause, although this is less common in formal writing.

- The laboratory that I worked for was dismantled last year. \Rightarrow The laboratory I worked for was dismantled last year.

Relative adverbs can never be omitted.

– *The laboratory where I work is very well funded.*

Non-defining clauses are always separated from the rest of the sentence by commas. The rela-

tive pronoun *that* cannot be used in non-defining clauses.

- Dr. Davis, who was a fellow with me at Cornell, started his own company and is now a millionaire.
- The European Congress, which takes place in November, is the most important meeting in our field.

Exercise 28

Complete the following sentences using a relative pronoun. If it is possible to omit the pronoun, put an asterisk after it.

- 1) Dr. Patricia McLean, whose husband pioneered the procedure, is probably the best choice.
- 2) She consulted a cardiologist, who ordered a stress test.
- 3) If you need advice on microarray techniques, the person you need to contact is Dr. Susan Lopez.
- 4) Professor Weiner, whose achievements include the Founders' Award, will be giving the keynote address.
- 5) This book was written by the geneticist who spoke at the conference in Madrid.
- 6) The osteoid osteoma was located in the epiphysis, which is extremely rare.
- 7) You cannot perform the procedure which we did without CT fluoroscopy.
- 8) She was transferred to this ICU, where she developed multiple organ failure.
- 9) What's the name of the instrument which you used to examine the eardrum?
- 10) The room where the procedure is done must have excellent lighting.

Exercise 29

Punctuate the following sentences according to whether they contain defining (not separated from the rest of the sentence by commas) or non-defining relative clauses (separated from the rest of the sentence by commas). Sometimes the same clause could be either type, but in that case the meaning is different.

- 1) Dr. Safier who works at the Mayo Clinic was my roommate at college.
- 2) We need to arrange a blood transfusion for the patient who was just operated on.
- 3) The nurse who had more experience than the resident was able to avert a disaster.
- 4) The fellows who understand English well enjoyed the talk.
- 5) The renovation of the wet lab which was announced yesterday will help keep our center on the cutting edge of science.
- 6) The lab manager who is from India can be very difficult to understand.
- 7) We're looking for a biologist who is willing to get her hands dirty.
- 8) The stratum corneum which is the outermost layer of the epidermis consists of dead cells that lack nuclei and organelles.
- 9) They have done this procedure dozens of times before which is no guarantee that they will succeed this time.
- 10) The urologist who is going to operate on my prostate is very good.

Word order

To communicate effectively, you need to carefully consider both the words you use and the way you arrange them. Presenting known information before new information (more about that in *Fluidity: Keeping the thread*) makes your text easier to follow. However, another aspect of word order, the position of modifiers, not only affects readability, but also has a crucial effect on meaning.

Consider the difference in meaning in the following sentences:

- *We nearly received a grant for a million euros.*
⇒ We received nothing.
- *We received a grant for nearly a million euros.*
⇒ We received almost €1 million.
- *One aspect of brain function that has most fascinated neurobiologists is learning and memory.* ⇒ Neurobiologists are interested in various aspects of brain function, especially in learning and memory.
- *One aspect of brain function that has fascinated most neurobiologists is learning and memory.* ⇒ The majority of neurobiologists are interested in learning and memory.
- *Only I examined the specimen with a light microscope in my private laboratory yesterday.* ⇒ I am the only person who examined the specimen.
- *I only examined the specimen with a light microscope in my private laboratory yesterday.* ⇒ I examined the specimen; I did not process it, stain it, damage it, or alter it in any way.
- *I examined only the specimen with a light microscope in my private laboratory yesterday.* ⇒ I did not examine anything except the specimen.
- *I examined the only specimen with a light microscope in my private laboratory yesterday.* ⇒ There was only one specimen.
- *I examined the specimen only with a light microscope in my private laboratory yesterday.*
⇒ I did not use any other equipment (e.g., an electron microscope).
- *I examined the specimen with a light microscope only in my private laboratory yesterday.*

⇒ Not in the hospital or university laboratory (where the results might have been different?).

- *I examined the specimen with a light microscope in my only private laboratory yesterday.*
⇒ I do not have more than one private laboratory.
- *I examined the specimen with a light microscope in my private-only laboratory yesterday.*
⇒ This laboratory is dedicated exclusively to private practice.
- *I examined the specimen with a light microscope in my private laboratory only yesterday.*
⇒ I did not examine the specimen at any other time.

An old-fashioned English grammar rule is that you should never “split” an infinitive. Interposing an adverb between the two parts of the infinitive (to + verb) often results in awkward sentences. Look at these examples:

- *It was impossible to even recruit 30 subjects.*
(AWKWARD)
- *It was impossible to recruit even 30 subjects.*
(NATURAL & EFFECTIVE)
- *They always try to carefully do the analysis.*
(AWKWARD)
- *They always try to do the analysis carefully.*
(NATURAL & EFFECTIVE)

However, in other cases, the most natural and effective place to put adverb is in the middle of the infinitive. Look at these examples:

- *They asked me to supervise the experiments that are to be done personally.* (UNCLEAR—“personally” seems to modify “to be done”)
- *They asked me personally to supervise the experiments that are to be done.* (UNCLEAR—“personally” seems to modify “asked”)
- *They asked me to personally supervise the experiments that are to be done.* (CLEAR)
- *I want you to consider Callaway’s offer to manage our database carefully.* (UNCLEAR—“carefully” seems to modify “to manage”)

- *I want you to consider carefully Callaway's offer to manage our database. (AWKWARD)*
- *I want you to carefully consider Callaway's offer to manage our database. (CLEAR & NATURAL)*

As a general rule, place modifiers close to what they modify to avoid misinterpretation.

Modifiers with absent or only tenuous links to the elements being modified are called danglers.

Exercise 30

Place the modifier in the best position

- 1) I determined the viral load using branched DNA in the university lab yesterday.
(ONLY; I did not use real-time PCR)
- 2) To compensate for inflation, we asked them to review our project funding. (YEARLY)
- 3) The lab manager asked them to register the material they used. (STRICTLY)
- 4) I died when the contaminated specimen spilled on the counter. (NEARLY)
- 5) In patients with diabetes, poor peripheral circulation can increase the risk of infection.
(FURTHER)

Participle clauses

Participle clauses are formed with either the present (VERB+ING) or past (VERB+ED/irregulars) participles. Like relative clauses, participle clauses add more information to a sentence and act as adjectives. It can be useful to think of a participle clause as a kind of reduced relative clause. We use the present participle when the meaning is active and the past participle when the meaning is passive.

- A report describing a new strain of H1N1 influenza was published last week. (i.e., that describes)
- Figure 3 shows a paramecium swimming in a thin layer of fluid. (i.e., that is swimming in...)

Although the relative clause replaced by the present participle clause need not be in a continuous tense, we cannot use a present participle phrase to talk about a single finished action that was not repeated. Thus, instead of "*The man dis-*

~~covering penicillin...~~", we need to say "The man who discovered...".

- We studied 50 cholangiocarcinoma specimens immunohistochemically stained with a marker for MAC387 and MMP-9. (i.e., that had been immunohistochemically stained...)

BEING + PAST PARTICIPLE can be used to express the idea of a continuous passive relative clause.

- *I think the boy being operated on this afternoon has anemia.*

Both present and past participle clauses can be used in introductory statements.

- *Working with Dr. Schmidt, I learned the importance of careful measurement.*
- *Detected when it was already stage IV, the carcinoma proved to be fatal.*

However, it is essential to make sure that it is perfectly clear what the participle clause is referring to. Dangling participle clauses (i.e., that do not have a clear connection to what is being modified) are among the most common mistakes in scientific writing. Look at the kind of mistakes that might have occurred if the examples above had been arranged differently. These mistakes are often difficult to see in your own work, but once detected, they are easy to correct.

- *Swimming in thin layer of fluid, I could see a paramecium.* (i.e., I was swimming)
- *Immunohistochemically stained with a marker for MAC387 and MMP-9, we studied 50 cholangiocarcinoma specimens.* (i.e., we were stained)
- *Being operated on this afternoon, I think the boy has anemia.* (i.e., I am being operated)

Exercise 31

Rearrange the following sentences so that the participle clause functions correctly.

- 1) After being denatured at 95°C, we use a primer-specific annealing temperature of 54°C.
- 2) Moving from a square detection region to a tapered detection region, we improved the signal by a factor of 2 and the SNR from 6.4 to 9.6.
- 3) Looking through the microscope, the drop of water seemed to come alive.
- 4) She sent the proposal to the director of the agency hoping for a grant.
- 5) Rehearsing his talk on the flight to the congress, a successful speech was unlikely.
- 6) Obstructed by adhesions, we resected a section of the small bowel and created an anastomosis.
- 7) Protruding through the skin of her left forearm, you could see the broken radius and ulna.
- 8) After listening to her explanation, the results made sense.
- 9) Inserting the distal tip of the chronic hemodialysis catheter too far into the atrium, the patient developed an arrhythmia.
- 10) Failing to record essential variables, the analysis was deeply flawed.
- 11) Focusing on the complications, uncontrollable bleeding is both the most common and the most dangerous.
- 12) Considering the consequences, intramuscular injection in the anticoagulated patient should have been avoided.
- 13) In performing colonoscopy, patients report greater satisfaction when sedated.
- 14) Wounded by knife, the surgeon checked the victim for internal injuries.
- 15) After explaining the possible benefits and risks involved, the patient signed the informed consent form.

Exercise 32

Rearrange these sentences so that it is clear what the modifiers are modifying.

- 1) Fellows who seek their tutors' advice often can improve their evaluation.
- 2) To carry out a successful research project, funds must be carefully administered.
- 3) She likes to listen to classical music analyzing the data.
- 4) Breeding freely in the cages, the undergraduates were delighted by the rats.
- 5) Dr. Joseph needs to do really well on his board examination.
- 6) An ameba appeared on the slide that moved all over the place.
- 7) Checking her blood pressure every 30 minutes, the results seemed to make more sense.

Continue

8) After reading her book, her talk is worth going to.
 9) She gave the cultures to the fellows on lidded Petri dishes.
 10) He had to repeat the course because he nearly failed every exam.

Verb patterns

When more than one verb is necessary to convey particular meanings, the verbs follow different patterns. These patterns are determined by the first verb.

Some verbs can be followed by an infinitive or gerund, with little or no difference in meaning.

– *They started sequencing individual genes from patient DNA.* = *They started to sequence individual genes from patient DNA.*

Other verbs admit only either the infinitive or gerund.

– *We expect to have the results next month.* ~~We expect having~~ is wrong.

– *You should avoid testing children for untreatable conditions.* ~~You should avoid to test~~ is wrong.

A few verbs have different meanings depending on whether they are followed by a gerund or an infinitive. We use these verbs together with the infinitive before we do something, and we use them together with the gerund while doing or after doing something.

	When followed by the infinitive	When followed by the gerund
<i>forget</i>	not do something because you did not remember <i>He forgot to ask permission to reprint the figure.</i>	do something but have no memory of doing it <i>He forgot telling her that he loved her</i> (i.e., he forgot that he told her that he loved her).
<i>mean</i>	have the intention to do something <i>I meant to ask you if I could use your slides for my class</i> (i.e., I was going to ask you).	imply doing something <i>Satisfying reviewer #4 means doing additional experiments.</i>
<i>regret</i>	feel bad about having to do something before you do it <i>We regret to inform you that we cannot pay your travel expenses.</i>	feel bad about having done something after you did it <i>I regret sharing my idea with him—he’s adopted it as his own.</i>
<i>remember</i>	bear in mind that you have to do something <i>You must remember to include her in the acknowledgments.</i>	do something and have memory of doing it <i>I remember reading about a similar case in the NEJM.</i>
<i>stop</i>	end one action in order to begin another <i>We were working on our paper, but we stopped to watch the match.</i>	end an action that is progress <i>We stopped watching the match when it was obvious that our team couldn’t win.</i>
<i>try</i>	aim to do something <i>We tried to explain it to him, but he just couldn’t understand it.</i>	do something to see if it works <i>We tried everything: we tried using simple language, we tried showing him examples, we tried drawing a diagram, but he just couldn’t get it.</i>

Exercise 33

Complete the sentences using the infinitive or gerund as appropriate.

- 1) Xavier plans (APPLY) for a grant next month.
- 2) She dislikes (DO) colonoscopies—she says her wrist hurts afterward.
- 3) The medical students practiced (TAKE) medical histories.
- 4) Dr. Walker enjoys (DRINK) whisky when he goes to congresses.
- 5) They hope (OBTAIN) a government grant to continue their research.
- 6) If Dr. Comas keeps on (WORK) so hard, she's going to get burned out.
- 7) He asked (HAVE) the morning off to answer the reviewers.
- 8) Do you mind (HELP) her with the statistical analysis?
- 9) Dr. Gould promised (HIRE) him for the summer.
- 10) Dr. Hill suggested (DO) an MRI to stage the tumor.
- 11) They agreed (WRITE) a recommendation for me.
- 12) She never mentioned (WORK) in Boston. How long was she there?
- 13) Dr. Stapleton decided (TAKE) her children with her to the seminar.
- 14) Geraldine offered (BUILD) the database for me.
- 15) The endocrinologists want (SET) up a diabetic foot clinic.
- 16) Where did you learn (WRITE) like that?
- 17) Dr. Whitbread appears (BE) the best person for the position.
- 18) Dr. Williams chose (ACCEPT) the fellowship in Cambridge.
- 19) I distinctly remember (TELL) him to lock the lab before leaving.
- 20) He claims (BE) an expert in biocomputing, but I don't believe him.

Exercise 34

Choose the best verb pattern.

- 1) Remember **to check / checking** on the cultures after lunch.
- 2) Lillian, I'm afraid I have some bad news—I regret **to tell / telling** you that we have hired someone else.
- 3) We tried **to use / using** different techniques, but none of them worked.
- 4) She can't go on **to work / working** without a contract; we must find a solution.
- 5) He stopped **to drive / driving** after his stroke.
- 6) Amy went on **to work / working** even after her grant money dried up.
- 7) Stephen went on **to win / winning** the Nobel Prize a few years later.
- 8) I regret not **to finish / finishing** my review in time.
- 9) I don't remember **to do / doing** the test, and I didn't record it in the lab log.
- 10) They tried **to resuscitate / resuscitating** the accident victim, but he died.

Exercise 35

Correct the mistakes in the use of verb patterns in these sentences.

- 1) What did happen at the meeting this morning?
- 2) A second molecular biology laboratory is constructed.
- 3) The operation has permitted that she lose 50 kg.
- 4) It is essential to remember entering the data in the database after each step.
- 5) They tried to give her noninvasive mechanical ventilation, but her condition did not improve.
- 6) Only three patients refused participating in the study.
- 7) The decrease failed reaching statistical significance.
- 8) The patient was sedated so he forgets to undergo the test.
- 9) We regret informing you that we cannot publish your article.
- 10) Dr. Severin cut her hair before her presentation at the American Congress.

Exercise 36

Choose the modal verb that best completes the sentence.

1) You smoke in the lab—there is a danger of explosion.
a) mustn't b) may not c) might not

2) I was up all night finishing my manuscript. I go to get some sleep.
a) should b) ought c) need

3) I left my stethoscope in the emergency department. you lend me yours?
a) May b) Could c) Shall

4) The patient is hemodynamically unstable. You do the procedure.
a) can't b) might not c) may not

5) You seem to have a huge backlog of work. I help you?
a) Would b) Will c) Shall

6) I saw your publication in *Nature*. You be very proud!
a) might b) must c) shall

7) It's the law. You to obtain approval from the institutional review board.

a) might b) could c) have

8) She have performed the experiment. She wasn't even in town last week.

a) might b) shouldn't c) couldn't

9) Dr. Vila, we've finished running the experiment. we take a break now, please?

a) May b) Would c) Must

10) This was the busiest call in my four years of residency. You be exhausted.

a) might b) must c) may

Using Google as a concordancer

A concordancer is a computer tool for language study. When you enter a word, it looks through a large body of texts and lists every single example of the word. The results reveal interesting information about how common the word is in the corpus (the body of texts searched), the words that come before and after it in the texts, and the more general context and style associated with it.

Google (G) and Google Scholar (GS) are very useful for finding both the best term to express or translate concepts and the best word order. Try different combinations and enclose search terms within quotation marks to evaluate the suitability of alternative terms and collocations. It is sometimes useful to add a specific term from your field when searching to check more general language-related questions such as articles and prepositions.

For example, you may have seen both “informed written consent” and “written informed consent” (both forms are common, sometimes even within the same document). Which order is better? Look at the search results: Google finds about 1,400,000 results for “informed written consent”. This seems to confirm that this word order is correct. However, if you search for “written informed consent”, Google finds about 13,300,000 results. If you think that these results might be “contaminated” by texts directed at laypeople, you can search for the same terms in Google Scholar. In this case, Google Scholar finds 90,900 for “informed written consent” and 402,000 for “written informed consent”. Thus, although both alternatives are correct, “written informed consent” is much more common than “informed written consent”.

When evaluating the results of your search, look at the number of hits but remember that numbers are not everything, although huge differences probably signal that one alternative is more grammatical or more conventional than the other(s). Pay attention to the sources cited; for example, a search for “cardiopathies” yielded a respectable 324,000 hits, but at least the first 40 results are all from French sources or medical dictionaries. If you think that the results might be “contaminated” by texts published in countries where English is not the predominant language, you can also refine your results with an advanced search that allows you to select the language and the region associated with the sites. Restricting our search to English lowers the number of hits to 55,000, but again, most of the first 40 results are from French pages or medical dictionaries. Restricting the search to English language and the USA lowers the number of hits to 25,200, and most of the first few pages listed come from medical dictionaries. You can find the English term for *cardiopatías* by looking up the term in the Spanish Wikipedia and then selecting English to see the corresponding article.

Radiation therapy (G: 6,890,000; GS: 1,350,000 results) and radiotherapy (G: 8,300,000; GS: 1,250,000) seem to be equivalent terms for the same technique. Could one be more common in the US and the other more common in the UK? An advanced search restricting the search to web pages in the US yields 10,900,000 results for “radiation therapy” and 10,500,000 for “radiotherapy”; in contrast, an advanced search restricting the search to the UK yields only 324,000 results for “radiation therapy”

but 1,740,000 for “radiotherapy”. Thus, we can conclude that both terms are used in both variet-

ies of English, but “radiotherapy” is much more common than “radiation therapy” in the UK.

Exercise 37

Use Google to decide which of the following arrangements of words is preferable.

- 1) Appendicitis often presents with
 - a) right iliac fossa pain / pain in the right iliac fossa
 - b) right lower quadrant pain / pain in the right lower quadrant
 - c) lower right quadrant pain / pain in the lower right quadrant
- 2) Most breast cancers develop in the
 - a) exterior superior quadrant
 - b) superior exterior quadrant
 - c) outer upper quadrant
 - d) upper outer quadrant
- 3) Inflammation of the uterus, fallopian tubes, and/or ovaries that leads to scarring with adhesions to nearby organs and structures is called
 - a) inflammatory pelvic disease
 - b) pelvic inflammatory disease
 - c) inflammatory disease of the pelvis
- 4) Which term is most common?
 - a) radioisotope scanning
 - b) radionuclide scanning
 - c) scintigraphy
 - d) gammagraphy
- 5) Which term is more commonly used to describe the condition resulting from the kidneys not filtering waste products from the blood adequately?
 - a) renal insufficiency
 - b) kidney insufficiency
 - c) renal failure
 - d) kidney failure
- 6) Which preposition is used with antibiotic prophylaxis?
- 7) The number one cause of death in the USA is
 - a) heart diseases
 - b) heart disease
 - c) cardiopathies
 - d) cardiopathy
- 8) Is it “invasive ductal carcinoma”, “infiltrative ductal carcinoma” or “infiltrating ductal carcinoma”?
- 9) Which term is more common: “epiploic torsion”, “omental torsion”, or “torsion of the omentum”?
- 10) What is the best order for the following words?
 - a) multicenter prospective cohort study
 - b) case-control observational prospective study
- 11) Which combination of these is best? valve or valvular with insufficiency regurgitation
- 12) Is it “computer tomography”, “computerized tomography”, “computed tomography”, “computer axial tomography”, “computerized axial tomography”, or “computed axial tomography”?
- 13) If you do not use a contrast agent with the above technique, what is it called?
- 14) Is it “one in four”, “one of four”, or “one out of four”?
- 15) Is it “lateral sulcus”, “lateral fissure”, “Sylvian fissure”, “Sylvian sulcus”, or “lateral fissure of Sylvius”?

Punctuation

Punctuation plays a crucial role in communication. Punctuation signs show the structure and organization of the text. They help readers interpret what they are reading and show them where to pause or change their intonation when reading out loud. Although in certain instances writers have a certain degree of flexibility in deciding whether to put in some punctuation marks, in most cases the rules about when and where to place punctuation marks are clear. In other cases, some simple guidelines can help writers use punctuation to facilitate understanding. This section deals only with the punctuation marks commonly used in scientific writing.

Commas

AFTER INTRODUCTORY DEPENDENT CLAUSES

An introductory dependent clause starts with an adverb like *after*, *although*, *as*, *because*, *before*, *if*, *since*, *though*, *until*, *when*, *while*, *whereas*, etc. A clause has a subject and predicate, so if it weren't for the introductory adverb, it could stand alone as an independent clause.

- *Because iodine is necessary for the production of thyroid hormone, iodine deficiency can lead to thyroid gland enlargement (goiter).*
- *Though many studies have addressed this issue, differences in the methods used and the populations studied make comparison difficult.*
- *After the antigen is immobilized, the detection antibody is added.*
- *When positive staining is used, the virions are coated with stain and fine details are obscured.*
- *When recombination or reassortment results in a major change in the genome of the influenza virus, a pandemic might occur.*
- *Although antibiotics can kill pathogenic bacteria, they can also kill beneficial bacteria.*
- *If the cell has the appropriate receptor on its surface, the virus enters the cell.*

AFTER INTRODUCTORY PHRASES

Unlike a clause, a phrase does not have a subject and a predicate. There are many types of

introductory phrases. Commas are required after some introductory phrases and are optional after others; however, it is never wrong to place a comma after an introductory phrase.

- Absolute phrases:
 - *After adjustment for age and sex, the variable was no longer significant.*
- Nonessential appositive phrases:
 - *An endemic organism in our environment, *A. baumannii*, represents the greatest threat to our immunocompromised patients.*
 - *A veteran member of our team, Dr. Stein is experimenting with regenerated limbs.*
 - *A condition in which pale green-brown blotches appear on the face, chloasma is related to sex hormones.*
 - *One of the oldest sleeping drugs still in use, chloral hydrate is mainly administered to elderly patients on a short-term basis.*
- Infinitive phrases:
 - *To determine which variables were associated with motor deficit severity, we used chi-square tests for categorical and ANOVA for quantitative variables.*
 - *To compare categorical variables, we used the chi-square test or Fisher's exact test, as appropriate.*
 - *To determine the cutoff point for P-ELISA, we used receiver operating characteristic analysis.*
 - *To rule out contamination by known virus contaminants, extensive *in vitro* and *in vivo* assays should be done.*
- Participle phrases:
 - *Working with rat brains, researchers at the University of Malaga found that the protein RGS-14 boosted the secondary visual cortex.*
 - *Working with rat brains, scientists at the Baylor College of Medicine identified an eight-segment chain of six amino acids that encoded the perception of a particular sound.*

- Obtained from monoclonal antibodies with significantly reduced immunogenicity, fragments of recombinant antibodies can be used to develop treatments.
- Recently developed from traditional ELISA assays, multiplex arrays can measure multiple cytokines in the same sample at the same time.
- Specially bred from sterile eggs, the maggots are a safe and effective way to debride gangrenous tissue.

However, remember that gerund phrases made with the present participle are often used as the subject of a sentence.

- Working with rat brains can be difficult because they are so small.
- Prepositional phrases:
 - At the start of his talk, he told a funny story that helped everyone relax.
 - In the 1990s, biotechnology based on gene splicing developed rapidly.

AFTER INTRODUCTORY WORDS

Introductory words like *furthermore*, *however*, *meanwhile*, *nevertheless*, and *still* can be used to connect two sentences and to show the relation between a sentence and the one that precedes it.

- Treatment with anthelmintics is usually effective. However, worms can develop resistance to these drugs.

Note that you can also use a semicolon to join the two ideas into a single sentence, but a comma is still required after the connecting adverb.

- Treatment with anthelmintics is usually effective; however, worms can develop resistance to these drugs.

WITH COORDINATING CONJUNCTIONS USED TO MAKE COMPOUND SENTENCES BY JOINING TWO INDEPENDENT CLAUSES

We often place a comma before coordinating conjunctions like *and*, *but*, *or*, *yet*, *for*, *nor*, and so when they are used to join two independent clauses. Although the comma can be omitted when the two clauses are brief and nicely balanced, it is never wrong to place a comma before a coordinating conjunction used to join two independent clauses.

- The major cause of direct lung injury is pneumonia, and the major cause of indirect lung injury is sepsis.
- The ethics committee approved the study, and all patients provided written informed consent.
- We enrolled 134 patients, but the study was discontinued because of the high rate of adverse events.

Similarly, a comma is optional but never wrong before *and* or *or* when listing a series of three or more elements. This comma often facilitates correct interpretation.

- The circulatory system consists of the heart, the arterial network to supply blood to the tissues, and the venous network to return it to the heart.
- The nonviable fetus had microcephaly, an enlarged thoracic cavity containing the liver, and talipes equinovarus.

However, note that coordinating conjunctions used to connect each of the elements in a series are written without commas.

- The three nucleobases found in the nucleic acids of both DNA and RNA are guanine and adenine and cytosine.

Commas are also used with *but* to express contrast.

- He is a brilliant scientist, but a poor communicator.

Exercise 38

Place commas where necessary in the following sentences; justify your actions with one of the seven rules from the list below. Note that some sentences are correct.

Rule 1: Place a comma after an introductory clause, phrase, or word that comes before the main clause. Do not place a comma before these elements when they come after the main clause.

Rule 2: Place commas before and after nonessential or free-standing clauses, phrases, and words. If the clause, phrase, or word comes at the end of the sentence, place a comma before it and a period after it.

Rule 3: Do not place commas before or after essential clauses, phrases, or words.

Rule 4: Place a comma before a coordinating conjunction (*and, but, for, or, nor, so, yet*) that joins two independent clauses.

Rule 5: In series of three or more words, phrases, or clauses, place commas between the elements.

Rule 6: Place a comma between two coordinate adjectives (coordinate adjectives would sound alright if we inserted *and* between them).

Rule 7: Place a comma between elements of geographical names (town or city, state or province, country), between the day and the year in dates, and between names and titles that follow them.

- 1) We presented the preliminary results at the national congress and published the final results in an international journal.
- 2) Serotonin which is derived from tryptophan plays an important role in regulating intestinal movements.
- 3) An antigen is a large complex molecule that triggers a specific immune response against itself when it gains entry to the body.
- 4) Although they are both named after the same man Paget's disease of bone and Paget's disease of the nipple are completely unrelated phenomena.
- 5) The radiologist assured us that the lesion was benign and that it was unlikely to cause problems.
- 6) Some experiments cannot be done because of a lack of funding.
- 7) After the infection was diagnosed and treated the patient recovered quickly.
- 8) Studies that involve changes to the standard treatment regimen must be approved by the institutional review board.
- 9) The cultures revealed Gram-negative Gram-positive and fungal microorganisms.
- 10) The histological analysis revealed undifferentiated stem cells.
- 11) HBx promotes the transcriptional activities of NF-κB AP-1 and survivin.
- 12) Vitamin D3 plays a role in the induction of host defense peptides in human ocular barrier epithelial cells.
- 13) This conclusion is in my opinion not supported by the results.
- 14) The World Congress will be held in Arlington Virginia USA; the deadline for abstract submission is January 8 2015.
- 15) Because of their refusal to undergo blood transfusions some Jehovah's witnesses refuse to go to the hospital.
- 16) Physicians who have worked in intensive care units are often the ones who are most sensitive to end-of-life ethical issues.
- 17) Fluoroscopy which was once common in general practitioners' offices is now restricted to hospital environments.
- 18) As chief of the department she was responsible for hiring and firing staff members.
- 19) He had an ugly large brown mole on the tip of his nose.
- 20) Dr. Dubner is a paid consultant for GlaxoSmithKline and Dr. Lee has received lecture fees from Novartis.

Exercise 39

Decide whether the following sentences are correctly punctuated with introductory commas. Underline the introductory element and correct any mistakes. Say why each sentence is correct or incorrect.

- 1) When the patient turned around a dozen large welts could be seen on his back.
- 2) Since we got the new scanner, our throughput has nearly doubled.
- 3) Having finished the statistical analysis we started to write the results.
- 4) Usually, we do not administer anaesthesia in these cases.
- 5) From the time we started to monitor his heartbeat, we were aware that something unusual was happening.
- 6) When he was in medical school he was only a mediocre student.
- 7) Before you decide which approach to use, you should consider the possible complications involved in each and their importance in that particular patient.
- 8) Nevertheless the secondary analysis found no significant differences.

Exercise 40

Add introductory commas where they are needed in the following sentences.

- 1) To check the goodness of fit of the model we used the Kolmogorov-Smirnov test.
- 2) Since the study was discontinued prematurely our sample size is too small to draw valid statistical inferences.
- 3) Of course we did not start the experiment until the baseline data had been recorded.
- 4) The patient was in critical condition when we started the intervention.
- 5) As I mentioned it may occasionally be necessary to administer a contrast agent.
- 6) Having decided to exclude obese patients *a priori* we had difficulties recruiting enough diabetic patients within our unit.
- 7) To estimate the costs we consulted three independent economists.
- 8) To survive a suicide attempt is not necessarily desirable.
- 9) Conducting a pilot study helped us to design a more robust trial.
- 10) However he tried to extract the fragment he could not.

COMMAS WITH NONESSENTIAL ELEMENTS

An element that can be removed from a sentence without changing its mean is “nonessential”. This doesn’t mean that the element doesn’t add im-

portant information; it provides additional information that does not alter the core meaning of the sentence.

Exercise 41

Identify the nonessential words, phrases, or clauses in the following sentences and add the appropriate punctuation.

- 1) Dr. Patterson who was recently appointed Chief Resident is a born leader.
- 2) Dr. DeLonghi decided nonetheless to observe the procedure.
- 3) Anyone who enters the operating room must scrub up beforehand.
- 4) The grant that I wanted to get is no longer available.
- 5) The first-year resident Sarah Hansen claimed to be an expert in statistics.

- 6) The surgical resident observing the procedure nervously did not say a word.
- 7) The surgical resident that was the most nervous of all did not say a word.
- 8) The research project which many in the hospital considered to be a waste of money eventually increased the institution's funding by over 30%.
- 9) The physical examination sometimes the most informative part of the work-up is often done hastily.
- 10) The hepatic artery which arises from the celiac artery supplies oxygenated blood to the liver, pylorus, duodenum, and pancreas.

Exercise 42

Decide whether the essential and nonessential elements in the following sentences are punctuated correctly. If they are incorrect, correct them. Say why the punctuation is correct or incorrect.

- 1) Our results were as a matter of fact chiefly interesting for what we did not find.
- 2) The nurse who attended the patient said that he had a temperature of 39 °C.
- 3) We did not however intend to repeat the experiment.
- 4) Dr. Harmon having forgotten to close the door was responsible for all the animals escaping.
- 5) Common Gram-positive bacteria, which affect humans, include *Streptococcus*, *Staphylococcus*, *Bacillus*, and *Listeria*.
- 6) The German scientist and physician, Robert Koch, is considered one of the founders of microbiology.
- 7) Paul Ehrlich, who popularized the concept of a “magic bullet”, received a Nobel in physiology for his work in immunology.
- 8) Dr. Raul's chief, Dr. Ferrer, is president of the national society.
- 9) The poster about tight junction proteins, that our residents made, won an award at the European congress.
- 10) Our research center which was renovated recently dates from 1956.

Exercise 43

The following sentences have essential and nonessential words, phrases, and clauses in them. Put in the necessary punctuation. Some sentences are already correct.

- 1) Dr. Mariachi wearing a lead apron entered the interventional radiology suite.
- 2) The auricles located inside the atrium are lined with pectinate muscles that form a network of hills and furrows that give it a trabeculated surface.
- 3) The woman who teaches parasitology at the central campus has published a lot.
- 4) The high school course that was most valuable to me was word processing.
- 5) Dr. Harding whose thesis dealt with molecular imaging explained how the PET scanner worked.
- 6) He rewrote his most famous essay “On Science” nine times.
- 7) The cardiology resident who was interested in electrophysiology decided to apply for a fellowship in our hospital.
- 8) Two of my colleagues Mary Beth Edwards and Sean McDowell are planning to study the anti-inflammatory effects of curcumin.
- 9) The graduate student who made the discovery had been investigating a completely unrelated technique.
- 10) Dimitri Medelev the designer of the periodic table of the elements never won the Nobel Prize.

Connecting two independent clauses

Independent clauses are clauses containing a subject and a predicate, so they can stand alone as simple sentences. Two independent clauses can be connected in four ways:

- 1) by ending the first with a period and starting a new sentence;
The major cause of direct lung injury is pneumonia. The major cause of indirect lung injury is sepsis.
- 2) by placing a comma at the end of the first, adding a conjunction (*and*, *but*, *or*, *or so*) and then continuing the sentence with the second;
The major cause of direct lung injury is pneumonia, and the major cause of indirect lung injury is sepsis.
- 3) by placing a semicolon between the two clauses (this option is usually restricted to

clauses that are closely related and nicely balanced);

The major cause of direct lung injury is pneumonia; the major cause of indirect lung injury is sepsis.

- 4) and by placing a semicolon after the first, adding an adverbial conjunction (*however*, *nevertheless*, *thus*, *therefore*, *consequently*, *as a result*, *on the other hand...*) followed by a comma and then continuing with the second.

The major cause of direct lung injury is pneumonia; on the other hand, the major cause of indirect lung injury is sepsis.

Many words and phrases can be used as adverbial conjunctions, and adverbial conjunctions can have many functions. Some of these are listed in Appendix XI.

Exercise 44

Each of the following sentences needs either a comma or a semicolon. Put in the necessary punctuation.

- 1) Many companies make drug-eluting stents, which are coated with different substances that block cell proliferation these stents are usually placed by interventional cardiologists.
- 2) Dr. Wainwright worked in the emergency room for many years and he now runs a trauma center.
- 3) The operation was a success but the patient, unfortunately, died in the ICU.
- 4) The new scrubs came in a wide variety of colors it was a welcome change.
- 5) As I was leaving the ICU, I heard an alarm for the patient had removed his endotracheal tube.
- 6) The endoscopist preferred to sedate her patients she did not like inflicting discomfort.
- 7) The rats were sedated, intubated, and connected to the monitors everything was ready for the experiment to begin.
- 8) He looked carefully into the microscope but he failed to notice the tiny area of tissue with abnormal cells on the periphery of the specimen.
- 9) The specimen had been fixed but, to his disappointment, nothing else had been done because of the technician's strike.
- 10) The computer could perform millions of operations per second however, it could not think spontaneously.
- 11) I knew the procedure would be tiring but I did not know I would have to be on my feet all night.
- 12) The patient, in delirium, rambled on I was unable to understand what she was trying to say.
- 13) The vascular surgeon repaired the severed artery subsequently, the wound was closed.
- 14) Spanish biologists are supposed to be well trained and I have seen plenty of evidence to support that claim since I have been at this center.
- 15) The first three experiments seemed to indicate that there was no relationship between the two variables however, the last four experiments showed that they were related.

- 16) In the first place, the patient was too ill to transfer in the second place, we did not have the means to treat her at our hospital.
- 17) I have read the article in *Circulation* but I have not read the article in *Stroke*.
- 18) Immunology is my favorite subject in fact, I plan to do a Master's degree in it next year.
- 19) The radiologist made a brilliant diagnosis and the surgeon did not need to perform exploratory laparotomy.
- 20) Large hospitals have everything you need you can find professionals from every specialty under one roof.
- 21) Dr. Ronstadt and Dr. Farell were both in the session this morning they gave an interesting presentation on their research.
- 22) The complications are not serious but they are numerous and annoying.
- 23) Writing lab reports is excellent practice I write several every week.
- 24) I am not interested in going to the European congress this year however, I would like to go to the American congress.
- 25) Not all successful scientists are good communicators but many good communicators are successful scientists.
- 26) Dr. Jackson spent the money on editing her text at least, that was her explanation for the missing funds.
- 27) I have checked the analysis three times but I cannot find the source of error.
- 28) His work may seem irrelevant but you would be surprised to see how many authors cite him.
- 29) She realized that something was wrong she was not however, the only person who was concerned.
- 30) They had to send their responses to the reviewers by Friday otherwise, they would have had to submit the article as a new submission.
- 31) I finished reviewing the article and then I went to bed.
- 32) We always prefer to send our articles to *The Annals* first they have the highest impact factor in our field.
- 33) Dr. Scott went to the pathology department quite often the secretaries even knew her name.
- 34) Most clinicians consider themselves perfectly capable of reading chest X-rays indeed they rarely bother to consult a radiologist at all.
- 35) The lab manager has promised to implement better safety measures and the technicians have agreed to undergo additional training.

Hyphenation

The hyphen is a very useful and necessary punctuation mark. Hyphens serve various purposes. For example, they are used to divide words at the end of a line of text. However, you cannot divide the word wherever you please—you need to divide it between syllables. This seems easy but can be tricky. You can usually avoid doing this, but on rare occasions you might have to, for example, if you are organizing a course and need to elaborate a brochure yourself. Always check a dictionary to confirm syllabification.

Another function of hyphens is to combine two words to make a compound. Compound words can be written three ways: as two separate words, as two words connected by a hyphen, or as an unhyphenated single word. Often there is no consensus about the best way to write a certain compound—sometimes all three ways can be confirmed in different dictionaries! English is rapidly evolving, so the conventions for writing compounds change over time. As a general rule, new compound forms start out be-

ing written as two separate words, then become hyphenated, and finally end up being written as a single word; however, many very common combinations of nouns that have been in the language for a very long time are still written as two separate words. On the other hand, some words that have entered the language only very recently are already consolidated as unhyphenated single words (e.g., *online*, *email*, etc.).

English's amazing ability to combine words to make a semantic unit is usually expressed as two or more words written separately; there are an infinite number of possibilities (e.g., *animal cell culture*, *bile duct obstruction*, *blood cell*, *chest pain*, *compartment syndrome*, *lipid body*, *transmission electron microscope*). However, many compound words in biology and medicine are commonly written as a single, unhyphenated word: *backbone*, *baseline*, *baseplate*, *bedbug*, *bedpan*, *bedside*, *bedsore*, *birthmark*, *blackhead*, *boxplot*, *brainstem*, *brainstorm*, *breastbone*, *catgut*, *chickenpox*, *database*, *doublebind*, *email*, *endplate*, *eyeball*, *eyelash*, *eyelid*, *feedback*, *fingertip*, *flatfeet*, *flatworm*, *foreskin*, *frostbite*, *gallbladder*, *gallstone*, *gunshot wound*, *hangnail*, *headache*, *headquarters*, *healthcare*, *heartburn*, *heatstroke*, *honeycomb*, *hookworm*, *horseradish peroxidase*, *horseshoe kidney*, *hotspot*, *housekeeping gene*, *keyboard*, *keywords*, *kneecap*, *mouthwash*, *network*, *newborn*, *nosebleed*, *pacemaker*, *papillomavirus*, *pathway*, *pokeweed mitogen*, *ringworm*, *roundworm*, *smallpox*, *stomachache*, *sunburn*, *sunstroke*, *tapeworm*, *toenail*, *toothache*, etc.

We do not usually hyphenate nouns made from back formation of phrasal verbs, regardless of whether the verb or particle comes first: *backup*, *backwash*, *breakdown*, *buildup*, *burnout*, *changeover*, *checkup*, *countdown*, *cutback*, *fallback*, *intake*, *outbreak outcome*, *outflow*, *outlet*, *output*, *setback*, *setup*, *spinoff*, *startup*, *throughput*, *turnout*, *uptake*, *upgrade*, *upregulate*, *washout*, etc.

Biomedical terms formed from combinations of root words and prefixes and suffixes that come from the classical languages are normally written as a single word without a hyphen (*anteroposterior*,

etc.), except when the same vowel ends one element and begins the following one (e.g., *salpingo-oophorectomy*). Nevertheless, you do see them written with hyphens. Using hyphens in these words is more common in British English (*antero-posterior*, etc.).

No hyphen is used after most prefixes: *antibody*, *bipolar*, *coenzyme*, *counteract*, *decompress*, *disconnect*, *hyperintense*, *hypoplasia*, *incurable*, *interstitial*, *intracellular*, *malabsorption*, *megabyte*, *microvascular*, *miscarriage*, *noninvasive*, *outpatient*, *overestimate*, *postcoital*, *preprandial*, *pseudoaneurysm*, *quadrilocular*, *recanalize*, *semicircular*, *subchronic*, *superimpose*, *suprasellar*, *transrectal*, *trilobar*, *ultraviolet*, *unenhanced*, *underweight*. Note that certain words containing prefixes require a hyphen to distinguish them from other words (*co-op*, *re-call*, *re-collect*, *re-form*, *re-cover*, *re-sent*, etc.). Traditionally, when using these prefixes implies doubling a letter, a hyphen was placed between the two elements (*anti-inflammatory*, *intra-abdominal*, *non-nucleated*, etc.); however, it is becoming more common to write these words without a hyphen. Note also that when the prefix is used with a proper noun, a hyphen is required (*anti-Alzheimer drug*, *non-Hodgkin lymphoma*, etc.). A few prefixes are normally written with hyphens: *all-encompassing*, *ex-president* (but be careful—*ex* is not always a prefix; e.g., *expectancy*, *exude*), *quasi-photosynthetic*, *self-limited*. Finally, the prefix *cross* is especially confusing because, depending on the word formed, it may be written as a single, unhyphenated word (*crossover*), with a hyphen (*cross-eyed*), or even as two separate words (*cross education*).

No hyphen is used before most suffixes. To my knowledge, the only exception is *like* when it follows a word ending in double L (e.g., *roll-like*) or when it is attached to an expression made up of two or more words (e.g., *heart attack-like*).

Hyphens are necessary with both prefixes and suffixes when they are used with numbers written as numerals (e.g., *pre-1980*, *10-fold*), but not when they are written as words (e.g., *subzero*, *tenfold*).

The numbers between twenty-one and ninety-nine are hyphenated when written out as words (*eighty-three million, two hundred and forty-three, etc.*). Fractions are hyphenated, except when the numerator or denominator contains a hyphen (*two-thirds, four-fifths, but twenty-one one hundredths*).

A few specific compounds are always hyphenated (e.g., *editor-in-chief, father-in-law, half-life, nurse-practitioner, X-rays*).

Eponyms are commonly used in biomedicine to refer to devices, diseases, syndromes, and techniques. When they refer to more than one person, the names are separated by hyphens: *Cheyne-Stokes respiration, Laurence-Moon-Biedl syndrome, Prausnitz-Kustner reaction, Swan-Ganz catheter, etc.*

With a few exceptions (see below), two or more words that function as a single adjectival expression are hyphenated when they come before the noun that they modify: *a three-year-old boy, a three-million-dollar grant, androgen-*

binding protein, enzyme-linked immunosorbent assay, follicle-stimulating hormone, the male-to-female ratio, a well-trained lab assistant, etc. However, when these expressions come after the noun, they are not hyphenated: *their son is three years old, the ratio of males to females, our lab assistant is well trained, etc.* Journals have different preferences for hyphenating adjectival expressions containing unhyphenated compounds—some prefer to leave them open (*liver disease-related*) whereas others prefer to hyphenate them (*liver-disease-related*).

We do not use hyphens in comparatives (*a more efficient approach, a better written discussion*), in superlatives (*the most probable explanation, the least expensive method*), in expressions with adverbs ending in -LY (a highly effective treatment), in chemical compounds (*adenosine diphosphate conversion*), in Latin expressions (*in vivo anti-infective activity*), or in expressions incorporating a number or letter (*Type II diabetes, stage 3 astrocytoma, grade A agar*).

Exercise 45

Add hyphens to the following sentences where necessary.

- 1) We studied four year old children with atopic dermatitis.
- 2) This experiment requires a little used beaker not found in many laboratories.
- 3) High school age students require different disciplinary approaches.
- 4) Patients with tightly controlled glycemia develop fewer insulin related complications.
- 5) The host's endothelial cells recover the corneal graft, restoring clarity.
- 6) Follow up visits should follow the three step protocol.
- 7) We must follow up the cohort to see whether there are long term changes.
- 8) Acetylcholine induced endothelium dependent relaxation was associated with the endothelium dependent hyperpolarization of the smooth muscle cells in the mesenteric arteries.
- 9) The five hour experiment had to be repeated three times.
- 10) An ad hoc committee was set up to explore ethics related issues in molecular genetics.

Exercise 46

Correct the use of hyphens in the following sentences. Note that some of the sentences are correct.

- 1) They did a four year out-come based study on wound healing and limb salvage in patients with frost-bite.
- 2) The article reported the findings from a randomized, placebo-controlled, clinical trial measuring the effects of high-dose supplementation with vitamins C and E, beta carotene, and zinc on age-related macular degeneration.
- 3) Her back was covered with purplish-red lesions.

Continue

- 4) Figure 3 shows a black and white photograph of the device.
- 5) The placenta is a low resistance path-way in the fetal circulation.
- 6) It was a double blind cross-over study about cell mediated immunity.
- 7) The movement of small ions through cell to cell gap junction channels mediates intercellular signaling at electrical synapses.
- 8) A two-month-old baby presented with a fever and projectile vomiting.
- 9) We studied in-vivo glucose metabolism in type-II diabetic patients.
- 10) We discuss complications resulting from the unintentional intraarterial injection of drugs.

Exercise 47

Put in commas, semicolons, colons, and parentheses wherever they are needed in the following sentences.

- 1) The physicians involved H. Jackson J. Mandarino and S. Freeman are being sued.
- 2) Four viruses can cause Ebola hemorrhagic fever BDBV EBOV SUDV and TAFV.
- 3) Sometimes however microbes normally found in the environment can overcome your defenses regardless of your general health.
- 4) Karen Smythe later to be appointed department head had supported the residents in their fight for better working conditions.
- 5) In last week's NEJM one of my favorite journals there was an interesting article about the dangers of calcium supplements to prevent osteoporosis.
- 6) Patients who were classified as grade I and grade II were followed for 6 months and 12 months respectively.
- 7) The article was published by Nancy Ingram MD and Mary Lou Reina PhD.
- 8) The *in vitro* assay showed that the drug was promising.
- 9) Biological membranes are made of three major components lipids proteins and sugars which are attached to some of the lipids and proteins by covalent bonds.
- 10) However in membranes of the endoplasmic reticulum where phospholipids are synthesized rapid transverse diffusion of particular lipids takes place across the bilayer.
- 11) In general surgery familiarity with a wide range of suturing techniques is useful.
- 12) In general surgery is restricted to patients who do not respond to medical treatment.
- 13) The Diabetic Foot Unit is led by physicians from three specialties podiatry endocrinology and vascular surgery.
- 14) However CT examinations are performed they deliver a large dose of radiation.
- 15) However CT examinations are performed when MRI is contraindicated for example in patients with implanted metallic prostheses or electronic devices or in those with claustrophobia.
- 16) Matrix metalloproteinases MMPs are zinc dependent endopeptidases other family members are adamalysins serralysins and astacins.
- 17) The 1982 Working Formulation introduced the category non Hodgkin lymphoma divided into 16 different diseases however because these different lymphomas have little in common with each other the non Hodgkin label is of limited usefulness.
- 18) However mistakes do occasionally occur for example the Therac-25 radiation therapy machine was responsible for at least six accidents between 1985 and 1987 where patients were given up to one hundred times the intended dose.
- 19) A cyst may contain air fluids or semisolid material a collection of pus is called an abscess not a cyst.

- 20) Myotonic muscular dystrophy type 1 also known as Steinert disease is the most common adult form of muscular dystrophy it results from the expansion of a short repeat in the DNA sequence of the myotonic dystrophy protein kinase gene.
- 21) Because ketamine can cause hallucinations it is not usually used as a primary anesthetic however since it suppresses breathing much less than most other anesthetics it is the anesthetic of choice when reliable ventilation equipment is not available.
- 22) Chemically oxidative stress is associated with increased production of oxidizing species or a significant decrease in the effectiveness of antioxidant defenses such as glutathione.
- 23) The production of nitric oxide is elevated in populations living at high altitudes which helps these people avoid hypoxia by aiding in pulmonary vasculature vasodilation.

Capitalization

In principle, the basic rules for capitalization are simple and straightforward. In practice, however, different interpretations and exceptions can make applying the rules tricky. Although your article will usually be corrected by a copy editor after it is accepted, there is no excuse for ignoring the basic rules for capitalization.

We capitalize the first word of every sentence. Some names and terms begin with a lowercase letter (e.g., mRNA, iPhone, van Horn, etc.); in this case, it is best to rearrange your sentence so that you do not begin with this word. So instead of writing something like A, write something like B.

- A) mRNA-based vaccines are being developed as prophylaxis against infectious diseases.
- B) Vaccines based on mRNA are being developed as prophylaxis against infectious diseases.
- A) iPhones have many potential uses in hospital environments.
- B) There are many potential uses for iPhones in hospital environments. *OR* In hospital environments, iPhones have many potential uses.

We capitalize terms when they refer to proper nouns, in other words, nouns representing unique entities (e.g., *Julia*, *Barcelona*, *Mediterranean*, *Bayer*). We do not capitalize common nouns, in other words, those representing a class of entities (e.g., *person*, *city*, *sea*, *company*) or instances of a class that are not unique. Thus,

we write *the Glasgow Coma Scale*, *the Charlson Comorbidity Index*, *the Minnesota Multiphasic Personality Inventory*, *the West Coast*, *the Board of Directors of Santa Maria Hospital*. However, when the words that make up these specific terms are used in a general way, they are not capitalized, so we write *on a scale of one to ten*, *the blood flow index can be calculated in various ways*, *an inventory of the patient's comorbidities*, *the most inaccessible part of the coast*, and *she attends the hospital board meetings*. Confusingly, a proper noun is often defined as a noun written with a capital letter. Unlike in Spanish, the days of the week and the months of the year are always capitalized in English (e.g., *The opening ceremony will be held on Saturday, August 31, 2013*).

Note that in taxonomic names, which are written in italics, the name of the genus is written with a capital letter and the name of species is written with a lowercase letter. Thus, we write *Staphylococcus aureus*; however, when we use *staphylococcus* as a common noun, we do not italicize or capitalize the word (e.g., *We isolated six species of staphylococci*).

We also capitalize proper adjectives, in other words, adjectives derived from proper nouns. Like in Spanish, in English we capitalize the names of countries and cities, which are proper nouns. However, unlike in Spanish, we also capitalize adjectives formed from these names, the names of languages, and the names of citizens in these places (e.g., *Spain*, *Spanish*, *Spaniards*, *Sevillian*). When this association becomes remote, the adjective becomes common and is

usually not capitalized (e.g., *caesarian*, *italics*, *roman numerals*, etc.). Another difference is that we capitalize all important words in geographic names (*Lake Michigan*, *the Pacific Ocean*, *the West Coast*, etc.).

Many anatomic structures, diseases, devices, and procedures are named after their discoverers. These eponyms are always capitalized. Note, however, that only the person's name is capitalized—the other words in the term are written in lowercase letters (e.g., *a Swan-Ganz catheter*, *the vein of Galen*, *Doppler ultrasound*, etc.). In what would seem to be a contradiction of the above-mentioned rule regarding proper adjectives, words derived from eponyms are not usually capitalized, although preferences vary among editors. Thus, we usually write *Gram-positive bacteria*, *parkinsonian gait*, and *müllerian ducts*.

We normally use capitals for *appendix*, *figure*, *table*, etc. when designated by a number or letter. *Articles may include up to three tables and three figures. A box and whisper plot for the three experimental groups and the controls is shown in Figure 3.*

When we define an acronym at first abbreviation, we do not capitalize the first letter of the words making up the term unless it is a proper noun. *Candidates for coronary artery bypass*

graft (CABG) must be screened by a heart surgeon. The bacillus of Calmette and Guérin (BCG) vaccine provides protection against tuberculosis.

Some journals also capitalize some words in titles. In this case, adjectives, adverbs, nouns, numbers, pronouns, and verbs are capitalized, whereas articles, conjunctions, and prepositions are not capitalized. The AMA Manual of Style specifies that you should not capitalize "a coordinating conjunction, article, or preposition of three letters or less, except when it is the first or last word in the title or subtitle", but insists that you should capitalize two-letter verbs like *am*, *be*, *do*, *go*, or *is*. Word processors' grammar correctors often suggest when you have capitalized the wrong words in these cases. One tricky aspect of capitalization for titles is what to do with hyphenated words. The AMA Manual of Style states that you should not capitalize the second part of a hyphenated word if both parts constitute a single word (e.g., *Half-life*, *X-ray*, etc.) or if either part is a prefix or suffix (e.g., *Anti-inflammatory Agents*, *Pre-embolization Planning Studies*, etc.), but that you should capitalize both parts in all other cases (e.g., *Thrombin-Induced Platelet Aggregation in a 12-Year-Old Boy*, etc.). Finally, when titles contain a colon (:), the first word after the colon is always capitalized for books but not for journal articles.

Exercise 48

Choose the answer with the correct use of capital letters to complete the sentence.

- 1) He earned a PhD from...
 - a) ohio state university.
 - b) Ohio state university.
 - c) Ohio state University.
 - d) Ohio State University.
- 2) Her father was the...
 - a) chairman of the anatomy department.
 - b) Chairman of the anatomy department.
 - c) Chairman of the Anatomy department.
 - d) Chairman of the Anatomy Department.
- 3) Duplex ultrasonography combines...
 - a) B-mode imaging to visualize morphology and color doppler imaging to visualize flow.
 - b) B-mode imaging to visualize morphology and color Doppler imaging to visualize flow.

c) B-mode imaging to visualize morphology and Color Doppler imaging to visualize flow.
 d) B-mode Imaging to visualize morphology and Color Doppler Imaging to visualize flow.

4) We found several species of...

- Staphylococci, including *Staphylococcus Aureus*.

5) All conference abstracts will be published in...

- spanish and english.
- Spanish and english.
- spanish and English.
- Spanish and English.

6) All patients underwent...

- magnetic resonance imaging (MRI).

7) My daughter was born on...

- friday, september 30, 2005.

8) None of the teaching assistants supported...

- professor wilkins in his bid to become the dean.
- professor Wilkins in his bid to become the dean.
- Professor Wilkins in his bid to become the dean.
- Professor Wilkins in his bid to become the Dean.

9) Her career took her from...

- northern california to southeast asia.

10) The best book I have read this year is...

- Genome: The Autobiography Of A Species In 23 Chapters*
- Genome: the Autobiography of a Species in 23 Chapters*
- Genome: The Autobiography of a Species in 23 Chapters*
- Genome: the Autobiography of a Species in 23 chapters*

11) The results of...

- experiment 3 are shown in table 4 and figure 5.
- Experiment 3 are shown in table 4 and figure 5.
- experiment 3 are shown in Table 4 and Figure 5.
- Experiment 3 are shown in in Table 4 and Figure 5.

Continue

12) We used a...

- murine model of diabetes mellitus.

13) The most common cyanotic heart defect is...

- the tetralogy of fallot.

14) She wrote a review article entitled...

- "On ANCA-associated Small-vessel Vasculitis among Young Native-American Women".
- "on ANCA-Associated Small-Vessel Vasculitis among Young Native-American Women".
- "On ANCA-Associated Small-Vessel Vasculitis among Young Native-American Women".
- "On ANCA-Associated Small-Vessel Vasculitis Among Young Native-American Women".

Exercise 49

Correct the use of capital letters in these titles where necessary.

- 1) Viral evolution in chronic Hepatitis B: a branched Way to HBeAg Seroconversion and Disease progression?
- 2) Deficiency of Intestinal mucin-2 Ameliorates experimental Alcoholic Liver disease in Mice
- 3) Beclin-2 Functions in Autophagy, Degradation of G-Protein-Coupled Receptors, and Metabolism
- 4) Loss of CARM 1 is Linked to Reduced HuR Function in Replicative Senescence
- 5) Resonance Raman Characterization of the Ammonia-Generated Intermediate of Cytochrome c Oxidase from *Paracoccus Denitrificans*

Apostrophes

Apostrophes have two basic uses in English: to show where letters have been omitted in contractions and to form the Saxon genitive to show possession. As contractions are inappropriate in formal scientific writing, only the second use

concerns us here. We show possession by adding 's to the possessor before the thing that is possessed. The possessor is usually a person or a group of people, although it can also be an animal or less frequently a place.

Situation	Rule	Examples
Single possessor	add 's after the possessor	Teresa's office The mailman's son The dog's heart rate
When a name ends in S	add 's or just an apostrophe	Dr. Ross's experiment Dr. Ross' experiment
Plural possessor (regular)	add an apostrophe after the s that forms the plural possessor	The brain-damaged rats' lungs The residents' calls

Plural possessor (irregular)	add 's after the plural possessor	The children's fear The mice's responses
Plural possessors (proper nouns), object(s) possessed in common	add 's after the last possessor	Watson and Crick's paper Marie and Pierre Curie's discovery
Plural possessors (proper nouns), objects possessed individually	add 's after each possessor	Dr. Smith's and Dr. Jones's conferences Dr. Dubner's and Dr. Rogers's secretaries

Exercise 50

Correct the mistakes in the use of apostrophes in these sentences. Some of the sentences are correct.

- 1) This is a photo of Hector's, where you can see the new microtome.
- 2) This is a photo of Hector.
- 3) This is a malignant tumor—look at it's pattern of radiotracer uptake.
- 4) Lab technicians' are expected to attend the session.
- 5) Dr. Ross' son will be doing a fellowship at Yale.
- 6) Many from the class of '99 have succeeded.
- 7) They work at Johns Hopkins Medical Center.
- 8) The Center's for Disease Control is a founding member of the International Association of Public Health Institute's.
- 9) Is that specimen her's or yours'?
- 10) Senior staff members salaries are competitive with those in the private industry.
- 11) In four month's time, I will have published my first paper.
- 12) Its important to seek the committees approval before starting your experiments.
- 13) Have you read John and Anna's review in *Cell*?
- 14) Julia and Joseph's lab coats need to go to the cleaners.
- 15) The Rockefeller's generous donation covered the building and the lab equipment.

Exercise 51

Correct the punctuation in the following sentences where necessary. Note that some sentences have no mistakes.

- 1) The male to female ratio is about 2:1.
- 2) The experiment, that we discussed last month, was never done.
- 3) However the postdocs English is terrible, so she is unlikely to understand the details of the presentation.
- 4) Department of Thoracic Surgery. Hospital Vall Hebron. Barcelona. Spain.
- 5) The senior resident explained why she hadn't asked for help before?
- 6) In the last five years we have published an average of 7,3 papers per year.
- 7) I can be found in the lab on monday's, wednesday's, and friday's, however, I am never there on tuesday's or thursday's.
- 8) Three fifths of the paramedics, who responded to the survey, had symptoms of burn out in the previous three-years.

Continue

- 9) Cri du chat syndrome is a group of symptoms, which result from a deletion, on the fifth chromosome.
- 10) Influenza can cause severe infections in patients with cystic-fibrosis.
- 11) The twin's father was the primary caretaker.
- 12) All patients underwent Positron Emission Tomography (PET).
- 13) Dr. Salem's secretary's English is excellent.
- 14) Despite Dr. Preston's qualifications, I don't think, he's right for the job.
- 15) The course was held in Miami beach convention center, in Miami, Florida. I could see the atlantic ocean from my room.

Writing numbers

Not everything that can be counted counts, and not everything that counts can be counted.

Albert Einstein

Science as we know it and live it is inconceivable without numbers.

Although the recommendations vary among style guides and journals, these general guidelines can help you express numbers more clearly.

- 1) Spell out one-digit numbers and use numerals for larger numbers. *No differences were found between the three groups. All 24 rats in the experimental group died.*
- 2) Spell out numbers at the beginning of a sentence. *Twenty healthy volunteers completed the motor tasks while undergoing fMRI.*
- 3) Rearrange sentences to avoid having to spell out large numbers. *Two hundred and seventy-two consecutive patients were eligible for the study. Two hundred and twenty-four provided written informed consent to participate.* \Rightarrow *A total of 272 consecutive patients were eligible for the study; 224 provided informed written consent to participate. Six hundred and eighty-eight events were recorded.* \Rightarrow *We recorded 688 events.*
- 4) Use a combination of numerals and words to express very large, general numbers. *The population of Spain is about 47.2 million. The total direct cost of treating diabetes in the USA was over \$176 billion in 2011.*

- 5) Use exponentials to express very large or very small numbers. *Her red blood cell count was 4.3×10^9 per ml. The ionization constant for acetylsalicylic acid is 4.0×10^{-4} at 25°C.*
- 6) Use numerals before abbreviated units of measurement. *Dissolve all dry reagents together in 800 ml of double-distilled H₂O. The lipid bilayer is about 5 nm thick.*
- 7) Use numerals in series in which at least one element is greater than or equal to ten. *The infants' weights were recorded at 1, 2, 3, 6, and 12 months.*
- 8) If two numbers are juxtaposed, spell out one of the numbers. *We analyzed 40 12-unit samples.* \Rightarrow *We analyzed 40 twelve-unit samples.* *We analyzed 40 units composed of 12 units each.*
- 9) Punctuate numbers correctly:
 - a) Use commas or spaces to set off thousands, millions, etc. *There are about 23,000 cardiologists in the United States. A total of 134,568 women reside in the screening program's target area.*
 - b) Do not put commas or periods in years. *We included all patients with diabetes diagnosed in 1999. Recruitment will end on December 31, 2016.*
 - c) Use periods to mark decimals. *Tumor signal-to-noise ratio was higher for Contrast A than for Contrast B (364.9 ± 217.8 vs. 253.6 ± 135.8 ; $p = 0.043$).*

d) Hyphenate adjectival expressions before nouns, prefixes before numerals, and numerals (but not spelled-out numbers) followed by “fold”. *A 53-year-old man presented with amaurosis fugax. Physicians' incomes are approaching pre-2001 levels. We observed an 11-fold increase in drug use affecting babies. Hepatotoxicity increased threefold.*

e) Hyphenate compound numbers from twenty-one to ninety-nine when spelled out; hyphenate spelled out fractions except when the numerator, denominator, or both are hyphenated. *Two-thirds of the patients developed some kind of complication. Five twenty-fourths...* (It is unusual to write out fractions like this. Fractions can be expressed in numerals $5/24$ or, when appropriate, as decimals).

10) Express ranges differently according to context: use “from... to” or “between... and” or “through” in the body of the text and dashes (—) in tables, parenthetical information, and references. *This concept is illustrated on pages 29 through 32. On Saturdays, the laboratory is open from 9 a.m. to 3 p.m.*

Between January 1 and December 31, 2012, a total of 645 patients presented with chest pain. 11) Goldacre RJ, Sylven B. On the access of blood-borne dyes to various tumour regions. Br J Cancer. 1962;306-22. We included 75 patients (mean age, 45.3 y; range, 33-54).

11) Express percentages correctly:

- Use the percent sign (%) after numerals. Repeat the percent sign in series and ranges. *The sensitivity, specificity, and diagnostic accuracy were 97%, 85%, and 92%, respectively. The positive predictive values in the 13 studies ranged from 96% to 99%.*
- Write out “percent” (US English) or “per cent” (UK English) after a number spelled out as a word. *Twelve percent of the patients in the open surgery group died.*
- Do not separate a percentage from the absolute value it represents. *Complications occurred in 45 of the 60 (75%) of patients treated with open surgery* \Leftrightarrow *Of the 60 patients treated with open surgery, 45 (75%) developed complications.*

Exercise 52

Correct the use of numbers in these sentences.

- 223 ICU chiefs were surveyed; a total of 446 20-minute telephone interviews were conducted.
- Four hundred and sixty-five patients were enrolled in the study. Three hundred and ninety-nine completed the entire 2-month follow-up: thirty patients were lost to follow-up, twenty-nine withdrew from the study prematurely, and seven died.
- In five days, we observed 6 seizures in two male and twenty-two female rabbits.
- 12 patients were excluded because of morbidities.
- 50% of the patients were discharged to home.
- All cultures remained negative for MRSA after 3 days.
- In about three weeks, all dogs had recovered the use of their tails.
- The sensitivity in the twelve studies ranged from 73 to 92%.
- In preparation for the procedure, she was administered 2 antiplatelet drugs, dipyridamole (one hundred mg/day) and acetylsalicylic acid (one hundred mg/day), for 5 days.
- TNF- α upregulated MCP-1 mRNA expression four-fold.

Spelling

The English orthographical system is challenging for both native and nonnative speakers. Unlike in Spanish, where there is nearly a one-to-one correspondence between sounds and their written expression, in English the same sounds can be expressed in writing in many different ways, and the same combination of written letters can be pronounced in many different ways.

Computer spell checkers can catch most—but not all—mistakes in nontechnical words, provided you remember to set the language in your word processor's toolbox. You also need to make sure you select the appropriate variety of English (nearly always UK English or US English—see Appendix XII). You should also create your own

personal dictionaries (one for UK English and one for US English) to which you add the technical words that are common in your fields of interest. It is crucial to check and double-check that the words you add are spelled correctly; otherwise, your computer will misinform you perpetually (or at least until you catch your own mistake).

Although computer spell checkers are becoming more and more sophisticated, they are still mostly limited to catching words that do not exist or words that do not fit grammatically into your sentence according to simple algorithms. On the other hand, they are practically incapable of interpreting spelling based on semantics, so there are occasions when they miss totally inappropriate words of the same grammatical class with spellings similar to your intended word.

Exercise 53

Many English words have similar spellings. Since these are valid words, tools in word processing programs to check spelling are sometimes incapable of detecting these mistakes. Correct the errors in spelling due to similarities with other valid words.

- 1) The prosthesis became lose in the neck of the femur because of bone resorption.
- 2) The day after the party, the nursing supervisor had a sever hangover and a badly bruised ego.
- 3) Fluid is hyperintense on T2-weighted MRI sequences.
- 4) No casual link has been found between antiplatelet agents or anticoagulants and the risk of ICH after CAS.
- 5) It seems that the arrhythmias were caused by scaring from the heart valve replacement three years earlier.
- 6) You should not tell a hyperventilating patient to breath into a paper bag.
- 7) The study aimed to asses the usefulness of vasodilators in patients with heart failure.
- 8) We couldn't find his chart because it was filled under his middle name.
- 9) A multicenter trail is underway to test the safety of the drug in children.
- 10) It is important not to bath until the wound has healed.

Exercise 54

The similarity in the spelling of many words between English and Spanish can also lead to mistakes. Correct the errors in spelling due to Spanish influence.

- 1) Data adquisition before contrast administration is important for image postprocessing.
- 2) Both topic and systemic antibiotics should be administered inmediately.
- 3) Patients presenting with biliar colic often require intravenous analgesia.
- 4) Axillary lymph node dissection is important for detecting metastasic breast cancer.
- 5) We will have to consult the neuroradiologist.
- 6) Critical care is not a recognized speciality in some countries.

- 7) There was an outbreak of colera in the refugee camp.
- 8) The patient was referred to an oftalmologist.
- 9) Coartation of the aorta accounts for 5% to 8% of all congenital heart defects.
- 10) Treatment for rhabdomyosarcoma consists of chemotherapy, radiation therapy, and sometimes surgery.
- 11) The incidence of hepatocellular carcinoma is higher in cirrotic patients.
- 12) The passage of kidney stones through the uretra can be painful.
- 13) A focal stenosis in the distal urether can be caused by a kidney stone.
- 14) Enteroclysis has been largely supplanted by CT enterography.
- 15) Thiazide diuretics can lead to caliuresis.

Exercise 55

Double consonants are common in English words. Although doubling rules are very useful for knowing when to double consonants before adding suffixes like *-ed*, *-ing*, *-er*, *-est*, there are a few exceptions to these rules. Doubling a consonant is supposed to show that a vowel is short rather than long; however, this practice is applied very inconsistently. In practice, it is extremely difficult to predict whether a consonant should be doubled in root words of more than one syllable. Some of the following sentences contain errors in spelling—find and correct them.

- 1) The anterior comisure is less than 1/10 the size of the corpus callosum.
- 2) Magnetic ressonance imaging shows excellent contrast among tissues.
- 3) The patient was asymptomatic.
- 4) The tissues are irrigated by the colateral vessels.
- 5) We are committed to reducing the rate of infectious complications.
- 6) Bleeding occurred in three patients in the treatment group.
- 7) Our anual report contains a summary of our research activity.
- 8) The great Brittish surgeon pioneered antiseptic surgery.
- 9) Early appropriate antibiotic administration is esential in subacute apendicitis.
- 10) The cappilaries are the smallest blood vesels.

Exercise 56

Correct the spelling mistakes in the following text. Mixed spelling mistakes.

Cronh's disease is a type of inflammatory bowel disease. It is a cronic condition that causes diarrhea, abdominal pain, vomitting, and sometimes weigth loss. It is caused by interactions between environmental, inmunological, and bacterial factors in people who are genetically susceptible. People with Cronh's disease have cronic reccuring periods of flare-ups and remision. There is no cure for Cronh's disease. Treatment consists of controlling syptoms, maintaining remision, and preventing relapse.

Exercise 57

Identify and eliminate the ambiguity in these sentences.

- 1) Located near the circle of Willis, we saw a bilobed aneurysm.

Continue

- 2) They found a mature teratoma that was in the mediastinum on April 1.
- 3) Situated under the patient's left breast, we could see a bluish-black mole.
- 4) Blocking the splenic flexure, we found a large fecalith.
- 5) Tumors, like carcinoid tumors, start in hormone-producing cells.
- 6) After sending the results, the cultures turned positive.
- 7) Adverse reactions to plasma volume expanders that are extremely uncommon in patients with septic shock probably do not involve IgE antibodies.
- 8) Patients, who take SSRI-type antidepressants, should avoid grapefruit juice.
- 9) However we measured the concentration again and found no signs of error.
- 10) Analyzing the data statistically, terminal repeats were relatively rare.

Simplicity: Avoiding unnecessary complexity

Simplicity is the ultimate sophistication.

Leonardo DaVinci

The problems science tries to solve and the material, methods, and equipment it uses to solve them can be extremely complex, so it comes as no surprise that scientific writers need to use highly complex language to convey their ideas. As science advances along the frontiers of knowledge, new terms must be coined to allow us to deal with new concepts, phenomena, processes, and equipment. Words are often formed by combining pieces of root words from classical languages as prefixes, stems, and suffixes. When we know the roots, the meaning is often readily discernible. Some terms are so long and complicated to say that we nearly always refer to them in abbreviated form, as in deoxyribonucleic acid (DNA), electroencephalography (EEG), temporomandibular joint (TMJ), or tetrachlorodibenzoparadioxin (TCDD or dioxin). Indeed, there is no simpler way to say electrophoresis, fasciotomy, or rhabdomyolysis. Although each of these terms can be explained in relatively simpler terms, it would be absurd to do so every time we wanted to refer to the concept they represent: these terms were coined precisely to enable us to communicate more effectively and more efficiently. This complexity cannot and should not be eliminated from your texts.

However, there is another kind of complexity that hinders rather than helps our efforts to communicate. We often add unnecessary complexity to our texts, stringing together big, “sophisticated” words in long, convoluted sentences when shorter, simpler words arranged in short, straightforward sentences would convey our ideas better. Whether these practices arise from mistaken ideas about what good writing is, from a desire to appear sophisticated or a fear of looking simple, or just from unwillingness to work hard enough to

express our thoughts as clearly as possible, they can make it more difficult for readers to grasp our message (or sometimes even for them to finish our texts).

Throughout the world, students are often rewarded for demonstrating their linguistic prowess through rich vocabulary and grammatical sophistry when learning composition at school. Likewise, programs to teach English as a foreign language are expansive rather than reductive, and many of the same approaches that can enhance your performance in the Cambridge First Certificate and Proficiency examinations can actually compromise the clarity of your scientific writing. Moreover, Spanish is a baroque, flowery language that lends itself to ostentation. In the hands of a talented writer in the appropriate circumstances, this style can be sublime, expressing complex subtleties of transcendent thought. All too often though, style overwhelms content, obfuscating any appreciable message.

People who speak Spanish and other Romance languages as their mother tongue need to be especially careful not weigh down their message with “sophistication” when writing in English. The Latinate English “equivalents” of words that would be the first or even the only choice in Spanish often sound pretentious to native speakers (e.g., utilize). Moreover, a series of long, complicated sentences with several prepositional phrases and subordinate clauses that might be acceptable in Romance languages can be tedious in English. The effects of unnecessary complexity are cumulative: readers may not be distracted when a writer occasionally uses an unnecessarily complex word or construction, but readers can easily be overwhelmed when a writer consistently adds unnecessary complexity to a text.

This section shows you various ways to eliminate unnecessary complexity from your writing. The two main strategies are using simple words and simple constructions (Fig. 4). Your readers will be grateful to you for eliminating the surrounding noise so they can hear your message loud and clear.

Unnecessarily complex words

Word choice has an important impact on the complexity of the text. Using simple words wherever possible can help make your text reader-friendly. Appendix VI lists some words that might be considered unnecessarily complex or pretentious in many contexts.

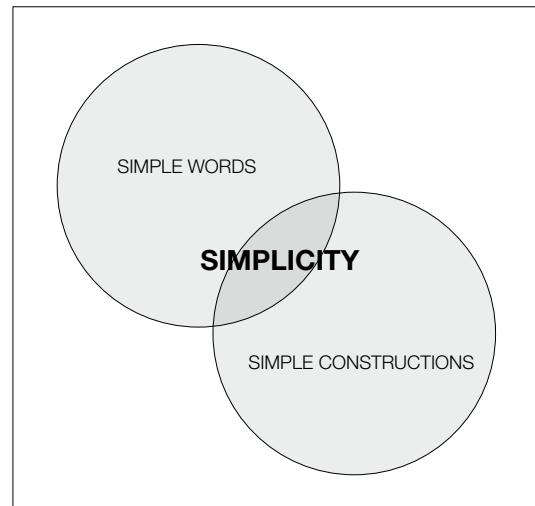


Figure 4. Major aspects related to simplicity.

Exercise 58

Replace the unnecessary complex words and phrases in these sentences with simpler ones.

- 1) Firstly, communities need to take preventative measures.
- 2) We initiated the experiment on Monday morning and finalized it on Thursday evening.
- 3) This manuscript describes a new methodology for genome mining and biosynthesis of polyketides and peptides.
- 4) The majority of experts agree that this problem necessitates the optimization of our methodology.
- 5) Patients with lung cancer frequently have fatal outcome.
- 6) When it is executed befittingly, the technique has efficacious capabilities.
- 7) A catheter was collocated in close proximity to the dilatation.
- 8) Monitorization is indispensable to orientate therapeutic actions.
- 9) The adaptability of the device utilized facilitated the performance of the procedure.
- 10) Familiarization with the most commonly frequently visualized findings will facilitate the implementation of an efficient diagnostic protocol.

Unnecessary nominalization

One way we make writing more complex is to transform a concrete verb into an abstract noun, which requires the use of an “empty”, unspecific verb like *perform*, *carry out*, *be*, or *do*. This practice weakens our writing, diffusing and obscuring

our message. It also lengthens our sentences, wasting valuable words we might need to express other ideas. Appendix VII lists common examples of nominalizations.

Exercise 59

Rearrange these sentences so that the verb carries the message.

- 1) We made the arrangements for the patient to be transferred.

- 2) The pronator teres syndrome should be taken into consideration in patients with pain in the volar surface of the proximal forearm.

- 3) Serine proteases exhibit a tendency to be inhibited in this fashion.

- 4) You must make thorough preparations for the experiment.

- 5) We made a comparison of the two drugs and found no difference in clearance.

- 6) They place a major emphasis on the use of the technique in mechanically ventilated patients.

- 7) We performed the calibration of both thermometers.

- 8) Few authors make reference to aliasing artifacts.

- 9) The authors reach the conclusion that MRI is more cost effective than CT in these patients.

- 10) Immunoglobulin M determinations were performed by nephelometry.

- 11) The measurement of the concentration was made at baseline, 5 minutes after injection, and 2 hours after injection.

- 12) Henri et al. make the assumption that CT is a sufficient imaging method for ruling out pancreatic involvement.

Double negatives

Double-negative expressions add complexity and length to writing, making it harder for readers to grasp your message and wasting words. We sometimes think using a double negative can

add subtle nuances to meaning, but these nuances are nearly always lost on readers. More often we use double negatives to hedge (i.e., to avoid being direct to evade criticism).

Exercise 60

Rewrite these sentences to avoid using a double negative.

- 1) It is not unusual for radiologists to hold two jobs.
- 2) Sex enhances pair bonding through a pathway that involves reward centers in the brain, suggesting the formation of a strong social bond is not unlike an addiction.
- 3) These findings are not without meaningfulness.
- 4) Ignorance is an enduring subject, and it has not gone uninvestigated in sociology.
- 5) We not incorrectly surmised that it might be difficult to enroll enough patients.
- 6) Allergies to iodine are hardly uncommon.
- 7) We were not unencouraged by the results.
- 8) Heather is not unlikely to publish her article in a top quartile journal.
- 9) The authors were not unaware of a possible bias.
- 10) Dr. Sophisticatus' writing is not infrequently incomprehensible.
- 11) The role of MMP levels in inducing instability in carotid plaques is hardly uncontroversial.
- 12) We are not infrequently unable to express ourselves clearly and concisely.
- 13) The reviewers' comments were not entirely uncritical.
- 14) However, the reviewers were hardly impartial.
- 15) To say they would not alter their data to avoid a poor grade in the course is not the least bit unlikely.

The passive voice

In active sentences, the grammatical subject is the agent, the person or thing that acts. Only transitive active sentences (i.e., sentences that have objects) can be transformed into passive sentences.

In passive sentences, the object of the action (the object of the active sentence) is the grammatical subject and the action is expressed by the verb *to be* in the appropriate tense plus the past partici-

ple. The agent can be specified in a “byline” (i.e., a prepositional phrase consisting of by + the agent); however, it is not necessary to specify an agent.

Transitive active sentences have the form: SUBJECT (the agent) + VERB (the action) + DIRECT OBJECT (the person or thing that is acted on):

ACTIVE:

Dr. White intubated the patient.
 SUBJECT + VERB + DIRECT OBJECT
 (the agent) action (the object of the action)

PASSIVE:

The patient was intubated by Dr. White.
 SUBJECT + TO BE + BYLINE
 + PAST PARTICIPLE
 (the object of the action) action (the agent—optional)

Although the direct object of the active sentence is usually the subject of the passive sentence, the indirect object of the active sentence can also become the subject of the passive sentence:

ACTIVE:

The Spanish Society gave Sarah an award.
 SUBJECT + VERB + INDIRECT OBJECT + DIRECT OBJECT
 (the agent) action (the recipient of the object) (the object of the action)

PASSIVE:

Sarah was given an award by the Spanish Society.
 SUBJECT + TO BE + OBJECT + BYLINE
 + PAST PARTICIPLE
 (the recipient of the object) action (the object of the action) (the agent—optional)

In a few cases, the preposition complement can also become the subject of the passive sentence:

ACTIVE:

Dr. Black operated on my 15-year-old son yesterday.
 SUBJECT + VERB + PREPOSITION + OBJECT
 (the agent) action (the object of the action)

PASSIVE:

My 15-year-old son was operated on by Dr. Black yesterday.
 SUBJECT + TO BE + OBJECT + BYLINE
 + PAST PARTICIPLE
 (the object of the action) action (the agent—optional)

The passive voice is often used in scientific writing, although not as much as it used to be. Thirty or forty years ago, science was written almost exclusively in the passive voice. It was thought that removing the subject (the scientist) somehow made the writing more objective. Today, most journals consider the active voice not only

appropriate but even preferable in most cases. The instructions to authors advise using the active whenever natural, even if it means using the pronouns “we” or “I”. The active voice is more direct; the passive voice takes longer for our brains to process. I recommend using the active voice whenever it seems natural.

The passive voice is best reserved for cases in which:

a) The agent is unknown or unimportant. In these cases, we never include the agent in a byline (*by somebody, by them, by people in general*, etc. or when the agent is obvious).

Her left foot was amputated. We don't care who amputated her foot.

Incorrect usage:

Her left foot was amputated by somebody.
(The byline adds no useful information.)

Her left foot was amputated by a surgeon.

(The agent is obvious, so the byline adds no useful information.)

Correct usage:

Her left foot was amputated by a sadistic psychopath. (The agent is NOT obvious, so the byline adds useful information.)

Her left foot was amputated by Dr. Kiraly. (The byline adds useful information; the passive voice shifts the emphasis.)

b) We want to emphasize the recipient of the action or the action itself rather than the agent.

Dr. Hill was appointed to the expert advisory board.

c) We do not want to name the agent (often to evade responsibility).

The patient's records were lost or misplaced. A terrible mistake was made.

d) The noun phrase that specifies the agent contains many modifiers that would require an excessive delay before reaching the verb.

The operation was performed by Foreman and Tierney, two highly specialized surgeons from University Hospital in London.

Finally, the passive voice can make it difficult to keep modifiers close to what they modify. For example:

Three endoscopes were reported stolen by the chief of the digestive disease department. (Did the chief steal them or report them?)

The chief of the digestive disease department reported three endoscopes stolen.

A final word of advice: do not be afraid to use the passive voice judiciously. The passive voice can be useful to help you make transitions and present known information before unknown information (see Familiar-before-new principle, p. 87).

Exercise 61

Change these sentences to the active voice where desirable.

- 1) Casein peptones are made from an insoluble precipitate from acidified milk.
- 2) None of the new approaches was found to be more effective than the standard.
- 3) According to Matthay et al., this restricted, relatively nonrecruitable pulmonary vascular bed with inordinate high pulmonary arterial pressure is considered to be the most likely mechanism of abnormal right ventricular response to exercise.
- 4) Foreman's conclusions are not supported by his findings.
- 5) When respiratory failure seemed likely, the patient was transferred to the ICU.

- 6) Our results are compared with those of previous studies in Table 2.

- 7) Treatment with topical antifungal preparations is usually sufficient.

- 8) Similar experiments were done by Oakes and colleagues.

- 9) The patient's body temperature was monitored by a nurse for two days.

- 10) Appendicitis was confirmed at laparoscopy.

Long sentences

Sometimes we try to cram too many ideas into a sentence, and this results in long, complex sentences that can be difficult for readers to follow.

Keeping sentences short also helps avoid making grammatical or stylistic mistakes.

Exercise 62

Break up these long, complex sentences to make a more intelligible text.

- 1) Certain kinds of mammalian cell lines that express very few endogenous ion channels have been exploited for the heterogeneous expression of ion channels by mixing cells in a tissue culture dish with the cDNA that encodes the ion channel under conditions that permit many of the cells to take up the cDNA, thereby avoiding the need for transcribing messenger RNA, which is fragile and difficult to manipulate *in vitro*.
- 2) Anemia due to an abnormal increase in the rate of destruction of circulating red blood cells, called hemolytic anemia, can result from the presence of antibodies against the red blood cells, as occurs in hemolytic disease of the newborn, or to autoantibodies or from overactivity of mononuclear phagocytes in association with hypersplenism or from metabolic abnormalities in the red blood cells such as glucose-6-phosphatase deficiency, which is aggravated by some drugs.
- 3) Because hormones that are catecholamines, such as epinephrine and norepinephrine, glycoproteins, and polypeptides are unable to pass through the lipid barrier of the target cell membrane, although some of them can enter the cell through pinocytosis, most of their effects result from their binding to receptor proteins on the outer surface of the target cell membrane.
- 4) Pneumothorax is lung collapse that occurs when air enters the pleural cavity through any breach in the chest wall or in the lung membrane whether resulting from trauma (traumatic pneumothorax), from unknown causes in an apparently healthy individual (spontaneous pneumothorax), or, in the past, from deliberate injection to treat tuberculosis (artificial pneumothorax).
- 5) The common fibular nerve, the smaller of the two terminal branches of the sciatic nerve, arises in the lower third of the thigh and runs downward through the popliteal fossa, closely following the medial border of the biceps muscle and superficially crossing the lateral head of the gastrocnemius muscle as it leaves the fossa to pass behind the head of the fibula and winding laterally around the neck of the bone and pierce the peroneus longus muscle, where it divides into two terminal branches.

Stacked modifiers

English words can be easily combined to make concise units of meanings, helping to keep texts within word limits. However, stringing together

too many modifiers can make it difficult for readers to know what you want to say.

Exercise 63

Expand these noun strings to make their meaning clearer.

- 1) transrectal ultrasound-guided prostate biopsy false-negative prevention protocol
- 2) interventional procedures review evaluation task force
- 3) X-ray beam adjustment calibration manual
- 4) hospital information system access protocol
- 5) a fortified fat-free protein-enriched vitamin C-supplemented pellet-based diet

Exercise 64

Eliminate the unnecessary complexity from these sentences.

- 1) The catalysts utilized are listed in Table 2.
- 2) The analysis that we performed after conducting our investigation offers confirmation that blood glucose levels show a peak within an hour after the administration of the drug.
- 3) The comparison that was made by Jones et al.³ showed that the control rats were not infrequently restless if you take into consideration that their cage was less crowded.
- 4) We were cognizant that we had to take additional measures to assess our methodology.
- 5) This preventative measure was not shown to be ineffective.
- 6) Although he had imbibed a considerable amount of alcohol, when he undertook to ambulate, he proved to have the capability of maintaining his equilibrium.
- 7) The separation of the conjoined twins was done by a surgical team.
- 8) Preparations were made to have the patient transferred to another hospital where more complex assessments could be done.
- 9) From the inception, their methodology of dilatating the stenosis was insufficient to bring about the recanalization of the vessel.

10) Not only had we failed to perform the determinations, but we also proved to be incapable of carrying out the calibration of the device.

Concision: Making every word count

The most valuable of all talents is that of never using two words when one will do.

Thomas Jefferson

There are many reasons why you should strive to make your writing concise. The most imperative reason is that the authorities require it. Grant applications, congress abstract submissions, and scientific journals all have strict word limits: failure to meet these limits is the first criterion for rejection. The most compelling reason for being concise, however, is that being concise helps us to communicate more efficiently. When we eliminate clutter and noise, we make it easier for our readers to see our arguments and hear our message. Remember that the burden of communication is on the writer's shoulders—we cannot expect our readers to sift through our texts to try to find something worth keeping. Our readers are busy people with projects and lives of their own, and concise writing shows respect for them.

A well-written manuscript should have no unnecessary paragraphs. A well-written paragraph should have no unnecessary sentences. And a well-written sentence should have no unnecessary words. The key word here is unnecessary—when we eliminate unnecessary paragraphs, sentences, and words, we eliminate distractions so readers can focus on what is essential.

Concision is closely related to simplicity, and the two aspects overlap. Many of the practices discussed in the section on simplicity (e.g., avoiding nominalization and the passive voice) will help keep your writing concise. In this section, we will focus on avoiding redundancy (unnecessary repetition), on eliminating empty words and phrases, and on replacing wordy expressions with shorter ones that convey the same meaning.

Avoiding redundancy

There is nothing wrong with repetition. Indeed, it is best to repeat key words and terms throughout your manuscript (see the next section, *Fluidity: Keeping the thread*), and it is a good idea to repeat key parts of your message to make sure that everybody grasps it. Unnecessary repetition, however, clutters your text, diluting your message. Redundancy often affects a single word, but it can also involve a phrase, a sentence, or even a whole paragraph. Redundancies make your writing inefficient, adding useless words to your word count and subtracting from the number of useful words you can use to communicate your ideas. Appendix VIII lists some common expressions that contain a redundant element.

Exercise 65

Eliminate the unnecessary repetitions in these sentences.

- 1) The myth that cell phones cause considerable electromagnetic interference in hospital environments still persists.

- 2) They completely eliminated salt from their diet.

Continue

- 3) We implanted a titanium metallic hip prosthesis.
- 4) The only other alternative choice that is available would be to fuse the three vertebrae together.
- 5) Stevens and colleagues introduced a new technique to extract the enzyme.
- 6) A study is currently underway to determine whether the drug is safe.
- 7) Sphenoid meningiomas can cause visual problems, loss of sensation in the face, or facial numbness.
- 8) Aspirin is absolutely essential in the management of myocardial infarction.
- 9) We detected a malignant carcinoma in his right kidney.
- 10) They used genetic engineering to create a genetically modified transgenic organism that incorporated genetic material from another species.

Eliminating empty words and phrases

Some words and phrases are practically devoid of meaning. Instead of helping your flow of ideas move forward, these words and phrases distract readers from your message and increase word

counts. Revise carefully to detect them and eliminate them from your writing. Appendix IX lists empty phrases that often clutter formal writing.

Exercise 66

Eliminate the empty words and phrases from these sentences.

- 1) She published her doctoral thesis in the year 2011.
- 2) Apart from the presence of local tenderness in the left abdomen, there were no remarkable findings.
- 3) Complications are not uncommon.
- 4) There were serous fluid inside of the pleural space.

- 5) Arthroscopy was performed and the existence of a paralabral cyst was confirmed.
- 6) The abdominal CT showed two large, 6 cm lesions that were round in shape.
- 7) All of the procedures were done under local anesthesia.
- 8) It has long been known that oxidative metabolism occurs in both the cytoplasm and mitochondria inside of the cells.
- 9) We estimated that about one out of ten patients would refuse to participate.
- 10) Comorbidities were greater in number among older patients.

Replacing wordy expressions

Many wordy phrases can be replaced by shorter ones or even by a single word that has the same meaning (see Appendix X). English language education often encourages the use of these expres-

sions and constructions to show proficiency and increase fluency. In scientific writing, though, it is best to be simple and direct. Moreover, shorter alternatives help you to meet word counts.

Exercise 67

Replace the wordy expressions in these sentences with shorter alternatives.

- 1) About three-quarters of patients on sustained low-efficiency dialysis received treatments on a daily basis.
- 2) For the purpose of increasing vasculogenesis, chemokine injection at the site of injury could attract bone-marrow-derived cells.
- 3) Abstract submissions must be received no later than October 12.
- 4) A great number of the experimental animals failed to survive.
- 5) This result would seem to suggest that the left angular gyrus might possibly mediate a spatial representation of number.

Continue

- 6) We determined the hepatitis C virus genotypes in order to define the genotypic profile and examine the relationship between genotype and the prevalence as well as severity of liver disease.
- 7) The presence of this allele has been associated with protective effects against many disease conditions, including but not limited to development of asthma, juvenile arthritis, multiple sclerosis, and liver damage from hepatitis C infection.
- 8) The patient continued to exhibit hypotension in spite of the fact that we administered vasoactive drugs.
- 9) They identified a new murine lectin-like gene in close proximity to CD94.
- 10) Due to the fact that patients in the placebo group were older and sicker than those in the treatment group, the difference in mortality, although significant, may not be meaningful.
- 11) The rate of infections was higher in comparison to the group receiving macrolides.
- 12) There are many germs that can cause pneumonia.
- 13) It is interesting to note that this is not true in the vast majority of cases in the laboratory environment.
- 14) In light of the fact that all of the patients who died had lesions in close proximity to the great vessels, in all probability it is unlikely that...
- 15) We have insufficient knowledge to settle the question as to whether or not this increase in nicotinic receptor levels is accompanied by changes in receptor function.

Exercise 68

Make these sentences more concise.

- 1) There are many conditions that can affect the nervous system.
- 2) It has been well established that cocaine is harmful to your health.
- 3) The study took place in the month of January of the year 2013.

- 4) His gallbladder was full of stones that were brown in color.
- 5) Prof. Thomas, MD, PhD, and colleagues discovered a new, previously unknown species of *Giardia*.
- 6) The belief still persists that all cases of cholecystitis require surgery.
- 7) The end result was two different cells that were exactly identical.
- 8) All traces of the thrombus were completely eliminated from the internal carotid artery after 2 h.
- 9) Lesions that were smaller in size were followed periodically.
- 10) The alternative choice was to deliver the particles with a syringe.

Fluidity: Keeping the thread

Good stories flow... A bad story? One that cannot be absorbed on the first time of reading.

Arthur Christiansen

We must never forget that our ultimate goal is to communicate and that the burden of communication is on the writer. Good writers work hard not only to make sure that their message is clear, but also to make it as easy as possible for readers to follow the thread of their arguments. Well-written texts can be understood on the first reading. Readers should not have to reread any part of a text to be able to understand it, nor should they have to keep referring back to earlier passages to make sense of what they are reading. This section focuses on how to facilitate the reader's task by presenting information and ideas in a logical way (known information before new information and parallel constructions), making smooth transitions, and eliminating obstacles to flow (abuse of abbreviations, inconsistencies in spelling and terminology).

Cohesion and coherence

Cohesion refers to the way the underlying ideas in a text are connected through linking surface elements. In all texts, the interpretation of some words or phrases depends on what comes before them or after them, and good writers make sure this interpretation is clear and obvious. We need to make sure that our ideas are connected so that our readers can follow them. We connect ideas by referring back to preceding text and by using words and phrases (linking devices) that show how the information being presented relates to what was presented before or to what is about to be presented. These linking devices help show the connections between ideas (see Appendix XI). However, these devices are often overused and misused, and linking badly is just as bad as not linking at all.

Other ways to ensure cohesion through a text include repeating key words and using them with determiners (e.g., *this, that, these, those, etc.*), possessive adjectives or pronouns (e.g., *his, her, hers, etc.*), or relative pronouns (e.g., *which, whose, etc.*). Do not be afraid to use identical words in both parts that you want to connect. You can also use synonyms, hyponyms, or hypernyms (e.g., *microbe* is a synonym of *microorganism*, *bacteria* is a hyponym of *microorganism*, and *microorganism* is the hypernym of *bacteria*), but be very careful (see *Consistent terminology* below). Another very useful device is to use a grammatical variant of the same word (e.g., ...the cell becomes hyperpolarized. This hyperpolarization...). Finally, cohesive nouns provide a kind of lexical reference by summarizing many words in one (e.g., *problem, issue, etc.*) and can be used to refer back to previous text (e.g., The artifacts discussed above...) or to indicate what is to come (e.g., The protocol delineated below...).

The sentences in the following paragraph link strongly to those that come before and after them; however, something else is wrong.

*A Cesarean section is an operation to deliver a baby through an incision in the abdomen. An incision in the abdomen is called a laparotomy. The word laparotomy comes from combining the Greek roots *laparo-*, which means *flank*, and *-tomy*, which means *incision*. Many medical words come from Greek. Many medical words also come from Latin. Latin gave rise to the Romance languages. Spanish is a Romance language spoken in Spain and the Americas. Other languages are also spoken in the Americas.*

What point does this paragraph make? It is impossible to say. Even though it has cohesion,

we cannot know what it is about, because it lacks coherence.

Each paragraph should focus on a specific topic. Each sentence in the paragraph should relate to that specific topic. Likewise, every text should have unifying theme, and each paragraph should be related to that unifying theme.

Just as the connections within paragraphs should help to show how the information added relates to the main point expounded in that particular paragraph, connections between paragraphs should show how the separate ideas that each expresses are related and how they work together to support the main message that unifies your entire text.

In general, the ideas in a new paragraph should fit into in the flow of thought from the preceding one, and the new paragraph should start

off where the preceding one finished. In cases where this is impossible or extremely difficult to achieve, you should consider moving the paragraph to another position or eliminating it altogether. Transitions between paragraphs should show the connections between them, so it helps to refer to relevant material from the previous paragraph. Ideally, rather than using a transition that could serve to connect any two paragraphs, you should aim to make specific transitions to connect two specific paragraphs. One way to do this is to use key phrases from the previous paragraph. It is often possible to make these connections with only a few words.

Smooth transitions help your text to flow, making it easier for readers to follow the thread of your argument and to grasp your manuscript as a unified whole.

Exercise 69

Analyze the way these texts are linked.

Look at how these sentences are connected. Note how the underlined text strengthens cohesion.

The pancreas makes insulin and other hormones. These hormones enter the bloodstream and travel throughout the body. They help the body use or store energy from food. For example, insulin helps control blood sugar levels. The pancreas also makes pancreatic juices. These juices contain enzymes that help digest food. The pancreas releases the juices into a system of ducts leading to the common bile duct. The common bile duct empties into the duodenum, the first section of the same intestine.

A. Look at how these sentences are connected. Underline the features that help make the text cohesive.

- 1) The prevalence of type 1 diabetes in the UK is one of Europe's highest. In 2008, the estimated rate was 1.9 per 100,000 children under 18 years of age. Furthermore, strong evidence suggests this prevalence is increasing.
- 2) The UK has the one of the highest prevalences of type 1 diabetes in Europe (1.9/100,000 children < 18 years of age). This rate is at least ten times higher than that of some other European countries. The reason for this large difference is unknown.
- 3) One of Europe's highest prevalences of type 1 diabetes occurs in the UK. Researchers at UK universities and NHS hospitals are at the forefront of research into this disease.
- 4) The UK has one of Europe's highest prevalences of type 1 diabetes. This disabling disease costs the country huge amounts of money.

B. Now choose the best sentence to continue each of the texts. What clues helped you decide?

- a) Not only have they published the four largest series of type 1 diabetes patients to date, they have also made some of the most striking discoveries.
- b) The specific roles of genetics and environmental factors remain to be elucidated.
- c) Not only does the state pay for expensive treatment through the National Health Service, but the government also pays for care for children with diabetes through its Disability Living Allowance programme.
- d) If the trend toward higher prevalence continues, the rate will have nearly doubled by 2020.

Exercise 70

Underline examples of how the authors use transitions to make the text cohesive.

Single-center studies have reported benefits for combination therapy in pneumococcal bacteraemia [8], Gram-negative bacteraemia [9], infective endocarditis [10], and community-acquired pneumonia [3-7, 11, 12, 13]. Two multicenter studies compared combination therapy with monotherapy in patients with community-acquired pneumonia; both found improved outcome in patients receiving combination therapy. In the first, a randomized clinical trial comparing beta-lactam monotherapy versus betam-lactam plus a fluoroquinolone in 14 hospitals in France, Janice et al. [14] reported shorter hospital and ICU stay and a trend toward improved survival. In the second, a case-control study of 654 patients in 22 hospitals in Spain, López et al. [15] reported that patients receiving combination therapy with a beta-lactam plus a macrolide had shorter hospital and ICU stay, fewer readmissions, and lower in-hospital, 30-day, and 90-day mortality rates than those receiving a beta-lactam alone. Interestingly, in both studies this protective effect was more pronounced in the more severe patients. Although to date no studies comparing fluoroquinolone-based combination therapy with macrolide-based combination therapy have been published, Charles et al. [16] reported a multiple treatment comparison meta-analysis indirectly comparing the two combinations. These authors showed including a macrolide in combination therapy improved survival compared to combination therapy with fluoroquinolones. Thus, combination therapy including macrolides seems recommended in patients with community-acquired pneumonia caused by bacteria.

The rationale for combining antibiotics in patients with community-acquired pneumonia is based on their different mechanisms of action, resulting in synergistic killing and a broader antimicrobial spectrum; however, macrolides are linked to an anti-inflammatory effects more than anti-infective properties [3,4,5].

Familiar-before-new principle

Place familiar information before new information. “Familiar information” refers to information that readers would be expected to know either because you have presented it relatively recently in the same text or because it is information that your target audience would be expected to have before coming to your text. The familiar information provides a framework that helps readers see

how each piece of new information fits into what they already know.

This approach also helps us to create cohesion because it allows us to refer back to preceding information to connect ideas. If we reverse this order, placing new information before familiar information, we can make it difficult for readers to see what our text is really about.

Exercise 71

Analyze the order in which information is presented in these texts.

1) Compare these two versions of a text about the importance of calcium in the nervous system. The sentences are numbered to help you compare the way the information is presented in each. Which one is easier to follow? Why?

Text A

[1] Calcium channels are particularly interesting because this mineral does much more than simply carry a charge across the membrane.

Text B

[1] Calcium channels in neuronal cell membranes are particularly interesting because calcium does much more than simply carry

Continue

[2] Calcium's role as an intracellular messenger might be even more important than the calcium ions' essential contributions to neuronal electrical activity. [3] Calcium ions that enter the cell regulate several intracellular enzymes after they bind with proteins. [4] Moreover, the gaing of several types of ion channel is regulated by intracellular calcium ions, which are even involved in the deactivation of some of their own channels. [5] Finally, intracellular calcium has a tremendous effect on signaling between neurons because it directly controls the release of chemical neurotransmitters at synapses. [6] Thus, calcium plays a key role in the functioning of the nervous system.

a charge across the membrane. [2] Although calcium ions' contributions are essential to neuronal electrical activity, calcium's role as an intracellular messenger might be even more important. [3] Calcium ions that enter the cell bind with proteins and then regulate several intracellular enzymes. [4] Intracellular calcium ions also regulate the gaing of several types of ion channel and are even involved in deactivating some of their own channels. [5] Moreover, intracellular calcium directly controls the release of chemical neurotransmitters at synapses, so it has a tremendous effect on signaling between neurons. [6] Thus, calcium plays a key role in the functioning of the nervous system.

2) Both the following texts about the development of visual acuity present the same information; however, the order the information is presented in is different. Which do you prefer? Why?

Text A

Visual acuity improves markedly throughout the first six months of life, then more gradually until the child is nearly five years old. At birth, a baby's ability to detect detail (i.e., acuity) is about 20/600, which is thirty times poorer than normal adult acuity (20/20) acuity. This rapid improvement in acuity is due to changes in both the eye and the cerebral cortex.

Text B

Visual acuity is the ability to detect detail. At birth, a baby's acuity (20/600) is about thirty times worse than normal adult acuity (20/20) acuity. But developmental changes in both the eye and the cerebral cortex result in rapid improvement of acuity. During the first six months of life, acuity improves markedly. After that, acuity continues to improve, although more gradually, until the child is nearly five years old.

Exercise 72

Rewrite this paragraph to improve the flow of information.

Malignant tumors of the testicle usually present as a painless lump. About 1 in 250 men develop testicular cancer sometime in their lives, so it is rare. The cause of testicular cancer is unknown. However, a testicle that was not descended during fetal development (cryptorchidism) has an increased risk of developing cancer, and even if it is brought down into the scrotum by surgery early in life, this risk persists. On the other hand, if it has been descended, it is easier to find the lump than if the testicle was left inside the abdomen. It has a high cure rate. Surgery, radiation therapy, or chemotherapy can be used to treat testicular cancer. Most patients survive, even those with metastases to the abdomen.

Parallel constructions

Our minds form expectations as we read. If a page ends "...red, blue, orange, and...", we would be surprised to see "intelligent" or "matrix" at the top of the next page; indeed, anything other than a color will fail to meet our expectations and disrupt the flow of information. Writers need to present information in a structured way that meets readers' expectations. By using similar patterns for presenting words, phrases,

sentences, and even paragraphs that serve similar purposes, we make it easier for readers to process the information. These parallel constructions create symmetry and make your writing more forceful. Failure to use parallel constructions can create confusion and slow readers down.

Look at these examples of parallel and non-parallel constructions in different contexts:

Context	Nonparallel	Parallel
<i>Lists, tables, etc.</i>		
Present information in the same form (i.e., all gerunds, all infinitives, all imperatives, etc.)	a) <i>smoking</i> b) <i>drinking alcohol</i> c) <i>drug abuse</i> d) <i>not exercising</i>	a) <i>smoking</i> b) <i>drinking alcohol</i> c) <i>abusing drugs</i> d) <i>not exercising</i>
<i>Series of elements within a sentence</i>		
Present elements in the same form (i.e., all nouns, all adjectives, all past participles, all gerunds, all infinitives, all relative clauses, etc.)	<i>The specimens were processed as follows: fixation in formaldehyde, then dehydrated, cleared, infiltrated in paraffin, and embedded in paraffin blocks.</i>	<i>The specimens were processed as follows: they were fixed in formaldehyde, dehydrated, cleared, infiltrated in paraffin, and embedded in paraffin blocks.</i>
Place articles either before all elements in the series or only before the first element.	<i>Familial Mediterranean fever mainly affects the Arabs, Armenians, the Jews, Turks, and Cypriots.</i>	<i>Familial Mediterranean fever mainly affects the Arabs, the Armenians, the Jews, the Turks, and the Cypriots.</i> <i>Familial Mediterranean fever mainly affects the Arabs, Armenians, Jews, Turks, and Cypriots.</i>
When the same preposition is appropriate for all the elements, place it either before all items in the series or only before the first element.	<i>This relation has been demonstrated in rats, cats, dogs, and in monkeys.</i>	<i>This relation has been demonstrated in rats, in cats, in dogs, and in monkeys.</i> <i>This relation has been demonstrated in rats, cats, dogs, and monkeys.</i>

Continue

Context	Nonparallel	Parallel
When different dependent prepositions are required, do not omit one. These constructions can seem awkward, so it is often a good idea to seek another solution.	<i>Participating patients must consent and comply with the diet explained above.</i>	<i>Participating patients must consent to and comply with the diet explained above.</i> <i>Participating patients must consent and adhere to the diet explained above.</i>
When more than one verb is used in a sentence, make sure that their objects make sense.	<i>We describe and illustrate the normal findings in the first session, the pathologic findings in the second, and the results of our study in the third.</i>	<i>We describe the normal findings in the first session and the pathologic findings in the second. In the third session, we discuss the results of our study.</i>
Use the same form for elements on both sides of correlative expressions (and; or; both...and; neither...nor; not only...but also; first, second, third...; etc.).	<i>Our institutional review board approved this prospective study, and informed consent was obtained from all patients.</i>	<i>Our institutional review board approved this prospective study, and all patients provided informed consent.</i>
Shift the connector to avoid unnecessary repetition.	<i>This mechanism has been demonstrated both in animal experiments and clinical trials.</i>	<i>This mechanism has been demonstrated both in animal experiments and in clinical trials.</i> <i>This mechanism has been demonstrated in both animal experiments and clinical trials.</i>
Use other similarities apart from form to reinforce connections.	<i>When the amount of neurotransmitter rises, the number of receptors decreases.</i> This sentence is parallel in form; nevertheless, there is a slight semantic imbalance. The sentences in the column to the right are parallel in form and semantically balanced.	<i>When the amount of neurotransmitter rises, the number of receptors falls.</i> <i>When the amount of neurotransmitter goes up, the number of receptors goes down.</i> <i>When the amount of neurotransmitter increases, the number of receptors decreases.</i>

Note: be careful when using of *respectively*. Even when used in parallel constructions, this word interrupts the flow of information by forcing readers to refer back to previous statements before moving on.

Exercise 73

Rewrite these sentences so that the elements are parallel.

- 1) It was both a brilliant article and very concise.
- 2) Ultrasonography is noninvasive, inexpensive, and in nearly all hospitals.
- 3) She wants to learn how to read mammograms, do sonography, and how to perform biopsies.
- 4) First, ensure the patient is conscious; secondly, she must be able to understand you.
- 5) The laboratory findings are listed in Table 2 and the relation between them in Figure 1.
- 6) Not only was the experiment well designed, but also perfectly executed.
- 7) The patient agreed to undergo hemodialysis not a clinical trial.
- 8) Being concise is nearly as important as it is to be clear.
- 9) The device saves time, decreases costs, and patients will be safer.
- 10) The sensitivity in our study was superior and more variable than the other studies.
- 11) In hemochromatosis, iron accumulates in the pancreas, the liver, and heart.
- 12) We told patients that they should drink plenty of water, avoid alcohol, and to sleep eight hours a night.
- 13) The major cause of direct lung injury is pneumonia, and sepsis is the major cause of indirect lung injury.
- 14) Exercising is as important as it is to diet.
- 15) The lab manager has promised to implement better safety measures, and the technicians have agreed to additional training.

Consistent terminology

Sometimes more than one word or phrase is valid to represent a concept; more often, closely related terms refer to closely related but distinct concepts. When more than one term exists for a concept, you need to choose one and use it consistently in all parts of the manuscript (title, abstract, body, tables, figures, etc.). When terms represent closely related concepts, be careful not to use them loosely as if they were synonyms;

if necessary, define them for your readers. Being careful and consistent with terminology can help avoid confusion (some readers might not be familiar with the synonyms) and can help readers process your information more efficiently.

In the artificial exercise below, the misuse of synonyms is easy to appreciate; however, in longer texts, these mistakes might be difficult to spot.

Exercise 74

Correct the inconsistencies in terminology in the following texts.

- 1) Erythrocytes are the most common type of blood cell. Red blood cells (RBCs) deliver oxygen to the body tissues through the circulatory system. These red corpuscles take up oxygen in the lungs and deliver it while squeezing through the capillaries. Unlike other cells, mature red cells have no nucleus.
- 2) The lateral sulcus runs between the frontal lobe and the temporal and parietal lobes. It is one of the most prominent structures in the human brain. The lateral fissure is found in both hemispheres, but it is longer in the left hemisphere in most people. Also called the Sylvian fissure, because its discovery was attributed to the Greek physician Sylvius, the lateral sulcus is one of the earliest developing sulci in the human brain.
- 3) Adrenaline is a naturally occurring hormone produced in the suprarenal glands. The adrenal medulla secretes adrenaline in times of stress. Epinephrine increases the speed and force of the heart beat and thus cardiac output. Adrenalin has been produced synthetically since 1900. The drug epinephrine is sometimes given by injection as an emergency treatment for cardiac arrest.
- 4) Ultrasound scanning is a diagnostic technique in which very high frequency sound waves are passed into the body and the reflected echoes are used to construct a picture of what is inside the body. Unlike some other imaging techniques, ultrasonography uses no ionizing radiation, and it is considered totally noninvasive. For this reason, sonography is the most common imaging technique during pregnancy.
- 5) The hypophysis is a protrusion at the bottom of the hypothalamus. Functionally, it is connected to the hypothalamus by the pituitary stalk. The pituitary gland secretes nine hormones that regulate homeostasis. Diseases of the hypophysis can thus affect the organism in many different ways.

UK vs US English

Oscar Wilde said “The Americans are identical to the British in all respects except, of course, language”. W.B. Yeats said the United Kingdom and the United States “... are two countries separated by a common language”. Although the informal spoken English of the UK and US can sometimes seem like different languages, there are few differences between the two varieties in the formal written language used for scientific writing.

However, it is usually a good idea to use British English for British journals (some admonish prospective authors in the *instructions to authors* not to use American English) and American English for American journals. Nowadays, reviewers are likely to come from all over the world, and the most important thing is not to mix the two varieties. Appendix XII lists the differences that are most likely to affect scientific writing.

Exercise 75

Decide whether these sentences are written in US or UK English. How can you tell?

- 1) Chronic dialysis catheters have a cuff that is tunneled about 3 cm to 8 cm beneath the skin.
- 2) At least two gene pairs are thought to control human hair color.
- 3) The staff of the Paediatrics Department are holding a talent show to raise funds for playroom.
- 4) We utilised a novel manoeuvre to retrieve the stent graft.
- 5) Dr. Jordan has invented a new breathalyzer to detect certain volatile organic compounds.
- 6) The hematologist diagnosed leukemia.
- 7) Haemolytic anaemia is caused by the abnormal breakdown of red blood cells.
- 8) The urologist, Mr. Chandragupta, and the anaesthetist, Dr. Gray, never speak to one another outside the operating theatre.
- 9) The outpatient clinic is open from 9 a.m. to 5 p.m. Monday through Friday except on holidays. Only emergency patients are attended on weekends.
- 10) After gray-scale ultrasonography, we always do color Doppler imaging because the behavior of the tumor at color Doppler is often indicative of its benign or malignant nature.
- 11) At our centre, we use large calibre needles for core biopsy.
- 12) We used fluoroscopy to visualise the oesophageal course during catheter ablation of atrial fibrillation.
- 13) This paper reports a pilot study using a remote EEG headband that provides a real-time EEG read-out unencumbered by conventional artifacts.
- 14) Studies on the viability of limited bowel catharsis using faecal-labelling techniques have been encouraging.
- 15) We aimed to determine the etiology of diarrhea in travelers to Nepal.

Exercise 76

Correct the mistakes in the use of UK or US English in the following sentences.

- 1) American English: To minimise artefacts due to variations in staining, all samples were processed in parallel.
- 2) British English: The cecum had edema of unknown etiology.
- 3) American English: We report a multicentre study of paediatric anaemia.
- 4) British English: We reviewed the relation between estrogen-binding receptors and the metastatic behavior of breast tumours.
- 5) American English: We use statistical modelling and analysis to characterise genes that influence susceptibility to disease.
- 6) British English: Her doctoral thesis was about leukopoiesis in hematopoietic organs in the fetus.

Continue

- 7) American English: The paediatricians in the group criticised the organisation for the lack of material about childhood diseases in the programme.
- 8) British English: Septicemia can cause hemolytic uremic syndrome, resulting in acute renal failure and sometimes severe hemorrhage.
- 9) American English: She was sceptical about travelling to be treated by a more skilful surgical team.
- 10) British English: Low enrollment led to the cancelation of the trial.

Abbreviations

Abbreviations can help keep your text within the word limits. However, abbreviations can also make your text more difficult to follow. Unless the meaning of the abbreviation is readily apparent to readers, the abbreviation will break the flow of information, requiring readers either to ponder its meaning or to search the text for its definition or even to skip over the term. For this reason, you must be very careful about how you use abbreviations.

In an ideal world, you could always limit your use of abbreviations to those that are better known than the terms they represent (e.g., DNA, RNA, AIDS, etc.). However, be aware that many standard abbreviations have various meanings across fields and even within the same field. For example, PCR can stand for principal components analysis, polymerase chain reaction, protein-creatinine ratio, or prophylactic cranial radiotherapy. In practice, however, it is often convenient to abbreviate.

These common-sense guidelines can help you to use abbreviations well:

- Always check to make sure that there is no standard abbreviation for a term before inventing one yourself.
- Never forget that standard abbreviations can vary across languages.
- If you do invent an abbreviation yourself, make sure it is not offensive for anybody in any way.

- Do not abbreviate single words, unless you have a compelling reason to do so. For example, if you are comparing the imaging techniques computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography (US), it can be convenient to abbreviate ultrasonography because it is a long word, because it will make your text be parallel in structure, and because US is a standard abbreviation for this technique. The same arguments might also be used for abbreviating tuberculosis as TB.
- Do not abbreviate terms that are used only a very few times. The definition of very few is proportional to the length of the text and to the distance between the definition of the abbreviation and the sentences where it is used. Most journals require you to define all abbreviated terms on first use, but this practice is not very helpful in a long article in which the abbreviation is defined in the introduction and not used again until deep into the discussion. Some journals also require you to provide a list of all abbreviations used anywhere in the text; such a list can be useful, provided readers bother to print it out and keep it handy when reading your article.
- Always be consistent—use the same abbreviations in all parts of the document, including the tables and figures.

- When defining an acronym, do not capitalize words that would otherwise be written in lower case letters: write gamete intrafallopian transfer (GIFT), not Gamete IntraFallopian Transfer (GIFT).
- Be careful not to repeat words that make up part of the abbreviation. For example, do not write MRI imaging, because the I stands for imaging. Do not refer to the Health and Education Research Trial as the HEART trial, because trial is included in the acronym.
- Remember that whether to use the indefinite article *a* or *an* depends on the pronunciation, so in abbreviations that are read letter-by-letter the pronunciation of the name of the letter dictates which to use. We write *a Master of science* but *an MSc*, *a magnetic resonance scanner* but *an MR scanner*.
- Avoid starting a sentence with an abbreviation that begins with a lowercase letter. For example, instead of beginning a sentence “hCG, like other gonadotropins, can be extracted from the urine of pregnant women...”, write “Like other gonadotropins, hGC can be extracted from the urine of pregnant women”.

Exercise 77

Correct the use of abbreviations in the following texts.

- We measured the peak systolic velocity (PSV) in the external carotid artery (ECA) and in the internal carotid artery (ICA). PSV was normal in the ECA artery but elevated in the ICA artery.
- Intratubal transfer (TIT) of gametes and TIT of zygotes are common assisted reproductive technology (ART) techniques.
- All patients who survived (PWS) had severe cognitive deficits.
- An SNP is a DNA-sequence variation in which a single nucleotide differs between members of a species.
- Observations after 12 weeks of treatment were excluded from the ANOVA analysis.
- Adverse Drug Reactions (ADR) were recorded at each center and uploaded to a centralized database.
- Tartrate-resistant acid phosphatase (FART) is an enzyme expressed in bone-resorbing osteoclasts, inflammatory macrophages, and dendritic cells.
- We did an US examination to rule out appendicitis.
- mRNA transport differs between eukaryotes and prokaryotes.
- Telediastolic volume (ESV) is the volume of blood in the ventricle at the end of contraction.

Exercise 78

Rewrite these sentences to make it easier to follow the thread.

- There are several subsets of thymic lymphocytes: the helper T lymphocytes, cytolytic T lymphocytes, and the suppressor T lymphocytes.
- The treatment of anemia depends on its aetiology.
- I agreed I would review your paper not to rewrite it.

Continue

- 4) ICU patients often develop neurocognitive impairments that can be observed years after discharge. These neuropsychological and psychological deficits have an important impact on patients' quality of life.
- 5) Disulfide bonds in keratin fibres confer mechanical rigidity.
- 6) Lipocytes specialize in storing energy as fat. The number of lipocytes can increase once existing fat cells are full, but the number of adipocytes does not decrease after weight loss.
- 7) The animal's behavior showed the anaesthetic was ineffective.
- 8) Carney complex is characterized by superficial angiomyxomas, cardiac myxomas, lentigines, and endocrine hyperactivity. LAMB syndrome shows no racial predilection. Men and women are equally likely to have NAME syndrome.
- 9) Protocols help avoid errors in carrying out tests and reports.
- 10) The large bowel absorbs water from the remaining undigested matter and passes waste material from the body. Colorectal cancer develops in the large intestine, but other diseases also affect the colon.
- 11) Whereas standard EKGs record information from 12 leads, Holter monitors typically have only 2 or 3 ECG channels.
- 12) The residents found the session too detailed, too complex, and thought it could have been shorter.
- 13) Our team is interested and excited about the grant opportunity.
- 14) We studied the effects of estrogen-induced uterine oedema on foetal development.
- 15) Glial cells play a role in dilating arterioles and in their constriction.

3

The overview

Don't lose sight of the forest for the trees.

International adage

Writing an original research article can be very complicated. After having done so much research—reading so many papers and doing so many analyses on your data—it is easy to get caught up in the details and lose sight of the big picture. A good manuscript is more than the sum of its parts. Manuscripts should be built around a unifying message. The earlier you decide on this message, the easier it will be to create a harmonious whole. This is not to say that you need to have a refined version of your message at your fingertips when you first sit down to write. On the contrary, your message will evolve as you write

and rewrite. Working through successive drafts will bring new insights into your work and help you discover new relationships among your data and analyses. Once you know what you want to say, you can concentrate on how to say it clearly, correctly, concisely, and convincingly. This is why the title, abstract, and conclusion should be the last parts of the manuscripts to be put into their final form.

This section deals with the parts of the article that represent the whole: the title, summary statement, abstract, and conclusion.

Titles

Your title is arguably the most important part of your paper. Prospective readers search for key words in search engines that return lists of titles linked to abstracts. Based on your title, they will decide whether your paper is potentially interesting; if they decide it is not, they will not bother to read the abstract. A well-written title should attract readers who might be truly interested in your work, but it should also redirect those who would definitely not be interested in it. To accomplish this, a title should be honest: it should give prospective readers a realistic idea of what to expect.

Titles must convey as much specific information as possible while remaining brief and clear. The same precepts that guide writing in other parts of the manuscript apply to titles; in other words, consider your audience and be meticulous in your choice of words and in how you put them together. If you are writing for a general science journal, it would be unwise to abbreviate the term “magnetic resonance imaging” in the title; however, if you are writing for a neuroradiology journal, you can be assured that your potential audience would understand and appreciate the abbreviation.

Titles can be classified as indicative, in other words, those that indicate what the article is about (e.g., The relationship between A and B), or informative, in other words, those that inform readers of the findings (e.g., A increases B). The journal’s instructions for authors will inform you of the word or character limits, but you will probably need to browse a few issues to see whether they ever accept informative titles.

The titles of hypothesis-based studies should include the independent variable (if applicable), the dependent variable, and the population or animal studied. The following formats are often used:

- For indicative titles:

- Effect of (independent variable) on (dependent variable) in (population):

Effects of vasopressors on pulmonary vascular function in patients with liver transplants

- (Dependent variable) in (population) in response to (independent variable):

Pulmonary vascular function in patients with liver transplants in response to vasopressors

Or when there is no clear independent variable:

- (Dependent variable) in (population):

Outcome after transmetatarsal amputation in patients with diabetic foot

- For informative titles:

- (Independent variable) verb describing an effect (dependent variable) in (population):

Vasopressors improve pulmonary vascular function in patients with liver transplants

- (Dependent variable) verb describing an effect (independent variable) in (population):

Pulmonary vascular function improves after vasopressor administration in patients with liver transplants

- Adjective (Dependent variable) preposition (independent variable) in (population):

Improved pulmonary vascular function after vasopressor administration in patients with liver transplants

High rate of complications after transmetatarsal amputation in patients with diabetic foot

In addition to the title of your manuscript, many journals require you to provide a short title or “running head”, which is usually limited to a maximum of 50 characters, including spaces. This abbreviated title will appear at the top of every page of your article.

Exercise 79

Rewrite the following titles to make them more concise.

- 1) A study of the pharmacodynamics and pharmacokinetics of intravenously administered digoxin and digitoxin
- 2) An investigation into the effects of XYZ39 on liver fibrosis in adult male Wistar rats
- 3) The nature of the interaction between norepinephrine and magnesium sulfate on cerebral vasoconstriction in rabbits' brains
- 4) A comparison of the normal findings in the elastic fibers in the musculature of the rectosigmoid colon in children compared with the findings in children with Hirschsprung's disease.
- 5) A description of the normal anatomy, anatomical variants, and common abnormalities of the cerebral vessels in the circle of Willis on magnetic resonance angiography

Exercise 80

Suggest how these titles might be improved.

- 1) Brain assessment in rats using micro positron emission tomography
- 2) Complications in babies resulting from anesthesia
- 3) Human losartan pharmacokinetic profile prediction based on in vitro uptake transport data
- 4) Preliminary results of a multicenter study on the ultrastructural changes in renal tissues brought about by misoprostol in adults treated with cisplatin
- 5) Analysis of possible multiple sclerosis development predisposing factors

Exercise 81

Select the best title for these abstracts.

- 1) BACKGROUND: Enchondromatosis is characterized by multiple benign cartilage lesions in bone. While Ollier disease is typified by multiple enchondromas, in Maffucci syndrome these are associated with hemangiomas. Studies evaluating the predictive value of clinical symptoms for development of secondary chondrosarcoma are lacking. This multi-institute study evaluated the clinical characteristics of patients to gain insight into behavior of these diseases.
METHOD: We retrospectively analyzed clinical data from 144 Ollier and 17 Maffucci patients from 13 European centers and one national databank supplied by members of the European Musculoskeletal Oncology Society.
RESULTS: Patients had multiple enchondromas in the hands and feet only (group I, 18%), in long bones including scapula and pelvis only (group II, 39%), and in both small and long/flat bones (group III, 43%), respectively. The overall incidence of chondrosarcoma thus far is 40%. In group I, only 15% developed chondrosarcoma, in contrast to 43% in group II and 46% in group III, respectively. The risk of developing chondrosarcoma increases when enchondromas are located in the pelvis (odds ratio, 3.8; $p = 0.001$).
CONCLUSIONS: Overall incidence of development of chondrosarcoma is 40%. Patients with enchondromas located in long bones or axial skeleton, especially the pelvis, have a seriously increased risk of developing chondrosarcoma and are need regular screening for early detection of malignant transformation.

- a) Incidence of chondrosarcoma: A multicenter study of 161 patients
- b) Prognosis of Chondrosarcoma in Patients with Ollier Disease and Maffucci Syndrome
- c) Incidence and Predictive Factors of Chondrosarcoma in Patients with Ollier Disease and Maffucci Syndrome: An International Multicenter Study of 161 Patients
- d) Incidence, severity, diagnosis, and prognosis of Chondrosarcoma in patients with Ollier Disease and Maffucci Syndrome: an international multicenter study of 161 patients

2) BACKGROUND/AIMS: The optimal timing of laparoscopic cholecystectomy (LC) in the treatment of acute cholecystitis remains controversial. This retrospective study was undertaken to assess the clinical outcomes and possible advantages and disadvantages of early versus delayed LC for acute cholecystitis.

MATERIALS AND METHODS: Records of all patients admitted for acute cholecystitis in whom LC was attempted between January 2004 and January 2006 at National Taiwan University Hospital were reviewed.

RESULTS: A total of 89 patients were recruited to the study. Of these, 56 patients received early LC, and 33 patients received delayed LC following conservative therapy. There were no intergroup differences in age, gender, or days of symptoms prior to presentation. Patients undergoing early LC experienced a significantly longer operation time (109 ± 37.59 minutes versus 77 ± 25.65 minutes, $p < 0.001$), more blood loss (76 ml versus 28 ml, $p = 0.006$), and a longer post-operation hospital stay (4.5 days versus 2.6 days, $p < 0.001$). The conversion rate to open cholecystectomy was not significantly different (4/56 versus 2/33, $p = 0.84$), and there were no biliary tract injury or other major complications in either group. However, patients with early LC had a shorter total hospital stay (4.53 days versus 7.79 days, $p < 0.001$) and fewer admissions (1 in early LC versus 2.4 in delayed LC, $p < 0.001$).

CONCLUSIONS: Both early and delayed LC appear to be effective and safe in the treatment of acute cholecystitis. Early LC may be more technically demanding and time-consuming, and may be associated with a higher rate of wound infections; however, it also tends to shorten the total length of hospital stay and reduce the risk of repeat cholecystitis. We recommend early LC for acute cholecystitis comparison with delayed LC.

- a) Clinical outcomes, advantages, and complications of delayed laparoscopic cholecystectomy in the treatment of acute cholecystitis
- b) Is early laparoscopic cholecystectomy safer than delayed cholecystectomy in the treatment of acute cholecystitis?
- c) Evaluation of early versus delayed laparoscopic cholecystectomy in the treatment of acute cholecystitis
- d) Both b and c are good titles for this abstract.

Abstracts

After the title, the abstract is the part of your paper that is most likely to be read. Just as only a small proportion of those who read your title will go on to read your abstract, only a small proportion of those who read your abstract will go on to read the entire article. Like your title, your abstract should give readers a realistic idea of what to expect in your article.

Abstracts can be classified into two basic types. A descriptive abstract is usually a single paragraph telling readers what to expect if they read the article. This type of abstract is usually reserved for review articles or case reports, which do not represent original research. Descriptive abstracts merely serve to help readers decide whether to read the full article; without the accompanying article, they are relatively useless. The other type of abstract, the informative abstract is much more common.

An informative abstract should be a condensed version of your article. It should be written to stand alone. Readers should be able to understand your abstract without reading the entire article; likewise, they should be able to understand your article without reading your abstract. The abstract is not an introduction. There should be no information in the abstract that does not appear in the article itself, yet all the most impor-

tant information from the article should appear in the abstract.

Most journals use a version of the IMRaD format for indicative abstracts. This requires you to state the background or rationale for your study in one or two lines, followed by a brief but detailed statement of your objectives or hypothesis. You need to include enough information about your methods to orient your readers so they can understand your results. You need to highlight your most important results and sum them up in a succinct conclusion that shows your work is meaningful. Any conclusions in the abstract must be supported by information that also figures in the abstract—as mentioned above, the abstract must be completely intelligible without referring to the article.

The precepts that apply to all the other parts of a scientific paper are even more relevant in an abstract. Word limits force you to be concise, but you must be careful not to sacrifice clarity. Some journals forbid the use of abbreviations in abstracts, but most allow judicious use of abbreviations. Abbreviations are less likely to cause confusion in an abstract than in longer texts, because readers will have the definition fresh in mind and present on the same page if they need to refer back to it.

Exercise 82

Answer the questions about what is wrong with the following abstracts.

1) *What is missing from this abstract?*

BACKGROUND

Lithium is used to treat and prevent episodes of mania in people with bipolar disorder. Lithium-induced hyperparathyroidism (LIH) is a relatively underrecognized complication of long-term lithium treatment. Symptoms of LIH can be similar to those of bipolar disorder, delaying diagnosis of LIH. The first sign of LIH may be hypercalcemia, although it is often overlooked. We aimed to determine the prevalence of hypercalcemia in a cohort of patients with bipolar disorder.

METHODS

In this cross-sectional study, we collected data from 314 patients treated with lithium for bipolar disorder. Patients with bipolar disorder from the same clinics who had never been treated with lithium served as controls ($n=15$).

RESULTS

In patients on lithium, mean serum calcium was 2.49 (SD 0.11) mmol/l and the point prevalence of hypercalcemia (>2.60 mmol/l) was 15.6%. In controls, mean serum calcium level was 2.37 mmol/l, and none had hypercalcemia ($p=0.001$). The duration of lithium treatment was the only significant predictor for the development of hypercalcemia ($p=0.002$).

CONCLUSION

The prevalence of hypercalcemia was significantly higher in lithium-treated patients than in controls. Prevalence correlated with the cumulative time under lithium treatment.

2) *What is missing from this abstract?*

BACKGROUND

The objective of this research was to investigate the synergistic effects of two dietary components: docosahexaenoic acid (DHA), an omega-3 fatty acid present in cold-water fish, and curcumin (CCM), an herbal nutrient present in turmeric, in an *in vivo* model of DMBA-induced mammary tumorigenesis in mice.

METHODS

We used the carcinogen DMBA to induce breast tumors in SENCAR mice on control, CCM, DHA, or DHA+CCM diets. Appearance and tumor progression were monitored daily. The tumors were harvested 15 days following their first appearance for morphological and immunohistological analysis. Western analysis was performed to determine expression of maspin and survivin in the tumor tissues. Characterization of tumor growth was analyzed using appropriate statistical methods. Otherwise all other results are reported as mean \pm SD and analyzed with one-way ANOVA and Tukey's post hoc procedure.

RESULTS

Analysis of gene microarray data indicates that combined treatment with DHA+CCM altered the profile of "PAM50" genes in the SK-BR-3 cell line from an ER-/Her-2+ to that resembling a "normal-like" phenotype. The *in vivo* studies demonstrated that DHA+CCM treatment reduced the incidence of breast tumors, delayed tumor initiation, and reduced progression of tumor growth. Dietary treatment had no effect on breast size development, but tumors from mice on a control diet (untreated) were less differentiated than tumors from mice fed CCM or DHA+CCM diets. The synergistic effects also led to increased expression of the pro-apoptotic protein, maspin, but reduced expression of the anti-apoptotic protein, survivin.

CONCLUSIONS

The SK-BR-3 cells and DMBA-induced tumors, both with an ER- and Her-2+ phenotype, were affected by the synergistic interaction of DHA and CCM. This suggests that the specific breast cancer phenotype is an important factor for predicting efficacy of these nutraceuticals. The combination of DHA and CCM is potentially a dietary supplemental treatment for some breast cancers, likely dependent upon the molecular phenotype of the cancer.

3) *What does not belong in this abstract?*

INTRODUCTION

The pathogenesis of juvenile dermatomyositis (JDM) remains poorly understood. Macrophages are often seen in muscle tissue very early in the disease process. We hypothesized that these cells secrete the pro-inflammatory myeloid-related protein (MRP) 8/14, which may then contribute to muscle pathology in JDM.

METHODS

We studied 56 patients with JDM. We compared serum MRP8/14 levels with clinical measures of disease activity. We used immunohistochemistry to determine the frequency and identity of MRP-expressing cells in muscle biopsies taken early in the disease process, and tested the effects of MRP stimulation and endoplasmic reticulum (ER) stress on muscle in vitro. We used multiplex immunoassay to analyze serum or supernatant levels of cytokines.

RESULTS

Serum MRP8/14 correlated with physician's global assessment of disease activity ($R=0.65$, $p=0.0003$) and of muscle strength/endurance measured by the Childhood Myositis Assessment Score ($R=-0.55$, $p=0.004$). MRP8/14 was widely expressed by CD68+ macrophages in JDM muscle tissue. Human myoblasts cultured with MRP8/14 secreted the cytokines MCP-1 and IL-6, and secretion increased after ER stress. Serum MCP-1 and IL-6 were significantly higher in JDM patients than in healthy controls.

CONCLUSIONS

Serum MRP8/14 is a potential biomarker for disease activity in JDM in clinical practice and research. MRP8/14 is easy to detect in serum even at low levels; it is already in clinical use to detect gut inflammation, and it is stable in clinical serum samples even when transported at room temperature. Tissue-infiltrating macrophages secreting MRP8/14 may contribute to myositis by stimulating the local production of cytokines directly from muscle.

4) *What does not belong in this abstract?*

BACKGROUND

Growing evidence suggests that alterations of the inflammatory/immune system contribute to the pathogenesis of depression. Peripheral and brain inflammatory markers are increased in depressed patients, and major depression often occurs together with other diseases associated with inflammatory alterations. We aimed to characterize the link between depression and inflammation by examining the inflammatory system alterations.

METHODS

We used homozygous rats with partial or total deletion of the serotonin transporter (SERT) gene as a genetic model of vulnerability for depression and wild-type, heterozygous rats as controls. We analyzed cytokine expression at baseline and after acute injection of lipopolysaccharide (LPS).

Continue

RESULTS

SERT mutant rats showed altered cytokine expression in the dorsal and ventral hippocampus at baseline and also displayed an exacerbated cytokine response to the LPS challenge. Moreover, mutant rats exhibit differences in the expression of markers for microglia activation.

CONCLUSION

Baseline or functional alterations of immune/inflammatory systems contribute to heightened susceptibility to depression. Failure to respond to antidepressant treatment may be due to increased cytokine expression.

5) *How can we improve the intelligibility of this abstract by moving the information from a single sentence?*

BACKGROUND

In assisted reproduction cycles, gonadotropins are administered to obtain a greater number of oocytes. Most patients have no adverse response, but 3% to 6% develop ovarian hyperstimulation syndrome (OHSS). Increased vascular permeability is central to OHSS. Metformin reduces the risk of OHSS, but little is known about its possible effects on OHSS or mechanisms of action. We evaluated whether metformin attenuates some of the ovarian adverse effects caused by OHSS and the mechanisms involved.

MATERIAL AND METHODS

We used a rat model of OHSS to investigate the effects of metformin administration, comparing rats administered gonadotropin to induce OHSS, rats pretreated with metformin before gonadotropin administration to induce OHSS, and control rats. Ovarian sections stained with Masson trichrome were examined histologically and follicles were counted. Vascular permeability was measured by the release of intravenously injected Evans Blue dye. Vascular endothelial growth factor (VEGF) levels were measured by immunosorbent assay. COX-2 protein expression was evaluated by western blot, and NOS levels were analyzed by immunohistochemistry.

RESULTS

Rats with gonadotropin-induced OHSS had pathophysiological characteristics similar to those seen in human OHSS: increased body weight, elevated progesterone and estradiol levels ($p < 0.001$), increased number of corpora lutea ($p < 0.001$), higher ovarian VEGF levels ($p < 0.001$), and greater vascular permeability ($p < 0.01$). Metformin prevented some of these effects. The vasoactive factors COX-2 and NOS were increased in the ovaries of animals with OHSS ($p < 0.05$ and $p < 0.01$) but not in those pretreated with metformin ($p < 0.05$), suggesting that metformin has a role preventing the increase in vascular permeability caused by the syndrome.

CONCLUSION

Metformin attenuates the increases in body weight, circulating progesterone and estradiol, and vascular permeability in OHSS. These effects are mediated by inhibiting the increase in the vasoactive molecules VEGF, COX-2, and partially NOS. These molecules are increased in OHSS and are responsible for many of the symptoms related to OHSS.

6) *What makes this abstract so hard to understand?*

BACKGROUND

M_3 muscarinic acetylcholine receptor (M_3 -mAChR) is stably expressed in the myocardium, but its pathophysiological role remains largely undefined. This study aimed to investigate the role of M_3 -mAChR in myocardial hypertrophy (MH) induced by angiotensin II (Ang II) and elucidate the underlying mechanisms.

METHODS

Cardiac-specific M_3 -mAChR overexpression transgenic (TG) mice and rat H9c2 cardiomyoblasts (CM) with ectopic expression of M_3 -mAChR were established. Models of myocardial hypertrophy (MH) were induced by transverse aortic constriction (TAC) or Ang II infusion in the TG mice *in vivo*, and by isoproterenol (ISO) or Ang II treatment of H9c2 CM *in vitro*. MH was evaluated by electrocardiography (ECG) measurement, hemodynamic measurement, and histological analysis. mRNA and protein expression were detected by real-time RT-PCR and Western blot analysis (WBA).

RESULTS

M_3 -mAChR was upregulated in MH, while M_2 -mAChR expression did not change significantly. M_3 -mAChR overexpression significantly attenuated the increased expression of atrial natriuretic peptide and β -myosin heavy chain induced by Ang II both *in vivo* and *in vitro*. In addition, M_3 -mAChR overexpression downregulated AT₁ receptor expression and inhibited the activation of MAPK signaling in the heart.

CONCLUSION

The upregulation of M_3 -mAChR during MH could relieve the hypertrophic response provoked by Ang II, and the mechanism may involve the inhibition of MAPK signaling through the downregulation of AT₁ receptor.

Exercise 83

Organize the following sentences into an abstract with the subsections *Background*, *Methods*, *Results*, and *Conclusion*.

PROTEIN INTERACTIONS OF THE TRANSCRIPTION FACTOR HOXA1

- a) Other families of transcription factors, such as Smad or Stat, are signaling transducers.
- b) Copurification confirmed 45 interactors, many of which were involved in cell-signaling transduction, cell adhesion, and vesicular trafficking.
- c) We aimed to investigate the mode of action of mammalian Hox-A-1.
- d) Whether Hox proteins are signaling transducers has never been investigated.
- e) Screening identified 59 interactors.
- f) Hox proteins are transcription factors involved in crucial processes during animal development.
- g) The intracellular patterns for these interactions were consistent with the selective recruitment of Hox-A-1 by subgroups of partner proteins at vesicular, cytoplasmic, or nuclear compartments.
- h) We used bimolecular fluorescence complementation (BFC) to determine where the interactions take place in live cells.
- i) BFC detected 41 interactions.
- j) Our characterization of the Hox-A-1 interactome suggests unexplored roles for Hox proteins in cell-to-cell communication and cell physiology.
- k) We used systematic yeast two-hybrid screening against ~12,200 polypeptides derived from open reading frames to characterize the interactome of Hox-A-1.
- l) BFC revealed distinctive intracellular patterns for these interactions.
- m) Little is known about the mode of action of Hox proteins.
- n) We used copurification and bimolecular fluorescence complementation to check the results of the screening.

Summary statements and conclusions

Some journals require you to write a single sentence that sums up your entire article. Whether the journal requires it or not, it is always a good idea to try to distill your message into this pure form. Writing a summary statement for every draft can help you maintain your focus and see how your ideas are evolving. If you cannot summarize your article in one or two sentences, it may mean that you have not worked on your ideas enough to have a single clear message.

Some journals specify that papers should have a dedicated conclusion section. Even if the journal does not require or admit a separate section for your conclusion, you should always include some sort of conclusion. A good conclusion looks both backward and forward; it summarizes and synthesizes what has come before and proposes a course of action or at least points to directions for further study.

The conclusion should be a statement of what you think your results mean. The reasoning behind your conclusions should be evident in your discussion of the results, so there is no need to explain it in the conclusion. Do not jump to conclusions based on assumptions not substantiated in your work or the work of others discussed in your manuscript, and do not introduce new information or arguments in your conclusion. Be careful not to overgeneralize the implications of your work, but do not water your conclusions down to the point where they are meaningless outside the context of your study. Remember that conclusions are never final: the more we know, the more realize what we do not know. Avoid clichés like “further studies are necessary”; instead, tell your readers specific points that need to be addressed and suggest how to go about addressing them.

Exercise 84

Correct the mistakes in the conclusions of the following abstracts.

1) BACKGROUND

Alcoholic beverages are widely consumed. Depression, the most prevalent mental disorder worldwide, has been related to alcohol intake. We aimed to prospectively assess the association between alcohol intake and incident depression using repeated measurements of alcohol intake.

METHODS

We followed up 5,505 high-risk men and women (55 to 80 y) of the PREDIMED Trial for up to seven years. Participants were initially free of depression or a history of depression and had no history of alcohol-related problems. A 137-item validated food frequency questionnaire administered by a dietitian was repeated annually to assess alcohol intake. Participants were classified as incident cases of depression when they reported a new clinical diagnosis of depression and/or initiated the use of antidepressant drugs. Cox regression analyses were fitted over 23,655 person-years.

Continue

RESULTS

Moderate alcohol intake (5 - 15 g/day) was significantly associated with lower risk of incident depression (hazard ratio (HR) and 95% confidence interval (95% CI)=0.72 (0.53 to 0.98) versus abstainers). Specifically, wine consumption in the range of two to seven drinks/week was significantly associated with lower rates of depression (HR (95% CI)=0.68 (0.47 to 0.98)).

CONCLUSIONS

Moderate consumption of wine may reduce the incidence of depression, while heavy drinkers seem to be at higher risk.

2) INTRODUCTION

Myocardial ischemia is common in critically ill patients and is associated with increased mortality. Troponin and creatine kinase (CK) are biomarkers of myocardial ischemia. We evaluated troponin, CK, and ECG abnormalities in patients with septic shock. Vasopressin (VP) and norepinephrine (NE) are often administered to improve hemodynamics in patients with septic shock. Higher doses of NE are associated with myocardial damage. We compared the effect of VP versus NE on troponin, CK, and ECGs.

METHODS

This was a prospective substudy of a randomized trial. Adults with septic shock randomly received, blinded, a low-dose infusion of VP (0.01 to 0.03 U/min) or NE (5 to 15 µg/min) in addition to open-label vasopressors, titrated to maintain a mean blood pressure of 65 to 75 mmHg. Troponin I/T, CK, and CK-MB were measured, and 12-lead ECGs were recorded before study drug, and 6 hours, 2 days, and 4 days after study-drug initiation. Two physician readers, blinded to patient data and drug, independently interpreted ECGs.

RESULTS

We enrolled 121 patients (median age, 63.9 years (interquartile range (IQR), 51.1 to 75.3), mean APACHE II 28.6 (SD 7.7): 65 in the VP group and 56 in the NE group. At the four time points, 26%, 36%, 32%, and 21% of patients had troponin elevations, respectively. Baseline characteristics and outcomes were similar between patients with positive versus negative troponin levels. Troponin and CK levels and rates of ischemic ECG changes were similar in the VP and the NE groups. In multivariable analysis, only APACHE II was associated with 28-day mortality (OR, 1.07; 95% CI, 1.01 to 1.14; $p=0.033$).

CONCLUSIONS

Troponin elevation is common in adults with septic shock. Troponin elevation was not an independent predictor of mortality.

3) BACKGROUND

Fastidious Gram-negative bacilli are slow-growing organisms that require special media for culturing. It is important to identify these organisms as infectious agents for susceptibility testing, but they are difficult and time consuming to identify by conventional phenotypic characteristics. 16S rRNA gene sequence analysis is generally considered the gold standard for identifying bacteria. However, it is not feasible to subject all clinical isolates to molecular analyses for identification. We aimed to design an effective protocol for identifying fastidious Gram-negative bacilli in the clinical microbiology laboratory.

METHODS AND RESULTS

We compared phenotypic and 16S rRNA gene sequence analysis for the identification of 158 clinical isolates covering 20 genera and 50 species. The gold standard, 16S rRNA gene homol-

ogy analysis, identified 148/158 (94%) of the isolates to species level, 9/158 (5%) to genus level, and 1/158 (1%) to family level. Phenotypic analysis correctly identified 64/158 (40%) isolates to species level, mainly *Aggregatibacter aphrophilus*, *Cardiobacterium hominis*, *Eikenella corrodens*, *Pasteurella multocida*, and 21/158 (13%) isolates correctly to genus level, notably *Capnocytophaga* sp.; however, 73/158 (47%) of the isolates were not identified or misidentified.

CONCLUSIONS

16S rRNA gene sequencing is an effective means for identification of fastidious Gram-negative bacilli that are not readily identified by conventional phenotypic methods. We propose the following routine diagnostic algorithm: conventional biochemical identification of *A. aphrophilus*, *C. hominis*, *E. corrodens*, and *P. multocida* and 16S rRNA gene analysis for any other result including *Capnocytophaga* sp. when accurate identification is needed. Integrating conventional phenotypic methods and 16S rRNA gene sequence analysis is an efficient, cost-effective strategy to ensure the accurate identification of fastidious Gram-negative bacilli in the clinical microbiology laboratory.

Exercise 85

Write a conclusion based on the information provided.

1) BACKGROUND

The use of substandard and degraded medicines is a major public health problem in developing countries. Improper packaging and storage conditions can reduce the quality of amoxicillin-clavulanic acid preparations at community pharmacies.

METHODS

We obtained amoxicillin-clavulanic acid tablets from consumer outlets. We examined packaging condition, printed information, and other sources of information. We tested the samples for quantity, content uniformity, and dissolution.

RESULTS

We collected 59 samples from 48 outlets. A total of 32 (54.2%) samples were substandard: 8 (13.6%), 10 (16.9%), and 20 (33.9%) samples failed quantity, content uniformity, and dissolution tests, respectively.

CONCLUSION

2) BACKGROUND

Arterial hypertension is more prevalent and associated with more complications in African-American adults than in white adults. Various types of drugs are used to treat hypertension. Blacks and whites may respond differently to different types of drugs. We examined the response to angiotensin-converting enzyme (ACE) inhibitors in blacks and whites.

METHODS

After a systematic search for clinical trials of ACE-inhibitors among hypertensive adults that compared blood pressure response between whites and blacks, we did a meta-analysis to

Continue

determine the difference in systolic and diastolic blood pressure response. We investigated possible sources of heterogeneity or bias through meta-regressions, funnel plots, and one-study-removed analyses.

RESULTS

The meta-analysis of 13 trials with 17 patient groups found ACE inhibitors reduced systolic and diastolic blood pressure less in blacks than in whites (*here the numbers show this a clinically significant difference*). In the meta-regression, the only significant source of heterogeneity was ACE-inhibitor dosage. There was little evidence of publication bias.

CONCLUSION

3) BACKGROUND

Aquilaria crassna has long been used to treat infections in traditional Thai medicine. We examined the antibacterial activity of *Aquilaria crassna* leaf extract against *Staphylococcus epidermidis* and its underlying mechanism. We also tested the extract's antioxidant activity and toxicity.

METHODS

We used the Kirby-Bauer test to determine antibacterial activity. We determined the minimum inhibitory concentration (MIC) by the dilution method. We defined the minimum bactericidal concentration (MBC) as the lowest concentration producing no growth of microbes in the subcultures. We used scanning electron microscopy to observe morphological changes in the bacteria and phase contrast microscopic analysis to evaluate the inhibitory effect on biofilm formation. We used transmission electron microscopy to assess bacterial cell wall integrity. We used FRAP, ABTS, and DPPH scavenging methods to determine antioxidant activity. Tests for acute toxicity were conducted in mice in accordance with the OECD's guidelines.

RESULTS

Staphylococcus epidermidis was susceptible to the extract with the MIC and MBC of 6 and 12 mg/ml, respectively. The extract caused swelling and distortion of bacterial cells and inhibited bacterial biofilm formation. The bacterial cell wall ruptured after being treated with the extract for 24 h. The extract had considerable antioxidant activity. Mice showed no signs of acute toxicity at doses of 2,000 mg/kg or 15,000 mg/kg body weight.

CONCLUSION

4

Putting it all together: Additional exercises

That which we persist in doing becomes easier.

Ralph Waldo Emerson

If you have completed the exercises in the previous sections of this book, you probably know more than you did when you first picked it up. This final section contains a variety of exercises to consolidate and extend your knowledge.

Whereas the exercises in the other sections focused on specific points, in this section you will have an opportunity to apply what you learned in a more realistic scenario, where all of the points dealt with in the previous sections come together.

Exercise 86

Find and correct the mistakes due to the influence of Spanish in these sentences.

- 1) CT allowed to be confirmed a stone in the left ureter.
- 2) Frontotemporal lobular degeneration is a term used to describe a group of clinically, pathologically, and genetically heterogeneous disorders that cause dementia.
- 3) The people from the pharmaceutical company is waiting in your office.
- 4) None of the studied patients died.
- 5) We studied the physiopathology of arterial stiffness in patients on hemodialysis.
- 6) Dr. Brescia is a member of the Association of Medical Directors of America.
- 7) Most infants (87%) responded to all the questions on the questionnaire.
- 8) The gastroenterology resident asked that I do a barium study.
- 9) It is important to discard DNA contamination in the RNA preparations.
- 10) Dr. Hill suggested to do a colonoscopy.
- 11) Dr. Budinsky explains very well the procedure.
- 12) Some of the reactant remained after the reaction.
- 13) When I was at college, I was the youngest child in my class; however, during my career I was the oldest in the faculty.
- 14) Dr. Oates would like see the results of the analysis.
- 15) Infirmary complies with hand-washing protocol better than the physicists.
- 16) Osteomuscular disorders can affect the muscles, joints, tendons, ligaments, and nerves.
- 17) Two participating centers in the study dropped out due to low recruitment.
- 18) The telediastolic volume is the amount of blood in the ventricle after contraction.
- 19) Please show us the chart of the patient.
- 20) The reported rates of complications oscillated between 1% and 34%.

Exercise 87

Change these sentences to make them shorter and simpler.

- 1) A study is currently underway to determine whether or not sex is an independent risk factor.
- 2) Complications after surgery occurred in a great number of patients.
- 3) Adipose tissue has a honeycomb appearance due to the fact that lipids are removed during normal tissue processing.
- 4) The paper needs to be published no later than April 1.
- 5) There are many germs that can cause pneumonia.
- 6) She published her doctoral thesis in the year 2011.

Continue

- 7) Early occlusion of the stent may be due to the fact that angioplasty is performed when the patient is hypercoagulated.
- 8) The lesion was round in shape.
- 9) Subjects were weighed on a daily basis.
- 10) During the course of the experiment, untreated mice had a total of 12 seizures, whereas treated mice had none at all.
- 11) Echocardiograms were performed on a daily basis in all patients receiving adriamycin.
- 12) Cells are joined together end to end to form fibers.
- 13) Lesions that were malignant in nature were surgically resected.
- 14) Proofreading is absolutely essential before sending your article for review.
- 15) Ischemic injuries due to an occlusion of the superior mesenteric artery include but are not limited to the jejunum, the ileum, the cecum, and the right colon.
- 16) Abdominal palpation was used for the purpose of measuring the size of the spleen.
- 17) Needless to say, celiac disease and gluten sensitivity are two separate entities.
- 18) Up to the present moment, only two cases have been reported in the literature.
- 19) A large number of findings are not infrequently equivocal.
- 20) The rate of infections was higher in comparison to in the group receiving macrolides.
- 21) There was serous fluid inside of the pleural space.
- 22) The abdominal CT showed two large, 6 cm lesions that were round in shape.
- 23) We estimated that about one out of ten patients would refuse to participate.

24) Comorbidities were greater in number among older patients.

25) At the present time, we have three full-time postdocs and six doctoral candidates.

Exercise 88

List specific ways to ensure the following characteristics in a scientific manuscript.

PRECISION:

SIMPLICITY:

CONCISION:

FLUIDITY:

Exercise 89

Improve these 100 sentences however you can.

- 1) Apart from the book you have in your hands, other book will appear soon (in print).
- 2) Martin et al.'s findings are different than our study.
- 3) The sole exclusion criteria was intracranial hemorrhage.
- 4) It is shown in the randomized placebo controlled study that...
- 5) 245 patients (145 men and 100 females) were subjected to Magnetic Resonance Imaging.
- 6) Patients operated for congenital cardiopathies were controlled for two years.
- 7) Patients who past the weaning trial were extubated inmediately.
- 8) Only male rats, who weighed 500 g at a very minimum, were utilized in the experiment.
- 9) We discuss about the results that are presented in Table 3 and figure 2 in the final section.
- 10) Of the \$250,000 dollars we received for the study 40 per cent (100,000) were spent on equipments.
- 11) The vast majority of the dogs (12 out of 15) failed to survive for more than twelve weeks.
- 12) An US examination was performed and found that her appendix had signs of inflamation.
- 13) Subjects had to be older than 65 years old, smoke at least twenty cigarettes for day, and they had to have a body mass index of at least 25.
- 14) In patient's diagnosed of malignant hepatocellular carcinoma, MRI was performed prior to performing any procedures.
- 15) The patient, an elderly man of 75 years of age, showed good evolution during the period of hospitalization.
- 16) The mean arterial tension in operated patients oscillated between 65 and 90.
- 17) We did not have money enough to finalize the third experiment.
- 18) A twenty years old boy victim of a motorcycle crash was hurt in multiple parts of his body.

Continue

- 19) The results that we got in the last experiment, proved beyond the shadow of a doubt, that our hypotheses were right.
- 20) The program included a work shop on analysing the etiology of the diarrhoea.
- 21) Patients with esplenic affection should be monitorized carefully.
- 22) Treatment consists in watchful waiting and monitorization of evolution.
- 23) The patient complained about sputum that was reddish brown in color.
- 24) As the children became younger, the severity of disease increased.
- 25) The most common pathogenic organism in these settings are Staphylococci.
- 26) We had three hypothesis: firstly, rats with brain damage would develop lung injury before rats without, second, lung injury in these rats would be worse, and last but not least, there will be some other differences in the evolution of the two groups of animals.
- 27) However we examined the anatomic piece and found no signs of neoplasia.
- 28) These phenomenon are extremely rare in most cases.
- 29) The ethical committee at our institution gave their approval for the study.
- 30) Due to the fact that we had a lot of false negative results our sensibility was low.
- 31) Wriggling under the conjunctiva of the patients left eye, we saw a large worm.
- 32) Shingles are caused by the same viruses as the ones that cause chicken pox.
- 33) They pretended to lower the rate of nosocomial infection four fold.
- 34) Different from those in the treatment group, at the three months follow up, none of the patients of the control group showed a significant increase of body weight.
- 35) A 35% of the procedures we performed under local or regional anesthesia.
- 36) It was found that administrating the drug in fasting patients' frequently resulted in loss of consciousness.
- 37) The examination was performed after the subjects had been given an intravenous contrast agent.
- 38) It has long been known that brain plasticity in the children is greater than in the adults.
- 39) The actual reason for these intracellular changes that seem to alter the cells ability to regulate calcium intake are poorly known.
- 40) Men like sports more than women.
- 41) Student research grants between \$500 to \$5,000 are available.
- 42) Before cardiac resynchronization therapy for auricular flutter, it is important to insure >90% biventricular pacing.
- 43) Immunofluorescence allowed to confirm the diagnosis of lupus erythematosus.
- 44) Whether or not cholera becomes epidemic depends largely of hygiene measures.
- 45) It is well known that observational studies cannot demonstrate causation beyond a shadow of a doubt.
- 46) MRI was performed, showing extensive damage to the intervertebral disc.
- 47) Our results would seem to suggest that our approach might possibly have some usefulness in a carefully selected population.
- 48) Endpoint PCR can only detect 10 fold changes on agarose gel.
- 49) Real time PCR can detect two-fold changes.
- 50) This poster is Dr. Smiths.
- 51) The secretion of proteins occurs through the exocytosis of membranous vesicles.
- 52) The incidence of AIDS was higher in homosexual men than in normal men.
- 53) The objective of this work is to determine the effect of diet supplementation with quinine on body weight and body composition in male mice, to investigate its mechanism of action, and whether the effect is mediated through Trpm5.

54) It is well known that given a similar dose of ionizing radiation and identical biological characteristics 9–10 percent of normal population have higher radiation response.

55) A case of a 63 year old male being treated with FOLFOX chemotherapy for stage 3B colorectal cancer, who developed bilateral optic disc edema and associated left sided optic neuropathy is described.

56) After hydrodissection of the synovial membrane with lidocaine, 80 mg of triamcinolone acetonide were injected into the knee.

57) The treatment lead to a rapid and efficient correction of both clinical symptoms and plasma sodium level.

58) Most of COPD medications except inhaled muscarinic antagonists were associated with GERD.

59) Vitamin D is not only crucial for bone health but for proper brain development and functioning.

60) During treatment or follow-up 352 patients (20%) showed exitus.

61) Different from what occurs in other cells, in neurons small changes in the expression of membrane receptor proteins can have far-reaching effects on the activity of neural networks.

62) It is important to note that manganese was shown to induce cell swelling in cultured astrocytes and that astrocytic pathology, such as gliosis and Alzheimer type II astrocytes were observed in both animal and cell culture models in response to manganese exposures.

63) One of the most popular and versatile model of murine melanoma is by inoculating B16 cells in the syngeneic C57BL6J mouse strain.

64) Irregardless of the fluctuations of the SERS signal from one acquisition to another, some bands could still be correlated.

65) Looking at the overall shape of these spectra, we noticed they resemble well the SERS spectra acquired from *ex vivo* mice skin tissue samples immersed in colloidal silver solution.

66) Beside the cells number, fetal calf serum concentration was also analyzed in each sample.

67) AML diagnosis was made in accordance with the revised French-American-British classification.

68) Overexpression of BAD was performed by transfecting different NSCLC cell lines with wild-type BAD.

69) A higher number of individuals were found to present mutations in the CD group and double mutants were only detected in the IBD group.

70) Future studies should address a larger sample of patients and controls from different geographical regions within the same country and measure possible environmental aspects of each region as well as culture and dietary habits.

71) There have been some different opinions in the published reports about the impact of body mass index on outcomes after aortic valve replacement.

72) The baseline characteristics of experimental and control animals are resumed in Table 1.

73) One of the important limitations of this study were the absence of physiological data.

74) We used the nonparametric Kaplan-Meier method to estimate survival curves and a log-rank test was used to compare survival curves between the two groups.

75) In the end of the provisional recruitment period, 23 patients had only been enrolled.

76) Only a 15% of the patients was still alive at the end of the follow up period.

77) Idiopathic granulomatous mastitis is a benign lesion with malignant clinical and radiological aspects.

78) Proteomic investigation of muscle mitochondria revealed decrease of several flavoenzymes.

79) This results suggest that antidepressive use among individuals without psychiatric diagnoses is common in the United States.

Continue

- 80) We received a grant for more than \$2 million dollars.
- 81) A number of experimental animals had levels of testosterone that were elevated compared to the control group.
- 82) Men were more likely to get traumatic lesions than females.
- 83) The eighteen month-old babies included in the study all walked toward their mothers.
- 84) Other disease processes involving the dura matter or subdural space can resemble meningiomas on neuroimaging.
- 85) Cardiac catheterization showed the coronary arteries were all permeable.
- 86) We investigated the security and efficacy of the drug in children.
- 87) The decision of if to operate or not is decided by the comite.
- 88) The maxillary arteries branch from the external carotid artery.
- 89) Improved INR control will improve outcomes for patients treated with warfarin, as it is suggested by the results of the bleeding analyses according to center TTR.
- 90) Either the primary tumor or its metastases are responsible of the increase of the marker.
- 91) Rickets most commonly affect children between the ages of 6 to 24 months.
- 92) The bronchus are lined with mucus membranes.
- 93) The patient went in septic shock and was admitted in the ICU.
- 94) Her conclusions were based in faulty premises.
- 95) Our chief which will give the keynote address at the American congress is the most well respected urologist of the world.
- 96) Her mother was operated for an invasive ductal carcinoma.
- 97) After seeing the number of lesions on the abdominal CT study, palliative treatment was decided.
- 98) The residents forgot recording the variable during calls, so there are important gaps in our data.
- 99) We could excise the entire tumor and the margins were clean, so the prognostic is good.
- 100) The level of lactate dehydrogenase was found to be elevated.

Exercise 90

Correct and shorten the abstracts to conform to the journal's requirements.

- 1) *The journal's instructions specify a 250-word limit (the current version has 427) and state that abbreviations are not allowed.*

RATIONALE: Patients with traumatic head injury have been shown to be at high risk of early-onset ventilator-associated pneumonia (EOP). In spite of previous data and recommendations of established guidelines about the ability of antibiotics to reduce the incidence of EOP in this group of patients this practice is not routinely used in daily practice. Clinical implementation of this method of prevention could be facilitated by the use of a unique dose of antibiotic immediately after tracheal intubation.

OBJECTIVE: The objective of this study was to evaluate the usefulness of the administration of a unique dose of antibiotic at the moment of intubation in the prevention of early-onset ventilator-associated pneumonia (EO-VAP) in patients who are in coma.

METHODS: Two different prospective cohorts of comatose patients (Glasgow Coma Score ≤ 8) were compared: patients admitted in 2009-2010 who were administrated a unique dose of antibiotic within the first 4 hours of intubation as prophylaxis of EOP and comatose patients

without prophylactic antibiotic administration comprising patients, admitted \geq 4 hours after intubation in 2009-2010, and a historical cohort of patients in coma from 2007-2008. The following variables were analysed in all patients: demographic variables, comorbidities, cause of coma, incidence of EO-VAP (within the first 4 days), late-onset ventilator-associated pneumonia (LO-VAP), and ventilator-associated tracheobronchitis (VAT), etiology, duration of mechanical ventilation, length of intensive care unit and hospital stays, and mortality rate. The effectiveness of antibiotic prophylaxis was estimated using propensity score regression analysis.

MEASUREMENTS AND MAIN RESULTS: One hundred and twenty-nine patients were included in the study. Seventy-one belonged to the prophylaxis group (Study group) and fifty-eight belonged to non-antibiotic group (Control group). The global incidence rate of pneumonia in the prophylaxis group was 10.8 episodes/1000 days mechanical ventilation, and 28.4 episodes/1000 days mechanical ventilation in control group ($p=0.015$). The incidence rate of early-onset ventilator-associated pneumonia in the prophylaxis group was 4.4 episodes/1000 MV days and 23.1 episodes/1000 days MV in control group ($p=0.02$). There were no differences found in the incidence of late-onset ventilator-associated pneumonia. A trend to a lower incidence of tracheobronchitis was also observed in the prophylaxis group (15.5% vs. 25.9%; $p=0.14$). No difference was found with regard to mortality when comparing the prophylaxis group with the control group. However, we observed a statistically significant reduction in the total days of mechanical ventilation and in the length of stay in the ICU in the study group.

CONCLUSIONS: Administration of a unique dose of antibiotic in comatose patients, at the moment of intubation, significantly reduces the incidence of early ventilator-associated pneumonia, also reducing ICU and hospital length of stay.

2) *Correct the mistakes in this abstract and shorten it to meet the 150-word limit.*

BACKGROUND

There is a lack of objective measures of the clinical efficacy of allergen immunotherapy which relies on patients' perception about the effect of this treatment. It has been hypothesized that the fraction of exhaled nitric oxide (FENO) may be indicative of the severity of allergic rhinitis. We studied whether the FENO might be affected by multiple allergen immunotherapy in polysensitized adult subjects with allergic rhinitis. In addition to that, we looked for associations between exhaled nitric oxide and subjects' demographics, symptom scores, and pulmonary function tests.

METHODS

Twenty adult, polysensitized subjects with seasonal and perennial allergic rhinitis who chose to undergo allergen immunotherapy were recruited and enrolled. They were evaluated at baseline, and at 4, 8, 12, 24, and 52 weeks later. Exhaled nitric oxide was reported as the mean of triplicate determinations.

FINDINGS

Our results indicate that multiple allergen immunotherapy did not affect exhaled nitric oxide levels and such levels did not correlate with subjects' demographics and pulmonary function tests. However, we did find that exhaled nitric oxide was associated with rhinoconjunctivitis and asthma symptom scores at the end of the study.

CONCLUSIONS

In polysensitized adult subjects with allergic rhinitis, exhaled nitric oxide levels are not affected by multiple allergen immunotherapy.

Continue

3) Rewrite this abstract to make it clearer and shorten it to meet the 200-word limit.

BACKGROUND

Acute pharyngitis is frequently seen in primary care settings. In many cases, acute viral pharyngitis is not infrequently misdiagnosed as acute bacterial pharyngitis. Laboratory-confirmed diagnosis of respiratory viruses is recommended. The purpose of this study was to try to compare the sensitivities among three different techniques for obtaining samples for laboratory analysis (oropharyngeal swab, nasopharyngeal swab, and nasal wash) in the diagnostic workup for acute pharyngitis in adults.

METHODS

Oropharyngeal swab, nasopharyngeal swab, and nasal wash specimens were obtained from each participant with acute pharyngitis. The specimens were tested for 15 different respiratory viruses by using TaqMan real-time polymerase chain reaction. A sample was considered to be a true positive if any of the different specimens was positive for any of the different viruses; otherwise, samples were considered to be negative. The sensitivities among samples were compared by using the chi-square test or the Fisher's exact test, as appropriate.

RESULTS

One hundred and three triple samples collected consecutively by oropharyngeal swab, nasopharyngeal swab, and nasal wash were obtained in total. In 73 patients, at least one or more viruses were detected by one or more of the three methods. Among all the viruses, the sensitivity of the nasopharyngeal swab was significantly higher than that of the nasal wash (74% vs. 49%, respectively; $p < 0.01$) and than that of the oropharyngeal swab (74% vs. 49%, respectively; $p < 0.01$).

CONCLUSIONS

Flocked nasopharyngeal collection may be the most effective alternate to nasal wash and oropharyngeal swab for the detection of respiratory viruses in adults with acute pharyngitis using TaqMan real-time polymerase chain reaction.

Appendices

Appendix I

The seven Cs of scientific writing

Clarity: scientific writing should be unambiguous; it should not allow more than one interpretation of the meaning of a message.

Correctness: scientific writing should not contain errors.

Completeness: scientific writing should contain all the information necessary for readers to fully understand the research done.

Comprehensibility: scientific writing should be as simple as possible to enable readers to understand complex material.

Concision: scientific writing should not contain redundant or unnecessary information.

Consistency: scientific writing should use the same terms, spelling, style, format, etc. throughout the document.

Conformance: scientific writing should conform to the standards specified by organizations that oversee publication and by journals.

Appendix II

Words that are often confused

Most of these words cause difficulties for native English speakers; indeed, some of them are more likely to be problematic for native speakers than for Spanish speakers. Words that are often misinterpreted due to the influence of Spanish are listed in the next appendix, *False friends*.

DEFINITION	EXAMPLE
ABILITY, CAPACITY	
<i>Ability</i> : power or competence to do something	<i>The brain's plasticity gives it the ability to adapt after focal damage.</i>
<i>Capacity</i> : ability to contain or amount contained	<i>The combined capacity of the third and lateral ventricles is about 20 ml in normal adults.</i>
ABSORPTION, ADSORPTION	
<i>Absorption</i> : incorporation of gas, liquid, light, heat, etc.	<i>Some drugs interfere with calcium absorption.</i>
<i>Adsorption</i> : collection of gas, liquid, dissolved substance on a surface in a condensed layer	<i>Adsorption by hemofiltration devices must be taken into account when dosing some drugs.</i>
ACCURACY, PRECISION	
<i>Accuracy</i> : degree of closeness of a measurement to the true value	<i>This test always yields the correct results: its accuracy is 100%.</i>
<i>Precision</i> : degree to which the correctness of quantity is expressed	<i>In well-reported results, the number of digits after the decimal point tells us the precision (but not the accuracy!) of the measurement.</i>
ADMINISTER, ADMINISTRATE	
<i>Administer</i> : to deliver treatment	<i>Administer the drug subcutaneously if intramuscular injection is contraindicated.</i>
<i>Administrate</i> : to manage or direct the affairs of a business, institution, etc.	<i>The university administers the laboratory's funding.</i>
AFFECT, EFFECT	
<i>Affect</i> : Normally a verb meaning to produce a change in; sometimes a noun meaning feeling or observed emotional response	<i>Different types of antibiotics affect different types of bacteria in different ways.</i>
<i>Effect</i> : Normally a noun meaning result or consequence; sometimes a verb meaning to bring about	<i>The effects of antibiotics are both concentration-dependent and time-dependent.</i>

Continue

DEFINITION	EXAMPLE
AFFECTION, AFFECTATION	
<i>Affection</i> : fondness; rarely, disease <i>Affectation</i> : behavior, speech, or writing that is not genuine and aims to impress	<i>He shows great affection for his daughter.</i> <i>Her British accent is an affectation.</i>
ALTERNATELY, ALTERNATIVELY	
<i>Alternately</i> : in an alternating sequence or position <i>Alternatively</i> : as an alternative	<i>The product was purified by alternately centrifuging and re-suspending in ultrapure water.</i> <i>We could use RT-PCR; alternatively, we could use NASBA.</i>
ALTHOUGH, WHILE	
<i>Although</i> : in spite of the fact that <i>While</i> : standard use expresses simultaneity of actions; when used to mean although, <i>while</i> can generate confusion	<i>Although they rewrote the manuscript, it was rejected.</i> <i>While they rewrote the manuscript, the authors suspected it would be rejected.</i> (In this case, <i>while</i> can be interpreted as both time-related and whereas.)
AMONG, BETWEEN	
<i>Among</i> : used for the relationships between one element and two or more others <i>Between</i> : used for the relationship between two elements or between more than two elements considered individually	<i>Lower respiratory tract infections are the leading cause of death among all infectious diseases.</i> <i>No differences in mortality were found between the experimental subjects and controls.</i>
AMOUNT, CONCENTRATION, CONTENT, LEVEL	
<i>Amount</i> : total quantity measured <i>Concentration</i> : relative quantity of a substance in a quantity of another substance <i>Content</i> : total quantity of a substance in a quantity of another substance <i>Level</i> : position on the vertical axis; position on a scale; sometimes used to mean <i>amount</i> , <i>concentration</i> , or <i>content</i>	<i>The amount of cerebrospinal fluid drained from the experimental animals was lower than the amount drained from the controls.</i> <i>There is a positive correlation between the plasma concentration of β-lactam antibiotics and the response of bacterial infections.</i> <i>The malignant liver lesions had higher fat content than the benign lesions.</i> <i>Retinol binding protein-4 circulating levels were higher in patients with nonalcoholic fatty liver disease.</i>
AMOUNT, NUMBER	
<i>Amount</i> : uncountable quantity <i>Number</i> : countable quantity	<i>We recorded the amount of fluid drained in 24 h.</i> <i>We recorded the number of SNPs identified.</i>

DEFINITION	EXAMPLE
ANESTHESIOLOGIST, ANESTHETIST, ANAESTHETIST	
<i>Anesthesiologist</i> : (US English) a physician specialized in anesthesiology <i>Anesthetist</i> : (US English) a nurse, technician, or physician trained to administer anesthetics <i>Anaesthetist</i> : (UK English) a physician specialized in anesthesiology	<i>Anesthesiologists usually complete a four-year residency program after obtaining their MD or DO.</i> <i>The anesthetist asked the patient to count backward from one hundred.</i> <i>The anaesthetist was responsible for perioperative care.</i>
AS, LIKE	
<i>As</i> : a conjunction, used before a clause with a subject and a verb <i>Like</i> : a preposition, used before a noun	<i>As Smythe et al.¹² reported,...</i> <i>Like Smythe et al.¹², we also found...</i>
ASSURE, ENSURE, INSURE, REASSURE	
<i>Assure</i> : to affirm something is right to reinforce belief <i>Ensure</i> : to make sure <i>Insure</i> : to contract insurance to cover possible losses <i>Reassure</i> : to restore confidence	<i>They assured me that the reagent would arrive today.</i> <i>Please ensure that the door to the laboratory is locked when you leave.</i> <i>We need to insure this equipment against theft.</i> <i>The negative results of the RT-PCR reassured the patient.</i>
atrium, atrial, auricle, auricular	
The noun <i>atrium</i> (plural, <i>atria</i>) and the adjective <i>atrial</i> (adjective) usually refer to the upper chambers of the heart. The noun <i>auricle</i> and the adjective <i>auricular</i> refer to the outer projecting part of the ear or to the ear-shaped appendage projecting from each atrium in the heart.	<i>Atrial flutter is caused by a reentrant rhythm in either atrium.</i> <i>The left auricle serves as a decompression chamber when left atrial pressure is high.</i>
BECAUSE, SINCE	
<i>Because</i> : used to give the reason for something <i>Since</i> : from a point of time in the past; also used to mean because, but this use can generate confusion	<i>She needs to inject insulin because she has diabetes mellitus.</i> <i>Since she was diagnosed with diabetes mellitus, she always carries sweets in her purse.</i> <i>(In this case, <i>since</i> can be interpreted as both time-related and causal.)</i>
BESIDE, BESIDES	
<i>Beside</i> : next to <i>Besides</i> : moreover, in addition to	<i>The operating room is beside the emergency room.</i> <i>Besides the residents, a staff physician is always present.</i>

Continue

DEFINITION	EXAMPLE
BOTH, THE TWO	
<i>Both</i> : the two together	<i>Both groups improved after treatment.</i> (In this case, <i>the two</i> would also be correct.)
<i>The two</i> : is used to differentiate between or to compare	<i>No differences in age, sex, severity of disease, or comorbidities were found between the two groups.</i> (In this case, <i>both</i> would be incorrect.)
CAN, MAY	
<i>Can</i> : to be able to; used for ability and general possibility	<i>Breast cancer can affect men as well as women.</i>
<i>May</i> : to be possible; used for possibility in a specific case	<i>In light of his symptoms and the results of the physical examination, this man may have breast cancer.</i>
COMPETENCE, COMPETITION	
<i>Competence</i> : having the necessary skill, knowledge, etc.	<i>We hired her because of her competence in statistical analysis.</i>
<i>Competition</i> : rivalry or contest for desired goal	<i>The competition between the two research teams was fierce.</i>
COMPRISE, COMPOSE, CONSIST OF, INCLUDE	
<i>Comprise</i> : include (exhaustive), contain, consist of, or constitute; considered by many to be incorrect in the passive voice	<i>The zygomycoses comprise a diverse group of rare mycotic diseases.</i>
<i>Compose</i> : to make or form by combining things, parts, or elements; often used in the passive	<i>These clusters are composed of paralogous genes, which are probably the products of local gene duplications.</i>
<i>Consist of</i> : to be composed of	<i>Teratomas consist of cells from the three main tissue layers of an embryo.</i>
<i>Include</i> : nonexhaustive	<i>Early warning signs of schizophrenia include social withdrawal; hostility or suspiciousness; oversleeping or insomnia; and inappropriate laughter or crying.</i>
CONTINUAL, CONTINUOUS	
<i>Continual</i> : occurring regularly or frequently	<i>The patient's reflexes were continually monitored (a neurologist tested him every 3 hours).</i>
<i>Continuous</i> : nonstop	<i>The pH in the perfusate was continuously monitored throughout the experiment.</i>
DISCREET, DISCRETE	
<i>Discreet</i> : prudent	<i>Health is a private matter; medical professionals need to be discreet.</i>
<i>Discrete</i> : distinct; defined only for an isolated set of points	<i>Genotypic data support the existence of six stable discrete typing units (DTU) in Trypanosoma cruzi.</i>

DEFINITION	EXAMPLE
DOSE, DOSAGE	
<i>Dose</i> : quantity of medicine taken at one time	<i>The maximum daily dose of acetaminophen is 4000 mg in adults.</i>
<i>Dosage</i> : administration of medicine in doses; determining the quantity, frequency, and number of doses	<i>He asked for information about the dosage of acetaminophen for children on CRRT.</i>
DOUBLE, DUPLICATE	
<i>Double</i> : twofold	<i>When asthma control deteriorates, clinicians may instruct patients to take a double dose of their inhaled corticosteroid medication for a short period.</i>
<i>Duplicate</i> : an exact copy of	<i>The region of mRNA that encodes the protein is a duplicate of the exon region of the DNA since the introns are removed from the mRNA.</i>
DURING, FOR	
<i>During</i> : preposition used before a noun; it does not tell us how long something took or lasted	<i>During my postdoctoral fellowship, I discovered an enzyme that...</i>
<i>For</i> : preposition used with a period to say how long something took or lasted	<i>I worked under Dr. Diamond for three years.</i>
EAR TUBE, EAR CANAL, AUDITORY TUBE	
<i>Ear tube</i> : tympanostomy tube	<i>An ear tube creates an airway that ventilates the middle ear and prevents the accumulation of fluids behind the eardrum.</i>
<i>Ear canal</i> : external auditory meatus	<i>Due to its relative exposure to the outside world, the ear canal is susceptible to diseases.</i>
<i>Auditory tube</i> : Eustachian tube	<i>The auditory tube links the nasopharynx to the middle ear.</i>
<i>e.g.</i> , <i>i.e.</i>	
<i>e.g.</i> : abbreviation of the Latin term <i>exempli gratia</i> , which means “for example”	<i>Signs of overdose (e.g., slow heart beat, blue lips or fingertips, deep snoring or gurgling) require immediate action.</i>
<i>i.e.</i> : abbreviation of the Latin term <i>id est</i> , which means “in other words”	<i>Hypoglycemia (i.e., fasting glucose <4.0 mmol/l) is a medical emergency.</i>
Note: both abbreviations are mostly used within parentheses	
EXCISE, RESECT	
<i>Excise</i> : to remove (e.g., a tumor) by cutting	<i>The tumor was excised, and the patient remained free of disease until death from unrelated causes 22 years later.</i>
<i>Resect</i> : to remove part of an organ or structure	<i>We resect the tissue that contains the cancer from the lungs.</i>

Continue

DEFINITION	EXAMPLE
EXPERIENCE, EXPERIMENT	
<i>Experience</i> : knowledge gained from what you have observed	<i>Our experience shows that nosocomial infection rates can be improved through an educational program.</i>
<i>Experiment</i> : a test, trial, or tentative procedure aimed at discovering something unknown	<i>This experiment investigated whether immunostimulation with TLR-2 agonists under conditions of sterile inflammation affects the immune response and remote organ inflammation.</i>
EXPOSITION, EXPOSURE, EXHIBITION	
<i>Exposition</i> : expounding or explaining	<i>Her exposition of the role of reverse transcriptase in DNA sequencing was helpful.</i>
<i>Exposure</i> : being exposed	<i>Exposure to ionizing radiation during pregnancy can result in miscarriage or malformation.</i>
<i>Exhibition</i> : displaying or showing	<i>The authors of the best posters in the exhibition were invited to publish their work in the society's journal.</i>
EXTENSION, EXTENT	
<i>Extension</i> : the act or state of extending	<i>The extension of disease through the bowel wall indicates a poor prognosis.</i>
<i>Extent</i> : the degree to which something extends	<i>It is crucial to determine the extent of disease.</i>
FEWER, LESS	
<i>Fewer</i> : less in number (used with countable nouns)	<i>Women reported fewer adverse effects than men.</i>
<i>Less</i> : less in amount (used with uncountable nouns)	<i>Less fluid formed in the pleural space of treated animals.</i>
FARTHER, FURTHER	
<i>Farther</i> : to a greater distance	<i>The experienced colonoscopist was able to reach much farther than the trainee.</i>
<i>Further</i> : additional	<i>The trainee made further progress in the succeeding weeks.</i>
FROM, OF	
These two prepositions have many, sometimes overlapping meanings. Read them in a good dictionary and pay attention to how they are used	<i>Copying of an article = copying the entire article</i> <i>Copying from an article = copying parts of the article</i>
GENDER, SEX	
<i>Gender</i> : a social construct	<i>Masculine and feminine are gender categories.</i>
<i>Sex</i> : a biological concept	<i>Male and female are sex categories.</i>

DEFINITION	EXAMPLE
HEAR, LISTEN TO	
<i>Hear</i> : perceive with the ears	<i>I heard on the radio that a hospital in Barcelona had made an exciting discovery.</i>
<i>Listen to</i> : direct the attention of the ears to	<i>I listen to the radio while I'm setting up my experiments.</i>
HUMAN, HUMANE	
<i>Human</i> : related to people	<i>The Declaration of Helsinki outlines guidelines for research on human subjects.</i>
<i>Humane</i> : characterized by compassion for people and animals	<i>The Office of Laboratory Animal Welfare guarantees the humane treatment of animals used for research.</i>
IF, WHETHER	
<i>If</i> : introduces conditional (yes or no), cannot be used before infinitives or after prepositions	<i>We did not know if/whether the animals would survive.</i>
<i>Whether</i> : (yes or no), can be used with infinitives and prepositions	<i>We did not know whether the animals would die after the first dose or after the second dose (only two possibilities).</i> <i>We did not know if the animals would die after the first or second dose (three possibilities—maybe the animals would not die).</i> <i>We cannot decide whether to include the chief as an author.</i> <i>I would like to talk about whether you should apply for the fellowship.</i> <i>Call me if you can come to my talk in Salamanca.</i> (Conditional.) <i>Call me whether or not you can come to my talk in Salamanca.</i> (Both <i>if</i> and <i>if not</i> .)
INCIDENCE, PREVALENCE	
<i>Incidence</i> : the number of new cases of a disease in a population in a specified period of time	<i>The incidence of AIDS in Spain is about 2.0 cases per 100,000 population per year.</i>
<i>Prevalence</i> : the total number of cases of a disease in a given population at a specific time	<i>The estimated prevalence of AIDS among adults in Spain is 0.4%.</i>

Continue

DEFINITION	EXAMPLE
INCREASE, AUGMENT, INCREMENT, ENHANCE, IMPROVE	
<i>Increase</i> : to make or become greater	<i>His systolic blood pressure increased from 100 mmHg to 120 mmHg.</i>
<i>Augment</i> : to make greater, especially by addition from the outside	<i>We examined whether estrogen withdrawal augments parathyroid-induced IL-6 production.</i>
<i>Increment</i> : to increase by discrete amount	<i>The dose was incremented by 1 mg/kg to reach a final dose of 12 mg/kg on the fourth day.</i>
<i>Enhance</i> : to increase a good quality	<i>All patients reported enhanced self-esteem after the sessions.</i>
<i>Improve</i> : to make better	<i>Cerebral blood flow improved after treatment.</i>
ILLEGIBLE, UNREADABLE	
<i>Illegible</i> : impossible to read because of poor handwriting, faded print, etc.	<i>The pharmacist had to phone the hospital because the prescription was illegible.</i>
<i>Unreadable</i> : impossible to read because of poor writing	<i>Somebody has to supervise her reports: her last report was unreadable.</i>
IMMUNIZE, INOCULATE, VACCINATE	
<i>Immunize</i> : to render immune	<i>Young children are immunized to many diseases through natural contact with microbes.</i>
<i>Inoculate</i> : to introduce serum, vaccine, or antigenic substance to increase immunity; to implant microorganisms or infectious material on a culture medium	<i>We inoculated 15 male Wistar rats with anthrax.</i>
<i>Vaccinate</i> : to inoculate with a vaccine (e.g., modified virus) as a preventive or sometimes curative measure	<i>All personnel dealing with patients must be vaccinated against the flu.</i>
INTERVAL, PERIOD	
<i>Interval</i> : an intervening period of time	
<i>Period</i> : an interval of time characterized by the occurrence of a certain condition, event, or phenomenon	<i>Animals' heart rate was measured at ten-minute intervals for a period of 30 minutes after administration of verapamil.</i>
LOCATE, LOCALIZE	
<i>Locate</i> : determine the location of	<i>We located the foreign body in the ileum.</i>
<i>Localize</i> : confine	<i>We hypothesized we could decrease localized bleeding by using blended current at the end of the sphincterotomy.</i>
LOOK, SEE	
<i>Look at</i> : direct the attention of the eyes to	
<i>See</i> : perceive with the eyes	<i>We looked at the specimen under the microscope, but we couldn't see any abnormalities.</i>

DEFINITION	EXAMPLE
MADE FROM, MADE OF, MADE OUT OF <i>Made from</i> : used when the material undergoes an essential change so that it is no longer recognizable <i>Made of</i> : used when the material is recognizable <i>Made out of</i> : implies the transformation of an object	<i>Wine is made from grapes.</i> <i>This heart valve is made of titanium.</i> <i>Dr. McGyver made a tracheostomy tube out of a ballpoint pen.</i>
MINIMAL, MINIMUM MAXIMAL, MAXIMUM <i>Minimal, maximal</i> : adjectives, although minimum and maximum are more common <i>Minimum and maximum</i> : nouns and adjectives	<i>Decide on the minimal (or minimum) number of samples you can use and the maximal (or maximum) number you are prepared to invest in.</i> <i>Our goal is to keep complications to a minimum.</i>
MOLALITY, MOLARITY <i>Molality</i> : number of moles of solute per kilogram of solvent <i>Molarity</i> : number of moles of solute per liter of solution	Solutions labeled with molal concentration are denoted with a lower case m: <i>a 1.0 m solution contains 1 mole of solute per kilogram of solvent.</i> Solutions labeled with the molar concentration are denoted with a capital M: <i>a 1.0 M solution contains 1 mole of solute per liter of solution.</i>
MUCOUS, MUCUS, MUCOSA <i>Mucous</i> : adjective <i>Mucus</i> : noun <i>Mucosa</i> : noun, pl <i>mucosae</i> or <i>mucosas</i> = mucous membrane	<i>The mucous membranes secrete mucus.</i> <i>Mucus is a viscous mixture of mucins, water, electrolytes, epithelial cells, and leukocytes.</i> <i>Grafts from the oral mucosa can be used to reconstruct the urethra.</i>
MULTIVARIATE, MULTIVARIABLE <i>Multivariate</i> : refers to a statistical analysis with multiple outcomes <i>Multivariable</i> : refers to a statistical analysis with multiple predictors	<i>Multivariate models are appropriate for data from longitudinal studies with an outcome measured for the same individual at multiple time points (repeated measures) or for nested/clustered data with multiple individuals in each cluster.</i> <i>A multivariable linear regression model has a continuous outcome and multiple continuous or categorical predictors.</i>
NOTICE, REALIZE <i>Notice</i> : to pay attention to, to take notice of <i>Realize</i> : to be aware of	<i>They didn't notice the flaw in their experimental design.</i> <i>When they realized their design was flawed, they understood why their results made no sense.</i>

Continue

DEFINITION	EXAMPLE
OPTIMAL, OPTIMUM <i>Optimal</i> : adjective	<i>We sought to determine the optimal (or optimum) biologic dose of sirolimus prior to prostate surgery.</i> <i>They are not functioning at their optimum.</i>
ORTHOTOPIC, ORTHOTROPIC <i>Orthotopic</i> : in the correct or normal position	<i>In orthotopic heart transplantation, the patient's heart is always removed.</i>
<i>Orthotropic</i> : showing growth in direct line with the stimulus	<i>Timely orthotropic procedures can often eliminate the need for orthodontic procedures.</i>
OSCILLATE, RANGE, VARY <i>Oscillate</i> : to swing back and forth at a regular speed <i>Range</i> : to vary within certain limits	<i>Basal insulin level oscillates with a regular period of three to six minutes.</i> <i>The normal range for red blood cells in women ranges from 4.2 to 5.4 million cells per microliter of blood.</i> <i>Concentrations of enzymes involved in both phase I reactions vary significantly between individuals with normal hepatic function.</i>
PARAMETER, VARIABLE <i>Parameter</i> : a potential variable to which a particular value can be assigned to determine the value of other variables <i>Variable</i> : values that vary from individual to individual	<i>Parameters do not relate to actual measurements or attributes but to quantities defining a theoretical model.</i> <i>The dependent variable is often called the response variable.</i>
PATENT, PERMEABLE <i>Patent</i> : unobstructed	<i>After the angioplasty procedure, the stenosed artery was patent.</i>
<i>Permeable</i> : with penetrable pores or interstices, etc.	<i>The walls of capillaries are permeable to ions, water, nutrients, and even whole cells.</i>
PERCENT, PERCENTAGE, PERCENTILE <i>Percent</i> : a fraction expressed as a number of hundredths <i>Percentage</i> : a rate or proportion	<i>Eighty-five percent of the patients were men.</i> <i>A large percentage of patients developed complications.</i>
<i>Percentile</i> : Any of the 100 equal parts into which the range of the values of a set of data can be divided to show their distribution	<i>His head circumference was in the 95th percentile for his age.</i>

DEFINITION	EXAMPLE
PERIODIC, PERIODICAL	
<i>Periodic</i> : recurring at intervals of time	<i>We investigated whether periodic intra-articular Ctp injections could delay disease progression in patients with osteoarthritis.</i>
<i>Periodical</i> : a journal issued at regularly recurring intervals	<i>He spoke at the International Conference on Biomedical Periodicals.</i>
PHOSPHORUS, PHOSPHOROUS	
<i>Phosphorus</i> : noun	<i>Calcitonin helps control the levels of calcium and phosphorus in the blood.</i>
<i>Phosphorous</i> : adjective	<i>Phosphorous acid is an intermediate in the preparation of other phosphorus compounds.</i>
PREDOMINATE, PREDOMINANT, PREDOMINANTLY, PREDOMINATELY	
<i>Predominate</i> : verb	<i>The 1b genotype, which predominates in Japan, was the most widely distributed genotype and accounted for 58% of all isolates sequenced.</i>
<i>Predominant</i> : adjective	<i>The predominant vacA genotype was s1c/m1b (22/30, 73.3%).</i>
<i>Predominantly or predominately</i> : adverb	<i>Lymphomas predominantly affect men in their second and third decades of life.</i>
PRINCIPLE, PRINCIPAL	
<i>Principle</i> : a fundamental law from which others are derived	<i>The principle that the simplest explanation for a phenomenon is the best one is called Occam's razor.</i>
<i>Principal</i> : main	<i>The principal contraindication for thorazine is depression.</i>
PROSTATE, PROSTRATE, PRONE, SUPINE, RECUMBENT	
<i>Prostate</i> : gland surrounding neck of the bladder in male mammals	<i>Enlargement of the prostate may interfere with urination.</i>
<i>Prostrate</i> : lying face down (strongly suggests submission)	<i>The terrorist made everybody lie prostrate on the floor.</i>
<i>Prone</i> : lying face down	<i>Stereotactic breast biopsy is usually done with the patient in the prone position.</i>
<i>Supine</i> : lying face up	<i>To insert a central line in the internal jugular vein, place the patient in the supine position.</i>
<i>Recumbent</i> : reclining, lying	<i>Patients who spend weeks or months in a recumbent position are likely to develop urinary tract problems.</i>

Continue

DEFINITION	EXAMPLE
REPRESENT, BE	
<i>Represent</i> : to designate, stand for, denote	<i>In this box-and-whisker plot, the ends of the whiskers represent the minimum and maximum of all the data.</i>
<i>Be</i> : to exist, to equal	<i>Methicillin is a narrow-spectrum beta-lactam antibiotic of the penicillin class.</i>
REABSORPTION, RESORPTION	
<i>Reabsorption</i> : reclaiming what is taken	<i>In the intestine, PTH increases reabsorption of calcium and inhibits reabsorption of phosphate. PTH increases bone resorption of both calcium and phosphate.</i>
<i>Resorption</i> : remodeling	
REVIEW, REVISE	
<i>Review</i> : to go over critically	<i>We have revised our manuscript; we are grateful for this opportunity to have the referees review it again.</i>
<i>Revise</i> : to make changes to	
SAFE (SAFETY), SECURE (SECURITY), SURE	
<i>Safe</i> : not dangerous	<i>The drug is safe.</i>
<i>Secure</i> : preventing unwanted intrusion	<i>The database is secure.</i>
<i>Sure</i> : certain	<i>We are sure that the results are valid.</i>
TEMPORAL, TEMPORARY, TRANSIENT, TRANSITORY	
<i>Temporal</i> : relating to or near the temples of the skull	<i>Temporal arteritis is inflammation and damage to blood vessels that supply the head.</i>
<i>Temporary</i> : suggests an arrangement established with the idea of being changed soon	<i>After the disaster, the school was set up as a temporary hospital.</i>
<i>Transient</i> : suggests something in the process of passing by	<i>A transient ischemic attack usually lasts about 24 hours.</i>
<i>Transitory</i> : suggests an innate characteristic by which a thing, by its very nature, lasts only a short time	<i>Transitory oxygen-glucose deprivation induced both apoptosis and necrosis in cerebellar granule cells.</i>
THAT, WHICH	
<i>That</i> : relative pronoun used only in defining clauses; cannot be used after a preposition	<i>The fellowship that was advertised in Molecular Genetics has been filled.</i>
<i>Which</i> : relative pronoun used in both defining and non-defining clauses	<i>The experiment, which has never been repeated, yielded some interesting results.</i>

DEFINITION	EXAMPLE
VARIABILITY, VARIATION, VARIANCE	
<i>Variability</i> : condition of being variable	<i>Homologous recombination is a significant source of variability.</i>
<i>Variation</i> : the act, process, or result of varying	<i>We used custom-designed virulence arrays to try to understand the high genotypic variation in streptococci.</i>
<i>Variance</i> : a statistical term referring to the spread of data from the mean	<i>We compared normalization methods for high density oligonucleotide array data based on variance and bias.</i>
Note: <i>Variability</i> and <i>variation</i> are often used interchangeably.	
VARIOUS, VARYING	
<i>Various</i> : different	<i>Various studies have found a strong association between the two variables.</i>
<i>Varying</i> : changing	<i>The widely varying results reflect methodological differences.</i>
VISCID, VISCOUS, VISCUS	
<i>Viscid</i> : adhering, glutinous	<i>The slime layer forms when the amorphous viscid secretion from the bacteria diffuses into the surrounding media.</i>
<i>Viscous</i> : sticky, with high viscosity	<i>Viscous body fluid samples may result in sampling errors and samples with insufficient volume.</i>
<i>Viscus</i> : an internal organ enclosed within a cavity	<i>The liver is the largest abdominal viscus.</i>
WHEREAS, WHILE	
<i>Whereas</i> : although	<i>Whereas Morton's neuroma is much more common in women, neurofibromas are equally distributed between the sexes.</i>
<i>While</i> : usually implies simultaneity, but can also be used to mean although (this figurative can lead to confusion in some cases)	<i>The orderly restrained the patient while the resident injected the sedative.</i> <i>Blood pressure was recorded by the nurse while heart rate was automatically recorded. (In this case, <i>whereas</i> would be preferable unless the actions took place simultaneously.)</i>

Appendix III

False friends

Words that look very similar across different languages but differ in meaning are called false cognates or false friends.

A few words are total false friends; in other words, none of their meanings coincide. More commonly, similar-appearing words may coincide across languages in some meanings and differ in others.

ENGLISH	Spanish meaning	SPANISH	English meaning
ABILITY	capacidad	HABILIDAD	skill
ABORTION	aborto	ABORTO	abortion (voluntary), miscarriage (involuntary)
ACTUAL, ACTUALLY	en realidad	ACTUALMENTE	currently, nowadays
ADEPT	experto	ADEPTO	adherent, fanatic
ADEQUATE	suficiente	ADECUADO	appropriate
ADVERTISE, ADVERTISEMENT	anunciar, anuncio (publicidad)	ADVERTIR, ADVERTENCIA	warn, warning
ADVICE, ADVISE	consejo, aconsejar	AVISO, AVISAR	notification, notify
ALTERATION	alteración	ALTERACIÓN	alteration, but more usually abnormality or dysfunction
ANTHRAX (disease caused by <i>Bacillus</i> <i>anthracis</i>)	carbunco	ÁNTRAX (furunculosis)	carbuncle
APPLY FOR	solicitar	APLICAR	apply
ARGUMENT	discusión, argumento	ARGUMENTO	argument, plot
ASPECT	aspecto en el sentido de elemento, faceta o matiz de algo	ASPECTO	appearance
ASSIST	ayudar	ASISTIR	attend
BILLION	mil millones	BILLÓN	trillion

Continue

ENGLISH	Spanish meaning	SPANISH	English meaning
BLAND	soso	BLANDO	soft
CANAL	Canal para estructuras abiertas, pero conducto para estructuras cerradas	CANAL	canal
CEREBRUM	cerebro (la parte superior y frontal del encéfalo, consistiendo principalmente de los hemisferios)	CEREBRO	brain
CAREER	carrera profesional	CARRERA	university studies
CARPET	alfombra	CARPETA	folder
CASUAL	informal	CASUAL	casual, chance, accidental, random
CASUALTY	herido, muerto en guerra o accidente	CASUALIDAD	chance, coincidence
CATHETER	catéter, sonda, drenaje	CATÉTER	catheter, line
COLLEGE	universidad, facultad	COLEGIO	school, professional association
CONTROL (birth control, self-control, symptom control)	anticoncepción, autodominio, supresión de síntomas	CONTROL	check-up, follow-up, surveillance
COMPLEXION	tez, cutis	COMPLEXIÓN	build
CONDITION (verb)	acondicionar	CONDICIONAR	affect, modulate
CONSISTENT, CONSISTENCY	coherente, constante	CONSISTENTE, CONSISTENCIA	solid, firm
CONSTIPATED	estreñido	CONSTIPADO	has a cold
CONVENIENT	oportuno, cómodo	CONVENIENTE	suitable, advisable
CURRENTLY	actualmente, hoy en día	CORRIENTEMENTE	ordinarily
DECEPTION	engaño	DECEPCIÓN	disappointment
DEMAND	exigencia	DEMANDA	lawsuit
DIAGNOSTIC	diagnóstico (adjetivo)	DIAGNÓSTICO (noun)	diagnosis
DETERMINE	determinar	DETERMINAR	cause, lead to, result in
DISCARD	desechar	DESCARTAR	rule out
DISCUSS	tratar, desarrollar un tema	DISCUTIR	argue, fight
DISGUST	asco	DISGUSTO	annoyance, misfortune

ENGLISH	Spanish meaning	SPANISH	English meaning
DISORDER	trastorno, enfermedad	DESORDEN	disorder, but not in the sense of malfunction or disease
DISTINCT	bien definido	DISTINTOS	different
DIVERSE	diverso, en el sentido de heterogéneo	DIVERSOS	various
DIVERSION	desviación	DIVERSIÓN	fun
EDUCATED	culto	EDUCADO	polite, courteous
EFFECTIVELY	eficazmente, en la práctica	EFFECTIVAMENTE	indeed
EMBARRASSED	avergonzado	EMBARAZADO	pregnant
EVENTUAL, EVENTUALLY	final, finalmente, al final	EVENTUAL, EVENTUALMENTE	possible, by chance
EVOLUTION	cambio gradual; evolución por selección natural	EVOLUCIÓN	outcome, result
EXIT	salida	ÉXITO	success
FACILITY	instalaciones	FACILIDAD	ease
FACULTY	profesorado	FACULTAD	department, school
FINGER	dedo de la mano, a veces utilizado con la exclusión del pulgar	DEDO	finger, thumb, toe
FORMIDABLE	formidable, en el sentido de temible	FORMIDABLE	tremendous, amazing
HUMIDITY	humedad, casi siempre la humedad relativa al aire	HUMEDAD	moisture
IDIOM	modismo	IDIOMA	language
IMPLICATE	comprometer, enredar	IMPLICAR	involve, imply, implicate
IMPLY	suponer, sugerir, insinuar	IMPLICAR	involve, imply, implicate
IMPORTANT	que tiene importancia	IMPORTANTE	strong or considerable, al menos que se quiere decir que tiene importancia
INCONVENIENT	incómodo, inoportuno	INCONVENIENTE	drawback, obstacle
INFANCY	periodo de vida entre cero y dos años	INFANCIA	childhood

Continue

ENGLISH	Spanish meaning	SPANISH	English meaning
INFANT	bebé (1-12 meses de edad)	INFANTE, INFANTA	prince, princess
INJURY	lesión, herida	INJURIA	offense, insult
INHABITANT	habitante	HABITANTE	inhabitant
INTRODUCE	presentar	INTRODUCIR	insert, add, put inside
LECTURE	conferencia, clase	LECTURA	reading
LENS	lente pero, en el ojo, cristalino	LENTE	lens
LIBERATE	liberar en el sentido de hacer que alguien quede libre	LIBERAR	release, secrete
LIBRARY	biblioteca y otras –tecas (software library, gene library, etc.)	LIBRERÍA	bookstore
MAJOR	más importante	MAYOR	greater, larger
MANIPULATE	manipular, en el sentido de intervenir con medios arteros	MANIPULAR	handle
MAYOR	alcalde	MAYOR	greater, larger
MEDIC	soldado paramédico	MÉDICO	medical, physician
MEDULLA	médula oblonga (bulbo raquídeo), médula del riñón, de la glándula suprarrenal	MÉDULA	marrow
NOTICE	anuncio, notar, observar	NOTICIA	news
ORIGINATE	comenzar	ORIGINAR	cause, lead to
OSCILLATE	oscilar, en el sentido de crecer y disminuir alternativamente, moverse como un péndulo	OSCILAR	range, oscillate, fluctuate
OSTEOARTHRITIS	artrosis	OSTEOARTRITIS	arthritis with inflammation of the ends of bones that come together at the joint
PARENTS	padres, progenitores	PARENTES	relatives
PERMEABLE	penetrable	PERMEABLE	patent, permeable

ENGLISH	Spanish meaning	SPANISH	English meaning
PHYSICIAN	médico	FÍSICO	physicist
PRESERVATIVE	conservante	PRESERVATIVO	condom
PRESUME	suponer	PRESUMIR	to be conceited
PRETEND	fingir, aparentar	PRETENDER	to try to, to claim
PROVE	demostrar	PROBAR	try, try out
PUNCTUAL	puntual, sólo en el sentido de que llega a la hora prevista	PUNTUAL	one-time only, single, exact mutación puntual = point mutation
QUIET	callado	QUIETO	still
QUIT	abandonar	QUITAR	remove
REALIZE	darse cuenta	REALIZAR	carry out
REMOVE	uitar	REMOVER	stir
REST	descansar	RESTAR	subtract
RESUME	reanudar	RESUMIR	summarize
SCIENTIFIC	científico (adjetivo)	CIENTÍFICO (noun)	scientist
SENSIBLE, SENSIBILITY	sensato, sensatez	SENSIBLE, SENSIBILIDAD	sensitive, sensitivity
SUBSTITUTE A FOR B	sustituir B por A	SUSTITUIR A POR B	substitute B for A
SUCCESS	éxito	SUCESO	event, incident
SUPPOSE	suponer	SUPONER (un reto, un éxito)	be, represent, constitute
SYMPATHETIC, SYMPATHY	comprensivo, comprensión (pero simpática cuando se refiere al sistema nervioso)	SIMPÁTICO, SIMPATÍA	nice, kindness, sympathy
TARGET	diana, objetivo	TARJETA	card
TERRIFIC	fantástico	TERRORÍFICO	terrifying
TEST	test, pero varía mucho. Apgar test = Índice de... blood test = análisis diagnóstic test = prueba Pap test = citología urine test = análisis	TEST	test
TOPIC	tema	TÓPICO	cliché

Continue

ENGLISH	Spanish meaning	SPANISH	English meaning
TRACT	tracto, pero varía mucho digestive tract=tubo genital tract=aparato olfactory tract=cintilla	TRACTO	tract
TRANSLATE	traducir	TRASLADAR	move
TRANSPIRE	transpirar, ocurrir, resultar que	TRANSPIRAR	transpire in the sense of perspire
ULTIMATELY	en última instancia, a la larga	ÚLTIMAMENTE	lately, recently
UNIQUE	único en el sentido de que sólo existe un ejemplar	ÚNICO	only, single, sole, unique
VACILLATE	vacilar, fluctuar	VACILAR	vacillate, but usually hesitate
VARIOUS	diferentes	VARIOS	several
VICIOUS	fiero, malicioso	VICIOSO	depraved

Appendix IV

Guidelines for forming plurals in words from classical languages

- Most words ending in *-a* change to *ae*. Here are a few examples: *alga/algae*, *ampulla/ampullae*, *fenestra/fenestrae*, *lamina/laminae*, *sequela/sequelae*, *vertebra/vertebrae*, etc. Importantly, this includes many families and genera in taxonomic classification and plurals used to refer to their members collectively: *Candida/Candidae*, *Drosophila/Drosophilae*, etc.

Be careful with words that end in *-ma*: they change to *-mas* or *-mata*. Here are a few examples: *adenoma/adenomas**, *carcinoma/carcinomas**, *chiasma/chiasmata*, *stigma/stigmas* or *stigmata***, *stoma/stomata*, etc.

*It is possible but very uncommon to make the plurals of tumor names by adding *-ata* instead of *-s*.

** We usually use *stigmata* in biology and medicine, and we use *stigmas* in everyday language to refer to being marked by social disgrace.

- Most words ending in *-us* change to *-i*. Here are a few examples: *alveolus/alveoli*, *bronchus/bronchi*, *coccus/cocci*, *embolus/emboli*, *fungus/fungi*, etc.

However, not all words ending in *-us* change to *-i*. Some words remain the same in the plural (e.g., *ductus/ductus*, *meatus/meatus*, *nexus/nexus*, *plexus/plexus*, etc.) and some changed to *-era* or *-ora* (*corpus/corpora*, *genus/genera*, *glomus/glomera*, *opus/opera*, *viscus/viscera*).

- Many words ending in *-is* change to *-es*. Here are a few examples: *anastomosis/anastomoses*, *axis/axes*, *crisis/crises*, *diaphysis/diaphyses*, *metastasis/metastases*, etc.

However, some words ending in *-is* change to *-des* (e.g., *arthritis/arthritides*, *dermatitis/dermatitides*, *glottis/glottides*, *iris/irides*, *neuritis/neuritides*, etc.).

- Words ending in *-um* change to *-a*. Here are a few examples: *acetabulum/acetabula*, *atrium/atria*, *diverticulum/diverticula*, *hilum/hila*, *infundibulum/infundibula*, *septum/septa*, etc.

- Most words ending in *-x* change to *-ces*. Here are a few examples: *appendix/appendices*, *apex/api-ces*, *calyx/calyses*, *cervix/cervices*, *fornix/fornices*, *matrix/matrices*, *thorax/thoraces*, *varix/varices*, etc.

However, in words ending in *-cyx* or *-nx*, the plural is formed with *-ges* (e.g., *coccyx/coccyges*, *larynx/larynges*, *menix/meninges*, *nasopharynx/nasopharynges*, *salpinx/salpinges*, etc.).

- Many words ending in *-ion* change to *-a*. Here are a few examples: *criterion/criteria*, *ganglion/ganglia*, *mitochondrion/mitochondria*, *phenomenon/phenomena*, *polyhedron/polyhedra*, etc.

Appendix V

Some common dependent prepositions

Verb + preposition

Add to, adhere to, agree with somebody on something, aim for, allow for, apply for, approve of, arise from, ask for, attend to, believe in, belong to, beware of, blame somebody for, call for, care for, choose between, comment on, compare to/with, complain of, comply with, conceal from, concentrate on, conform to, congratulate somebody on, consent to, consist of, contribute to, count on, cure of, deal with, decide on, depend on, die of, disagree on/with, discriminate against, distinguish between/from, excel in, exchange something for, hide from, insist on, interfere with, listen to, mistake something for, object to, participate in, pay for, persist in, prepare for, prevent something/someone from, prohibit from, protect from/against, provide somebody with, react to, recover from, rescue from, refer to, rely on, respond to, search for, specialize in, stop from, substitute for, succeed in, suffer from, take advantage of, wait for, warn someone about.

Adjective + preposition

Abreast of, absent from, according to, accustomed to, acquainted with, addicted to, adjacent to, afraid of, associated with, anxious about, ashamed of, attached to, aware of, based on, capable of, characteristic of, close to, coated with, committed to, compatible with, composed of, concerned about, connected to, conscious of, consistent with, contrary to, convinced of, coordinated with, covered with, dedicated to, different from, dissatisfied with, distinct from, eligible for, engaged in, equipped with, equivalent to, exempt from, exposed to, familiar with, filled with, full of, incapable of, interested in, involved in, limited to, made of/from/up of, married to, opposed to, preferable to, prepared for, prone to, related to, relevant to, responsible for something/somebody, responsible to somebody, safe from, sensitive to, similar to, suitable for susceptible to, typical of, unaware of.

Noun-preposition collocations

In addition to, (take) advantage of, in agreement with, all in all, attack on, attitude toward, on average, on behalf of, certainty about, in charge of, under (no) circumstances, chance of, comparison between, in comparison with, on condition, connection between, decrease in, delay in, difference between/of, difficulty in/with, disadvantage of, in doubt, doubt about, drop in, evidence for/against/of, experience in, under guarantee, impact on, increase in, information about, (have no) intention of, knowledge of, (keep) in mind, need for, (take no) notice of, under (no) obligation, in order, (take) pleasure in, point in, in power, in practice, preference for, prophylaxis for/against, proposal for, protection from, reaction to, reason for, reduction in, report on, result of, rise in, at risk, risk of, room for, solution to, substitute for, at stake, on strike, under surveillance, surveillance of, on suspicion of, under suspicion, in theory, in trouble, trouble with, uncertainty about, use of, on the whole.

Appendix VI

Unnecessarily complex words

HIGH COMPLEXITY WORDS	SIMPLER WORDS
ambulate	walk
capability	ability
cognizant	aware
commence	begin or start
customarily	usually
demonstrate	prove or show
determinant	cause
dilatation	dilation
elucidate	explain
expeditious	fast
facilitate	help, cause
familiarization	familiarity
finalize	end
firstly, secondly	first, second
following	after
heretofore	previous
hitherto	until now
inception	start
methodology	method
mitigate	lessen, relieve
oftentimes	often
preventative	preventive
prioritize	assess
prior to	before
proficiency	skill
utilization	use
utilize	use
visualize	see

Appendix VII

Nominalization

NOMINALIZED CONSTRUCTION	VERB
be in support of	support
bring to a conclusion	end, conclude
carry out the calibration of	calibrate
cause a delay	delay
come to the conclusion that	conclude that
conduct an investigation	investigate
determinations were performed	were determined
exhibit a tendency	tend
give consideration to	consider
give indication of	indicate, show, suggest
has a requirement for	requires, needs
has seen an expansion in	has expanded
is in violation of	violates
it is my intention to	I intend to
make an adjustment in	adjust
make an attempt to	try to
make an assumption that	assume
make a choice	choose
make a comparison of	compare
make preparations for	prepare for
make reference to	refer to
make a statement saying	state, say
obtain estimates of	estimate
offer confirmation of	confirm
perform the analysis	analyze
perform the development of	develop
perform the implementation of	implement

Continue

NOMINALIZED CONSTRUCTION	VERB
perform the measurement of	measure
perform the monitorization of	monitor
place a major emphasis on	stress, emphasize
provides a methodological emphasis	emphasizes methodology
provides appropriate information for	informs
provides guidance for	guides
reach the conclusion that	conclude that
show a peak	peak
take an assessment of	assess
take into consideration	consider
undertake the surveillance	monitor

Appendix VIII

Empty expressions that can be eliminated

- all things considered
- as already stated
- as has already been stated
- as we stated above
- the fact is
- in this day and age (or *replace with* now or today)
- in a very real sense (or *replace with* in a sense)
- it has been found that
- it is a fact that
- it is evident that
- it has long been known that
- it is interesting to note
- it is not impossible that
- it is possible that the cause is
- it is worth noting that
- it seems that there can be little doubt that
- it should be obvious that
- it is well known that
- month of
- needless to say
- obviously
- quite
- to all intents and purposes

Appendix IX

Redundant expressions

REDUNDANT EXPRESSION	CAN BE REDUCED TO
absolutely essential	essential
actual facts	facts
already existing	existing
alternative choices	choices
at the present time	at present
basic fundamentals	fundamentals
benign skin tag	skin tag
bright intensity	bright or brightness
complete stop	stop
completely eliminate	eliminate
completely empty	empty
completely full	full
consensus of opinion	consensus
currently underway	underway
definitively proved	proved
descend down	descend
empty space	space
end result	result
entirely eliminate	eliminate
exactly identical	identical
fewer in number	fewer
future plans	plans
green in color	green
had done previously	had done
important essentials	essentials
introduced a new	introduced
join together	join
knowledgeable expert	expert

Continue

REDUNDANT EXPRESSION	CAN BE REDUCED TO
large in size	large
malignant carcinoma	carcinoma
mandatory requirement	requirement
mix together	mix
mutual cooperation	cooperation
necessary prerequisite	prerequisite
never before	never
never before in the history of	never
new initiative	initiative
none at all	none
obviate the need for	obviate
optional choice	choice
period of time	period
pooled together	pooled
positive benefits	benefits
private industry	industry
refer back	refer
round in shape	round
rough texture	rough
separate entities	entities
serious crisis	crisis
still persists	persists
smaller in size	smaller
subject matter	subject or matter
successful solution	solution
sweet in taste	sweet
symmetrical in form	symmetric
time period	time or period
titanium metallic prosthesis	titanium prosthesis
very necessary	necessary
very unique	unique
8 p.m. Monday evening	8 p.m. Monday

Appendix X

Wordy expressions

WORDY EXPRESSIONS	SHORTER SUBSTITUTE
a considerable amount of	much
a considerable number of	many
a great number of times	often
a large number of	many
a majority of	most
a number of	some
a small number of	few
a sufficient amount of	enough
accounted for by the fact that	because
adversely impact on	hurt, hinder
afford an opportunity	let, allow
after the conclusion of	after
along the lines of	like
an example of this is the fact that	for example
an overwhelming amount	most
are of the same opinion	agree
as a consequence of	because, due to
as a means of	to
as of this date	today
as it stands right now	as it stands
as long as	if, unless
as to whether	whether
at a rapid rate	rapidly
at an early date	soon
at an earlier date	previously
at some future time	later
at the conclusion of	after

Continue

WORDY EXPRESSIONS	SHORTER SUBSTITUTE
at the present time	now
at this point in time	now
at this time	now
based on the fact that	because
because of the fact that	because
brought about an increase in	increased
by a factor of two	twice, double, twofold
by means of	by, with
causal factor	cause
considerable amount of	much
despite the fact that	although
due to the fact that	because
during the course of	during, while
during the period of	while
during the time that	while
equally as well	as well, equally well
fatal outcome	death
first of all	first
for a period of	for
for the purpose of	for, to
for the reason that	because
from the point of view of	for
give an account of	describe
give rise to	cause
has been engaged in a study of	has studied
has proved to be	is
has the capability of	can
has the functionality of	can function
have the appearance of	look like, resemble
having regard to	about
if and when	if, when
if you want so save on time	to save time
in all cases	always

WORDY EXPRESSIONS	SHORTER SUBSTITUTE
in an effort to	to
in a number of cases	some
in a position to	can
in a satisfactory manner	satisfactorily
in a timely manner	promptly
in almost all instances	nearly always
in close proximity to	close to, near
in excess of	more than
in a large measure	largely
in lieu of	instead
in light of the fact that	because
in many cases	often
in most cases	usually
in order to	to
in order that	for, so
in respect to	about
in spite of the fact that	although
in the absence of	without
in the event that	if
in the eventuality that	if
in the field of	in
in the first place	first
in the near future	soon
in the vast majority of cases	usually
in view of the fact that	because
inasmuch as	because
including but not limited to	including
it is essential for you to	you must
it is interesting to note that	note that
it is often the case that	often
it may be that	we think
laboratory environment	laboratory
larger in comparison to	larger than

Continue

WORDY EXPRESSIONS	SHORTER SUBSTITUTE
led to an increase in	increased
majority of	most
manner in which	the way that, how
not later than	by
notwithstanding the fact that	although
of insufficient magnitude	too small
of the opinion that	think that
on a daily basis	daily
on account of	because
on behalf of	for
on no occasion	never
on the grounds that	because
on the part of	by
owing to the fact that	because
presents a similar picture to	resembles
provided that	if
quite a large quantity of	much
quite unique	unique
rather large	large
reported in the literature	reported
resultant effect	result
resulted in a decrease in	decreased
serves the function of being	is
subsequent to	after
successfully complete	complete, pass
the great majority of	most
the predominant number of	most
the question as to whether	whether
the vast majority of	most
this result would seem to indicate	this result indicates
through the use of	by, with
to the extent that	if
to the fullest possible extent	fully

WORDY EXPRESSIONS	SHORTER SUBSTITUTE
until such time as	until
was of the opinion that	believed
we have insufficient knowledge	we do not know
what is the explanation of	why
whether or not	whether
with a view to	to
with reference to	about
with regard to	about
with respect to	about
with the result that	so that
writing activity	writing

Appendix XI

Transition markers

To add information: again, also, besides, equally important, finally, first, further, furthermore, in addition, last, moreover, next, second, still, too.

To concede a point: granted, naturally, of course.

To compare: also, in the same way, likewise, similarly.

To show contrast: at the same time, by contrast, despite that, even so, however, in contrast, instead, nevertheless, on the contrary, on the other hand, otherwise, regardless, still.

To emphasize: indeed, in fact, of course.

To introduce examples: after all, as an illustration, even, for example, for instance, in conclusion, indeed, in fact, in other words, in short, of course, namely, specifically, that is, to illustrate, thus.

To summarize: all in all, altogether, finally, in brief, in conclusion, in other words, in particular, in short, in simpler terms, in summary, on the whole, that is, therefore, to summarize.

To show sequence: after X minutes/hours/days/months/years, afterward, again, also, at last, at length, at that time, besides, eventually, finally, formerly, further, furthermore, in addition, first, in the past, last, lately, meanwhile, moreover, next, second, shortly, simultaneously, since, so far, soon, still, subsequently, then, thereafter, until now.

Appendix XII

UK vs. US English

The most important differences between the English of the United Kingdom and the English of the United States are in pronunciation and vocabulary, especially colloquial vocabulary. Neither of these differences is important for scientific writing. Here there is a list of the few differences between the two varieties that can affect scientific writing.

Spelling

Differences between American and British spelling tend to be systematic and relatively easy to learn. Be sure to select the correct variety of English in your word processor's toolbox and to add new words to a personal dictionary for each variety. Although most journals accept manuscripts written in either variety, nearly all caution against mixing British and American spellings in the same document. The following table lists the most common differences and a few examples for each.

UNITED KINGDOM	UNITED STATES
RE	ER
calibre	caliber
centre	center
fibre	fiber
goitre	goiter
litre	liter
metre	meter
theatre	theater
titre	titer
OU	O
behaviour	behavior
colour	color
favourite	favorite
humour	humor
tumour	tumor
AE	E
aetiology	etiology
anaemic	anemic
anaesthetic	anesthetic
caecum	cecum
haemolysis	hemolysis
paediatrics	pediatrics

Continue

UNITED KINGDOM	UNITED STATES
OE	E
diarrhoea	diarrhea
dyspnoea	dyspnea
foetus	fetus
manoeuvre	maneuver
oedema	edema
oesophageal	esophageal
oestradiol	estradiol
S	Z
<i>But note that Z is becoming more common in British English</i>	
analyse	analyze
catheterisation	catheterization
criticise	criticize
ionising	ionizing
organisation	organization
randomised	randomized
specialise	specialize
tranquilliser	tranquilizer
visualise	visualize
LL	L
bevelled	beveled
callipers	calipers
cancellation	cancelation
labelling	labeling
panellists	panelists
traveller	traveler
tunnelled	tunneled
L	LL
enrolment	enrollment
fulfil	fulfill
instalments	installments
skilful	skillful
PH	F
<i>The Royal Society of Chemistry recommends the F spelling.</i>	
sulphur	sulfur
sulphuric	sulfuric
sulphatase	sulfatase
sulphonamides	sulfonamides

UNITED KINGDOM	UNITED STATES
C	K
sceptical	skeptical
leucocyte	leukocyte
leucopenia	leukopenia
leucorrhœa	leukorrhea
<i>But note leukaemia</i>	leukemia
C and S	C or S
defence	defense
licence (noun), license (verb)	license (noun and verb)
offence	offense
practice (noun), practise (verb)	practice (noun and verb)
pretence	pretense
X	CT
connexion	connection
infexion	inflection
Connection and inflection are also common	<i>But note flexion</i>
MISCELLANEOUS	
acknowledgements	acknowledgments
analogue	analog (<i>analogue is also common</i>)
artefacts	artifacts
cheque (money)	check (all uses)
grey	gray
judgement	judgment
per cent (<i>two words</i>)	percent (<i>one word</i>)
programme (<i>for congresses, concerts, etc. But computer program</i>)	program (<i>all types</i>)
speciality	specialty
COMPOUND MEDICAL WORDS	
<i>Tend to be hyphenated, though there is a strong current trend to write these words without hyphens</i>	<i>Tend to be written without hyphens</i>
pancreato-duodeno-cystomy	pancreatoduodenocystomy
sterno-cleido-mastoid	sternocleidomastoid
ventriculo-peritoneal	ventriculoperitoneal

Continue

Grammar

There are also a few differences in grammar between UK and US English.

The use of the definitive article in some common expressions differs:

UNITED KINGDOM	UNITED STATES
In future	In the future
In/to hospital	In/to the hospital
In the light of	In light of
In the press	In press
At university	In/at the university

There are also a few differences in the use of prepositions:

UNITED KINGDOM	UNITED STATES
At weekends	On weekends
At school	In school
Different to (from is also common)	Different from
The hospital is in the High Street	The hospital is on Main Street
Monday to Friday	Monday through Friday
On heat (in estrus)	In heat
Up to chapter 3	Through chapter 3

Collective nouns

In the English of the United Kingdom, collective nouns can take either the singular or plural verb forms, depending on whether the emphasis is on the collective as a whole or on the individual members respectively. Some collective nouns, such as the Government or staff, nearly always take the plural form of the verb. By contrast, in the English of the United States, collective nouns nearly always take a singular verb. When a speaker wants to emphasize that the individuals are acting separately, a plural verb is possible, but it is much more common to change the construction to avoid this usage (Instead of “The audience are taking their seats” “The members of the audience are taking their seats”).

United Kingdom: *The team are operating on a fifty-five-year-old woman with breast cancer.*

United States: *The team is operating on a fifty-five-year-old woman with breast cancer.*

Collective nouns with plural forms take a plural verb in both the United Kingdom and the United States. *The Rolling Stones are doing a concert to raise money for Doctors without Borders.*

There are also minor differences in the use of some verbs; for example, past participles sometimes change, some verbs are transitive in one and intransitive in the other, and phrasal verbs are sometimes used differently. These differences are unlikely to present problems in scientific writing.

Punctuation

A few differences in punctuation practices are worth mentioning.

UNITED KINGDOM

The punctuation mark to end a sentence is called a full stop.

The abbreviations Mr, Mrs, Ms, and Dr are not followed by full stops.

(between brackets)

[between square brackets]

UNITED STATES

The punctuation mark to end a sentence is called a period.

The abbreviations Mr., Mrs., Ms., and Dr. are followed by periods.

(between parentheses)

[between brackets]

Appendix XIII

Useful websites

SCITABLE

<http://www.nature.com/scitable>

The Nature Publishing Group's free science library and personal learning tool, concentrating mainly on genetics and cell biology, but also containing a section devoted to scientific communication.

<http://www.nature.com/scitable/topic/scientific-communication-14121566>

Organized as a course consisting of six self-contained units, this website contains dozens of resources to help you master scientific communication. Unit 1: Basic communication strategies for various audiences. Unit 2: Designing and drafting scientific papers. Unit 3: Designing and drafting e-mails, résumés, and short reports. Unit 4: Structuring, supporting, and delivering oral presentations. Unit 5: Creating and presenting posters, chairing sessions, and participating in panels. Unit 6: Preparing, running, and evaluating classroom sessions. You can browse the list of selected entries for help on particular topics.

PURDUE OWL

<http://owl.english.purdue.edu/owl>

This online writing lab provides clear guidelines and examples, as well as lots of exercises. It includes special sections for speakers of English as a foreign language.

UNIVERSITY OF RICHMOND'S WRITER'S WEB

<http://writing2.richmond.edu/writing/wweb.html>

This free, public-access handbook provides clear advice about many topics in the writing process. It includes a general guide for writing most basic biology laboratory reports.

DUKE GRADUATE SCHOOL SCIENTIFIC WRITING RESOURCE

<https://cgi.duke.edu/web/sciwriting/index.php>

Three great lessons explain key principles and provide illustrative examples. Each is followed by a worksheet to help you put theory into practice.

CLINICAL CHEMISTRY GUIDE TO SCIENTIFIC WRITING

http://www.aacc.org/publications/clin_chem/ccgsw/Pages/default.aspx

A series of educational articles on how to design and write scientific research papers. Easy to read, full of useful information and illustrative examples. Spanish translation available.

ENGLISH FOR MEDICAL STUDENTS

<http://www.english-lss.com/English%20for%20Medical%20Students/Introduction.htm>

Based on a systems approach to the human body, this site contains a wealth of material covering anatomy, chemistry, microbiology, pharmacology, and physiology. Each unit contains readings to expand students' technical and nontechnical vocabulary, a variety of exercises for practicing different elements of grammar and vocabulary, listenings, and other activities like crossword puzzles, doctor-patient dialogues, and quizzes.

MEDLINEPLUS

<http://www.nlm.nih.gov/medlineplus/>

MedlinePlus is the National Institutes of Health's website for patients, who can learn about the latest treatments, look up information on a drug or supplement, find out the meanings of words, or view medical videos or illustrations. It also provides links to the latest medical research on your topic and information about clinical trials on a disease or condition.

You can switch back and forth between the English and Spanish versions.

Appendix XIV

Selected books and articles

- **Cómo escribir un artículo científico en inglés.** Guy Norman. Published by Editorial Hélice, 1999. 141 pp. Helpful advice for Spanish speakers about all aspects of publishing science in English, especially about organizing ideas and structuring papers.
- **The Elements of Style.** W. Strunk Jr. and E.B. White. 3rd edition published by Allyn and Bacon, 1979. 92 pp. ISBN 0-205-19158-4. A standard for many decades. It remains up-to-date and has the merit of brevity. An on-line version of this book is available at <http://www.bartleby.com/141/>
- **Essentials of Writing Biomedical Research Papers.** Mimi Zeiger. 2nd edition published by McGraw-Hill, 2000. 440 pp. ISBN 0071345442. Excellent explanation and useful exercises. Written for advanced, native English-speaking students.
- **The Craft of Scientific Writing.** M. Alley. 3rd edition published by Springer, 1996. 282 pp. ISBN 0-387-94766-3. Great explanations of the less tangible elements of expository style and examples from a wide variety of authors and disciplines.
- **The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid.** M. Alley. Published by Springer, 2003. 241 pp. ISBN 0-387-95555-0. Provides scores of examples of scientific presentations to show what makes an effective presentation.
- **Writing, Speaking, & Communication Skills for Health Professionals.** The Health Care Communication Group. Published by Yale University Press, 2001. 338 pp. ISBN 0-300-08861-2. Offers practical advice on a broad range of essential medical communication skills.
- **Preparing and Delivering Scientific Presentations: A Complete Guide for International Medical Scientists.** J. Giba and R. Ribes. Published by Springer, 2011. 153 pp. ISBN 10-3-642-15888-9. Aimed especially at non-native English-speaking physicians and biomedical scientists, this book gives clear advice on scientific presentations, includes dealing with questions, chairing sessions, and avoiding common pitfalls in English usage and pronunciation.
- **Inglés Médico y Sanitario.** R. Ribes and J. Giba. Published by Editorial LID, 2010. 352 pp. ISBN 978-848-35611-7-1. Clear and thorough explanation with illustrative examples of points Spanish speakers must understand if they want to master biomedical English.
- **Scientific English: A Guide for Scientists and Other Professionals.** R.A. Day. 2nd edition published by Oryx, 1995. 148 pp. ISBN 0-89774-989-8. A simple nuts and bolts approach to clear writing.
- **Mastering Scientific and Medical Writing: A Self-Help Guide.** S. Rogers. Published by Springer, 2007. 146 pp. ISBN 103-540-34507-8. Explains important aspects of scientific writing and offers some exercises. Especially useful for non-native-English speakers.

ESTEVE FOUNDATION NOTEBOOKS

1. Guardiola E, Baños JE. Eponímia mèdica catalana. Quaderns de la Fundació Dr. Antoni Esteve, Nº 1. Barcelona: Prous Science; 2003.
2. Debates sobre periodismo científico. A propósito de la secuenciación del genoma humano: interacción de ciencia y periodismo. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 2. Barcelona: Prous Science; 2004.
3. Palomo L, Pastor R, coord. Terapias no farmacológicas en atención primaria. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 3. Barcelona: Prous Science; 2004.
4. Debates sobre periodismo científico. En torno a la cobertura científica del SARS. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 4. Barcelona: Prous Science; 2006.
5. Cantillon P, Hutchinson L, Wood D, coord. Aprendizaje y docencia en medicina. Traducción al español de una serie publicada en el British Medical Journal. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 5. Barcelona: Prous Science; 2006.
6. Bertomeu Sánchez JR, Nieto-Galán A, coord. Entre la ciencia y el crimen: Mateu Orfila y la toxicología en el siglo xix. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 6. Barcelona: Prous Science; 2006.
7. De Semir V, Morales P, coord. Jornada sobre periodismo biomédico. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 7. Barcelona: Prous Science; 2006.
8. Blanch LI, Gómez de la Cámara A, coord. Jornada sobre investigación en el ámbito clínico. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 8. Barcelona: Prous Science; 2006.
9. Mabrouki K, Bosch F, coord. Redacción científica en biomedicina: Lo que hay que saber. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 9. Barcelona: Prous Science; 2007.
10. Algorta J, Loza M, Luque A, coord. Reflexiones sobre la formación en investigación y desarrollo de medicamentos. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 10. Barcelona: Prous Science; 2007.
11. La ciencia en los medios de comunicación. 25 años de contribuciones de Vladimir de Semir. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 11. Barcelona: Fundación Dr. Antonio Esteve; 2007.
12. Debates sobre periodismo científico. Expectativas y desencantos acerca de la clonación terapéutica. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 12. Barcelona: Fundación Dr. Antonio Esteve; 2007.
13. González-Duarte R, coord. Doce mujeres en la biomedicina del siglo xx. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 13. Barcelona: Fundación Dr. Antonio Esteve; 2007.
14. Mayor Serrano MB. Cómo elaborar folletos de salud destinados a los pacientes. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 14. Barcelona: Fundación Dr. Antonio Esteve; 2008.
15. Rosich L, Bosch F, coord. Redacció científica en biomedicina: El que cal saber-ne. Quaderns de la Fundació Dr. Antoni Esteve, Nº 15. Barcelona: Fundació Dr. Antoni Esteve; 2008.
16. El enfermo como sujeto activo en la terapéutica. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 16. Barcelona: Fundación Dr. Antonio Esteve; 2008.
17. Rico-Villademoros F, Alfaro V, coord. La redacción médica como profesión. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 17. Barcelona: Fundación Dr. Antonio Esteve; 2009.
18. Del Villar Ruiz de la Torre JA, Melo Herráiz E. Guía de plantas medicinales del Magreb. Establecimiento de una conexión intercultural. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 18. Barcelona: Fundación Dr. Antonio Esteve; 2009.
19. González-Duarte R, coord. Dotze dones en la biomedicina del segle xx. Quaderns de la Fundació Dr. Antoni Esteve, Nº 19. Barcelona: Fundació Dr. Antoni Esteve; 2009.
20. Serés E, Rosich L, Bosch F, coord. Presentaciones orales en biomedicina. Aspectos a tener en cuenta para mejorar la comunicación. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 20. Barcelona: Fundación Dr. Antonio Esteve; 2010.
21. Francescutti LP. La información científica en los telediarios españoles. Cuadernos de la Fundación Dr. Antonio Esteve, Nº 21. Barcelona: Fundación Dr. Antonio Esteve; 2010.

22. Guardiola E, Baños JE. Eponímia mèdica catalana (II). Quaderns de la Fundació Dr. Antoni Esteve, N° 22. Barcelona: Fundació Dr. Antoni Esteve; 2011.
23. Muguerza P. Manual de traducción inglés-español de protocolos de ensayos clínicos. Cuadernos de la Fundación Dr. Antonio Esteve, N° 23. Barcelona: Fundación Dr. Antonio Esteve; 2012.
24. Marušić A, Marcovitch H, coord. Competing interests in biomedical publications. Main guidelines and selected articles. Esteve Foundation Notebooks, N° 24. Barcelona: Esteve Foundation; 2012.
25. De Semir V, Revuelta G, coord. El periodismo biomédico en la era 2.0. Cuadernos de la Fundación Dr. Antonio Esteve, N° 25. Barcelona: Fundación Dr. Antonio Esteve; 2012.
26. Casino G, coord. Bioestadística para periodistas y comunicadores. Cuadernos de la Fundación Dr. Antonio Esteve, N° 26. Barcelona: Fundación Dr. Antonio Esteve; 2013.
27. Carrió M, Branda LA, Baños JE, coord. El aprendizaje basado en problemas en sus textos. Ejemplos de su empleo en biomedicina. Cuadernos de la Fundación Dr. Antonio Esteve, N° 27. Barcelona: Fundación Dr. Antonio Esteve; 2013.
28. El científico ante los medios de comunicación. Retos y herramientas para una cooperación fructífera. Cuadernos de la Fundación Dr. Antonio Esteve, N° 28. Barcelona: Fundación Dr. Antonio Esteve; 2013.

Clear explanations, illustrative examples, and 90 exercises make this book a practical way to improve your scientific writing. Suitable for beginners and experienced writers alike, it guides you toward more effective communication while pointing out pitfalls along the way.

Covering general principles and myriad details about key topics,

- organization and structure
- scientific style
- coherency and cohesion.

It emphasizes controlled practice to develop the skills you need to write well.

A companion notebook discussing the answers to all the exercises can be downloaded for free at www.esteve.org

