CHAPTER 53

Writing in the Natural and Applied Sciences

The natural and applied sciences include biology, chemistry, physics, mathematics, engineering, computer science, and their branches. Their purpose is to understand natural and technological phenomena. (A *phenomenon* is a fact or event that can be known by the senses.) Scientists conduct experiments and write to explain the step-by-step processes in their methods of inquiry and discovery.

53a Using the methods and evidence of the sciences

Scientists investigate phenomena by the **scientific method,** a process of continual testing and refinement.

Scientific evidence is almost always quantitative—that is, it consists of numerical data obtained from the measurement of phenomena. These data are called **empirical** (from a Greek word for "experience"); they result from observation and experience, generally in a controlled laboratory setting but also (as sometimes in astronomy or biology) in the natural world. Often the empirical evidence for scientific writing comes from library research into other people's reports of their investigations. Surveys of known data or existing literature are common in scientific writing.

53b Understanding writing assignments in the sciences

No matter what your assignment, you will be expected to document and explain your evidence carefully so that anyone reading can check your sources and replicate your research. It is important for your reader to know the context of your research—both the previous experimentation and research on your particular subject (acknowledged in the survey of the literature) and the physical conditions and other variables surrounding your own work.

Assignments in the natural and applied sciences include the following:

- **A summary** distills a research article to its essence in brief, concise form. (Summary is discussed in detail on pp. 140–42.)
- **A critique** summarizes and critically evaluates a scientific report.
- **A laboratory report** explains the procedure and results of an ex-periment conducted by the writer. (See p. 820 for an example.)
- **A research report** explains the experimental research of other scientists and the writer's own methods, findings, and conclusions.
- **A research proposal** reviews the relevant literature and explains a plan for further research.

A laboratory report has four or five major sections:

1. **"Abstract":** a summary of the report.
2. **"Introduction" or "Objective":** a review of why the study was undertaken, a summary of the background of the study, and a statement of the problem being studied.
3. **"Method" or "Procedure":** a detailed explanation of how the study was conducted, including any statistical analysis.

4. **"Results":** an explanation of the major findings (including unexpected results) and a summary of the data presented in graphs and tables.
5. **"Discussion":** an interpretation of the results and an explanation of how they relate to the goals of the experiment. This section also describes new hypotheses that might be tested as a result of the experiment. If the section is brief, it may be combined with the previous section in a single section labeled "Conclusions."

In addition, laboratory or research reports may include a list of references (if other sources were consulted). They almost always include tables and figures (graphs and charts) containing the data from the research (see p. 822).

53c Using the tools and language of the sciences

Tools and language concerns vary from discipline to discipline in the sciences. Consult your instructor for specifics about the field in which you are writing. You can also discover much about a discipline's tools and language from the research sources listed on the next three pages.

1 Writing tools

In the sciences a **lab notebook** or **scientific journal** is almost indispensable for accurately recording the empirical data from observations and experiments. Use such a notebook or journal for these purposes:

- **Record observations** from reading, from class, or from the lab.
- **Ask questions and refine hypotheses.**
- **Record procedures.**
- **Record results.**
- **Keep an ongoing record of ideas and findings** and how they change as data accumulate.
- **Sequence and organize your material** as you compile your findings and write your report.

Make sure that your records of data are clearly separate from your reflections on the data so that you don't mistakenly confuse the two in drawing your conclusions.

2 Language considerations

Science writers prefer to use objective language that removes the writer as a character in the situation and events being explained, except as the impersonal agent of change, the experimenter. Although usage is changing, scientists still rarely use *I* in their reports and evaluations, and they often resort to the passive voice of verbs, as in *The mixture was then subjected to centrifugal force.* This conscious objectivity focuses attention (including the writer's) on the empirical data and what they show. It discourages the writer from, say, ascribing motives and will to animals and plants. For instance, instead of asserting that the sea tortoise *evolved* its hard shell *to protect* its body, a scientist would write only what could be observed: that the hard shell *covers and thus protects* the tortoise's body.

Science writers typically change verb tenses to distinguish between established information and their own research. For established information, such as that found in journals and other reliable sources, use the present tense: *Baroreceptors monitor blood pressure.* For your own and others' research, use the past tense: *The bacteria died within three hours. Marti reported some success*.

Each discipline in the natural and applied sciences has a specialized vocabulary that permits precise, accurate, and efficient communication. Some of these terms, such as *pressure* in physics, have different meanings in the common language and must be handled carefully in science writing. Others, such as *enthalpy* in chemistry, have no meanings in the common language and must simply be learned and used correctly.

3 Research sources

The following lists give resources in the sciences.

ν Specialized encyclopedias, dictionaries, and bibliographies

American Medical Association Encyclopedia of Medicine
Bibliographic Guide to the History of Computing, Computers, and the Infor-mation Processing Industry
Concise Oxford Dictionary of Mathematics
Dorland's Illustrated Medical Dictionary
Encyclopedia of Bioethics
Encyclopedia of Chemistry
Encyclopedia of Computer Science and Technology
Encyclopedia of Ecology
Encyclopedia of Electronics
Encyclopedia of Oceanography
Encyclopedia of Physics
Encyclopedic Dictionary of Mathematics
Grzimek's Animal Life Encyclopedia
Information Sources in the Life Sciences
Introduction to Reference Sources in Health Sciences
McGraw-Hill Encyclopedia of Engineering
McGraw-Hill Encyclopedia of the Geological Sciences
McGraw-Hill Encyclopedia of Science and Technology
Science and Technology in World History
Space Almanac
Van Nostrand's Scientific Encyclopedia
World Resources (environment)

ν Indexes

ACM Guide to Computing Literature
Applied Science and Technology Index
Bibliography and Index of Geology
Biological Abstracts
Biological and Agricultural Index
Chemical Abstracts
Compendex Engineering Index
Computer Abstracts
Computer Literature Index
Cumulative Index to Nursing and Allied Health Literature
Dissertation Abstracts International
Ecology Abstracts
Engineering Index
Environment Abstracts
General Science Index
Index Medicus
MathSciNet: Mathematical Reviews
Physics Abstracts
Science Citation Index

ν Book reviews

Technical Book Review Index

ν Web sources

For updates of these sources and URLs, visit *ablongman.com/ littlebrown*.

General

BUBL Link: Natural Sciences and Mathematics (*bubl.ac.uk/link/linkbrowse .cfm?menuid=6402*)
Google Directory: Science (*directory.google.com/Top/Science*)
Librarians' Index to the Internet: Science (*lii.org/search/file/scitech*)
The National Academies: Science, Engineering, and Medicine (*nas.edu*)
WWW Virtual Library: Natural Sciences and Mathematics (*vlib.org/Science .html*)

Biology
BioMedNet (*bmn.com*)

Biology Online (*biology-online.org*)

Biology.Arizona.Edu (*biology.arizona.edu*)
National Biological Information Infrastructure (*www.nbii.gov*)

Chemistry
Chemistry.org (*chemistry.org/portal/a/c/s/1/home.html*)
WWW Virtual Library: Links for Chemists (*liv.ac.uk/Chemistry/Links/links .html*)

Computer science
IEEE Computer Society (*computer.org*)
University of Texas Virtual Computer Library (*utexas.edu/computer/vcl*)
WWW Virtual Library: Computing and Computer Science (*vlib.org/ Computing*)

Engineering
American Society of Civil Engineers (*pubs.asce.org*)
Internet Guide to Engineering, Mathematics, and Computing (*eevl.ac.uk*)
National Academy of Engineering (nae.edu)

Environmental science
Center for International Earth Science Information Network (*ciesin.org*)
EE-Link: Environmental Education on the Internet (*eelink.net*)
EnviroLink (*envirolink.org*)
Environment Directory (*webdirectory.com*)

Geology
American Geological Institute (*www.agiweb.org*)
Digital Library for Earth System Education (*dlese.org*)
Geosource (*www.library.uu.nl/geosource*)
US Geological Survey Library (*library.usgs.gov*)

Health sciences
American Medical Association (*ama-assn.org*)
Centers for Disease Control and Prevention (*www.cdc.gov*)
Hardin MD (*www.lib.uiowa.edu/hardin/md*)
World Health Organization (*who.int/en*)

Mathematics
Math on the Web (*www.ams.org/mathweb*)
Internet Mathematics Library (*mathforum.org/library*)
Mathematical Atlas (*math-atlas.org*)

Physics and astronomy
American Institute of Physics (*aip.org*)
Astronomy Links (*astronomylinks.com*)
PhysicsWeb (*physicsweb.org*)
Science@NASA (*science.hq.nasa.gov/index.html*)

53d Citing sources in CSE style

Within the natural and applied sciences, practitioners use one of two styles of documentation, varying slightly from discipline to discipline. Following are some of the style guides most often consulted:

American Chemical Society, *ACS Style Guide: A Manual for Authors and Editors,* 2nd ed., 1997
American Institute of Physics, *Style Manual for Guidance in the Preparation of Papers,* 4th ed., 1997
American Medical Association Manual of Style, 9th ed., 1998

Council of Biology Editors, *Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers,* 6th ed., 1994

The most thorough and widely used of these guides is the last one, *Scientific Style and Format*. Its sponsoring organization, the Council of Science Editors, was until 2000 called the Council of Biology Editors, so the style is abbreviated either CSE (as in this book) or CBE.

Scientific Style and Format details both styles of scientific documentation: one using author and date and one using numbers. Both types of text citation refer to a list of references at the end of the paper (see the next page). Ask your instructor which style you should use.

1 Using CSE name-year text citations

In the CSE name-year style, parenthetical text citations provide the last name of the author being cited and the source's year of publication. At the end of the paper, a list of references, arranged alphabetically by authors' last names, provides complete information on each source.

The CSE name-year style closely resembles the APA name-year style detailed on pages 785–88. You can follow the APA examples for in-text citations, making several notable changes for CSE:

- **Do not use a comma to separate the author's name and the date:** `(Baumrind 1968, p. 34).`
- **Separate two authors' names with and (not "&"):** `(Pepinsky and DeStefano 1997).`
- **Use and others (not "et al.") for three or more authors:** `(Rutter and others 1996).`
- **List unnamed or anonymous authors as Anonymous,** both in the citation and in the list of references: `(Anonymous 1976).`

2 Using CSE numbered text citations

In the CSE number style, raised numbers in the text refer to a numbered list of references at the end of the paper.

Two standard references[1,2] use this term.

These forms of immunity have been extensively researched.[3]

Hepburn and Tatin[2] do not discuss this project.

Assignment of numbers The number for each source is based on the order in which you cite the source in the text: the first cited source is 1, the second is 2, and so on.

Reuse of numbers When you cite a source you have already cited and numbered, use the original number again (see the last ex-ample above, which reuses the number 2 from the first example).

This reuse is the key difference between the CSE numbered citations and numbered references to footnotes or endnotes. In the CSE style, each source has only one number, determined by the order in which the source is cited. With notes, in contrast, the numbering proceeds in sequence, so that each source has as many numbers as it has citations in the text.

Citation of two or more sources When you cite two or more sources at once, arrange their numbers in sequence and separate them with a comma and no space, as in the first example on the previous page.

3 Using a CSE reference list

For both the name-year and the number styles of in-text citation, provide a list, titled `References`, of all sources you have cited. Format the page as shown for APA references on page 788, except that CSE entries are single-spaced.

The following examples show the differences and similarities between the name-year and number styles:

Name-year style
Hepburn PX, Tatin JM. 2005. Human physiology. New York: Columbia Univ Pr. 1026 p.

Number style
2. Hepburn PX, Tatin JM. Human physiology. New York: Columbia Univ Pr; 2005. 1026 p.

Spacing In both styles, single-space each entry and double-space between entries.

Arrangement In the name-year style, arrange entries alphabetically by authors' last names. In the number style, arrange entries in numerical order—that is, in order of their citation in the text.

Format In both styles, begin the first line of each entry at the left margin and indent subsequent lines.

Authors In both styles, list each author's name with the last name first, followed by initials for first and middle names. Do not use a comma between an author's last name and initials, and do not use periods or spaces with the initials. Do use a comma to separate authors' names.

Placement of dates In the name-year style, the date follows the author's or authors' names. In the number style, the date follows the publication information (for a book) or the periodical title (for a journal, magazine, or newspaper).

Journal titles In both styles, do not underline or italicize journal titles. For titles of two or more words, abbreviate words of six or more letters (without periods) and omit most prepositions, articles, and conjunctions. Capitalize each word. For example, *Journal of Chemical and Biochemical Studies* becomes `J Chem Biochem Stud.`

Book and article titles In both styles, do not underline, italicize, or use quotation marks around a book or an article title. Capitalize only the first word and any proper nouns.

Publication information for journal articles The name-year and number styles differ in the placement of the publication date (see opposite). However, both styles end with the journal's volume number, any issue number in parentheses, a colon, and the inclusive page numbers of the article, run together without space: `28:329-30` or `62(2):26-40`.

The following box indexes the CSE models. The examples include both a name-year reference and a number reference for each type of source.

Books

1. A book with one author

Gould SJ. 1987. Time's arrow, time's cycle. Cambridge: Harvard Univ Pr. 222 p.

1. Gould SJ. Time's arrow, time's cycle. Cambridge: Harvard Univ Pr; 1987. 222 p.

2. A book with two to ten authors

Hepburn PX, Tatin JM. 2005. Human physiology. New York: Columbia Univ Pr. 1026 p.

2. Hepburn PX, Tatin JM. Human physiology. New York: Columbia Univ Pr; 2005. 1026 p.

3. A book with more than ten authors

Evans RW, Bowditch L, Dana KL, Drummond A, Wildovitch WP, Young SL, Mills P, Mills RR, Livak SR, Lisi OL, and others. 2004. Organ transplants: ethical issues. Ann Arbor: Univ of Michigan Pr. 498 p.

3. Evans RW, Bowditch L, Dana KL, Drummond A, Wildovitch WP, Young SL, Mills P, Mills RR, Livak SR, Lisi OL, and others. Organ transplants: ethical issues. Ann Arbor: Univ of Michigan Pr; 2004. 498 p.

4. A book with an editor

Jonson P, editor. 2006. Anatomy yearbook 2005. Los Angeles: Anatco. 628 p.

4. Jonson P, editor. Anatomy yearbook 2005. Los Angeles: Anatco; 2006. 628 p.

5. A selection from a book

Krigel R, Laubenstein L, Muggia F. 2005. Kaposi's sarcoma. In: Ebbeson P, Biggar RS, Melbye M, editors. AIDS: a basic guide for clinicians. 2nd ed. Philadelphia: WB Saunders. p 100-26.

5. Krigel R, Laubenstein L, Muggia F. Kaposi's sarcoma. In: Ebbeson P, Biggar RS, Melbye M, editors. AIDS: a basic guide for clinicians. 2nd ed. Philadelphia: WB Saunders; 2005. p 100-26.

6. An anonymous work

[Anonymous]. 2006. Health care for multiple sclerosis. New York: US Health Care. 86 p.

6. [Anonymous]. Health care for multiple sclerosis. New York: US Health Care; 2006. 86 p.

7. Two or more cited works by the same author published in the same year

Gardner H. 1973a. The arts and human development. New York: J Wiley. 406 p.

Gardner H. 1973b. The quest for mind: Piaget, Lévi-Strauss, and the structuralist movement. New York: AA Knopf. 492 p.

(The number style does not require such forms.)

Periodicals: Journals, magazines, newspapers

8. An article in a journal with continuous pagination throughout the annual volume

Ancino R, Carter KV, Elwin DJ. 2004. Factors contributing to viral immunity: a review of the research. Dev Biol 30:156-9.

8. Ancino R, Carter KV, Elwin DJ. Factors contributing to viral immunity: a review of the research. Dev Biol 2004;30:156-9.

9. An article in a journal that pages issues separately

Kim P. 2001 Feb. Medical decision making for the dying. Milbank Quar 64(2):26-40.

9. Kim P. Medical decision making for the dying. Milbank Quar 2001 Feb;64(2):26-40.

10. An article in a newspaper

Kolata G. 2006 Jan 7. Kill all the bacteria! New York Times;Sect B:1(col 3).

10. Kolata G. Kill all the bacteria! New York Times 2006 Jan 7;Sect B:1(col 3).

11. An article in a magazine

Scheiber N. 2004 June 24. Finger tip: why fingerprinting won't work. New Republic:15-6.

11. Scheiber N. Finger tip: why fingerprinting won't work. New Republic 2004 June 24:15-6.

Electronic sources

Scientific Style and Format includes a few formats for citing electronic sources, derived from *National Library of Medicine Recommended Formats for Bibliographic Citation.* For additional formats, the CSE Web site recommends the NLM 2001 supplement for Internet sources. The following models adapt these NLM formats to CSE name-year and number styles.

Note Since neither the CSE nor the NLM specifies how to break URLs at the ends of lines, follow APA style: break only after slashes or before periods, and do not hyphenate.

12. A source on CD-ROM

Reich WT, editor. 2005. Encyclopedia of bioethics [CD-ROM]. New York: Co-Health.

12. Reich WT, editor. Encyclopedia of bioethics [CD-ROM]. New York: Co-Health; 2005.

13. An online journal article

Grady GF. 2005. The here and now of hepatitis B immunization. Today's Med [Internet] [cited 2005 Dec 7];6(2):39-41. Available from: http:// www.fmrt.org/todaysmedicine/Grady050293.pdf6

13. Grady GF. The here and now of hepatitis B immunization. Today's Med [Internet] 2005 [cited 2005 Dec 7];6(2):39-41. Available from: http://www.fmrt.org/todaysmedicine/Grady050293.pdf6

Give the date of your access, preceded by "cited," in brackets: `[cited 2005 Dec 7]` in the models above. If the article has no reference numbers (pages, paragraphs, and so on), estimate the length in brackets—for instance, `[about 15 p.]` or `[about 6 screens].`

14. An online book

Ruch BJ, Ruch DB. 2004. Homeopathy and medicine: resolving the conflict [Internet]. New York: Albert Einstein Coll of Medicine [cited 2006 Jan 28]. [about 50 p.]. Available from: http://www.einstein.edu/ medicine/books/ruch.html

14. Ruch BJ, Ruch DB. Homeopathy and medicine: resolving the conflict [Internet]. New York: Albert Einstein Coll of Medicine; 2004 [cited 2006 Jan 28]. [about 50 p.]. Available from: http://www.einstein.edu/ medicine/books/ruch.html

As with an online journal article, give the date of your access, preceded by `cited`, in brackets. If the source uses page or other reference numbers, provide the total as in model 1 on page 815. If no reference numbers are provided, you may estimate them in brackets, as in the examples above.

15. A source retrieved from an online database

McAskill MR, Anderson TJ, Jones RD. 2005. Saccadic adaptation in neurolog-ical disorders. Prog Brain Res 140:417-31. In: PubMed [Internet]. Bethesda (MD): National Library of Medicine; [cited 2005 Mar 6]. Available from: http://www.ncbi.nlm.nih.gov/PubMed; PMID: 12508606.

15. McAskill MR, Anderson TJ, Jones RD. Saccadic adaptation in neurological disorders. Prog Brain Res 2005;140:417-31. In: PubMed [Internet]. Bethesda (MD): National Library of Medicine; [cited 2005 Mar 6]. Available from: http://www.ncbi.nlm.nih.gov/PubMed; PMID: 12508606.

After `In:` provide information on the database: title, place of publication, and publisher. (If the database author is different from the publisher, give the author's name before the title.) If you see a date of publication or copyright date for the database, give it after the publisher's name. Add the date of your access, preceded by `cited`, in brackets. After the availability statement, add any identifying number the database uses for the source.

16. A Web site

American Medical Association [Internet]. 2006. Chicago: American Medical Association; [cited 2006 Jan 26]. Available from: http://ama-assn.org

16. American Medical Association [Internet]. Chicago: American Medical Association; 2006 [cited 2006 Jan 26]. Available from: http://ama-assn.org

17. Electronic mail

Millon M. 2005 May 4. Grief therapy [Internet]. Message to: Naomi Sakai. 3:16 pm [cited 2005 May 4]. [about 2 screens].

17. Millon M. Grief therapy [Internet]. Message to: Naomi Sakai. 2005 May 4, 3:16 pm [cited 2005 May 4]. [about 2 screens].

18. A posting to a discussion list

Stalinsky Q. 2005 Aug 16. The hormone-replacement study. In: Women Physicians Congress [Internet]. [Chicago: American Medical Association]; 9:26 am [cited 2005 Aug 17]. [about 8 paragraphs]. Available from: ama-wpc@ama-assn.org

18. Stalinsky Q. The hormone-replacement study. In: Women Physicians Congress [Internet]. [Chicago: American Medical Association]; 2005 Aug 16, 9:26 am [cited 2005 Aug 17]. [about 8 paragraphs]. Available from:
ama-wpc@ama-assn.org

19. Computer software

Project scheduler 9000 [computer program]. 2006. Version 5.1. Orlando (FL): Scitor. CD-ROM. System requirements: IBM PC or compatible; Win-dows 98 or higher; 32 MB RAM; minimum 50 MB free disk space.

19. Project scheduler 9000 [computer program]. Version 5.1. Orlando (FL): Scitor; 2006. CD-ROM. System requirements: IBM PC or compatible; Windows 98 or higher; 32 MB RAM; minimum 50 MB free disk
space.

v Other sources

20. A government publication

Committee on Science and Technology, House (US). 2003. Hearing on pro-curement and allocation of human organs for transplantation. 108th Cong., 1st Sess. House Doc. nr 409.

20. Committee on Science and Technology, House (US). Hearing on pro-curement and allocation of human organs for transplantation. 108th Cong., 1st Sess. House Doc. nr 409; 2003.

21. A nongovernment report

Warnock M. 2004. Report of the Committee on Fertilization and Embryology. Baylor University, Department of Embryology. Waco (TX): Baylor Univ. Report nr BU/DE.4261.

21. Warnock M. Report of the Committee on Fertilization and Embryology. Baylor University, Department of Embryology. Waco (TX): Baylor Univ; 2004. Report nr BU/DE.4261.

22. A sound recording, video recording, DVD, or film

Teaching Media. 2005. Cell mitosis [DVD]. White Plains (NY): Teaching Media. 40 min, sound, color.

22. Cell mitosis [DVD]. White Plains (NY): Teaching Media; 2005. 40 min, sound, color.

53e Formatting documents in CSE style

Scientific Style and Format is not specific about margins, spacing for headings, and other elements of document format. Unless your instructor specifies otherwise, you can use the format of the APA (pp. 800–03). The CSE exception to this style is the list of references, which is described on pages 814–15.

The most troublesome aspects of manuscript preparation in the sciences are equations or formulas, tables, and figures. When typing equations or formulas, be careful to reproduce alignments, indentions, underlining, and characters accurately. If your word processor lacks special characters, leave space for them and write them in by hand.

Because you will be expected to share your data with your readers, most of your writing for the sciences is likely to require illustrations to present the data in concise, readable form. Tables usually summarize raw data (see p. 822 for an example), whereas figures (mainly charts and graphs) recast the data to show noteworthy comparisons or changes. Follow the guidelines on pages 121–25 for preparing tables and figures.

53f Examining a sample science paper

The following biology paper illustrates the CSE number style for documenting sources. On page 823 passages from the paper and a reformatted list of references show the name-year style. Except for the citations and the references, the paper is formatted in APA style because CSE does not specify a format.

ν A laboratory report: CSE number style

[Title page.]

Exercise and Blood Pressure
Liz Garson
Biology 161
Ms. Traversa
December 13, 2005

[New page.]

Abstract

The transient elevation of blood pressure following exercise was demonstrated by pressure measurements of twenty human subjects before and after exercise.

[New page.]

Exercise and Blood Pressure

Introduction

The purpose of this experiment was to verify the changes in blood pressure that accompany exercise, as commonly reported.1,2 A certain blood pressure is necessary for the blood to supply nutrients to the body tissues. Baroreceptors near the heart monitor pressure by determining the degree to which blood stretches the wall of the blood vessel.

[The introduction continues.]

During exercise, the metabolic needs of the muscles override the influence of the baroreceptors and result in an increase in blood pressure. This increase in blood pressure is observed uniformly (irrespective of sex or race), although men demonstrate a higher absolute systolic pressure than do women.3 During strenuous exercise, blood pressure can rise to 40 percent above baseline.1

Method

The subjects for this experiment were twenty volunteers from laboratory classes, ten men and ten women. All pressure measurements were performed using a standard sphygmomanometer, which was tested for accuracy. To ensure consistency, the same sphygmomanometer was used to take all readings. In addition, all measurements were taken by the same person to avoid discrepancies in method or interpretation.

The first pressure reading was taken prior to exercise as the subject sat in a chair. This pressure was considered the baseline for each subject. All subsequent readings were interpreted relative to this baseline.

In the experiment, the subjects ran up and down stairs for fifteen minutes. Immediately after exercising, the subjects returned to the laboratory to have their pressure measured. Thirty minutes later, the pressure was measured for the final time.

Results

Table 1 contains the blood pressure measurements for the male and female subjects. With the exception of subjects 3 and 14, all subjects demonstrated the expected post-exercise increase in blood pressure, with a decline to baseline or near baseline thirty minutes after exercise. The data for subjects 3 and 14 were invalid because the subjects did not perform the experiment as directed.

Discussion

As expected, most of the subjects demonstrated an increase in blood pressure immediately after exercise and a decline to near baseline levels thirty minutes after exercise. The usual pressure increase was 20-40 mmHg for the systolic pressure and 5-10 mmHg for the diastolic pressure.

[Table on a page by itself.]

Table 1. Blood pressure measurements for all subjects (mmHg)

Subject	Baselinea	Post-exercise	30-minute reading
Male			
1	110/75	135/80	115/75
2	125/80	140/90	135/85

3	125/70	125/70	125/70
4	130/85	170/100	140/90
5	120/80	125/95	120/80
6	115/70	135/80	125/75
7	125/70	150/80	130/70
8	130/80	145/85	130/80
9	140/75	180/85	155/80
10	110/85	135/95	115/80
Female			
11	110/60	140/85	115/60
12	130/75	180/85	130/75
13	125/80	140/90	130/80
14	90/60	90/60	90/60
15	115/65	145/70	125/65
16	100/50	130/65	110/50
17	120/80	140/80	130/80
18	110/70	135/80	120/75
19	120/80	140/90	130/80
20	110/80	145/90	120/80

aNormal blood pressure at rest: males, 110-130/60-90; females, 110-120/ 50-80.

In the two cases in which blood pressure did not elevate with exercise (subjects 3 and 14), the subjects simply left the laboratory and returned fifteen minutes later without having exercised. The experimental design was flawed in not assigning someone to observe the subjects as they exercised.
[New page.]

References

1. Guyton AC. Textbook of medical physiology. Philadelphia: WB Saunders; 2004. 998 p.

2. Rowell LB. Blood pressure regulation during exercise. Ann Med 1999;28:329-33.

3. Gleim GW, Stachenfeld NS. Gender differences in the systolic blood pressure response to exercise. Am Heart J 2001;121:524-30.

- **A laboratory report: CSE name-year style**

These excerpts from the preceding paper show documentation in CSE name-year style:

The purpose of this experiment was to verify the changes in blood pressure that accompany exercise, as commonly reported (Guyton 2004; Rowell 1999).

This increase in blood pressure is observed uniformly (irrespective of sex or race), although men demonstrate a higher absolute systolic pressure than do women (Gleim and Stachenfeld 2001). During strenuous exercise, blood pressure can rise to 40 percent above baseline (Guyton 2004).

References

Gleim GW, Stachenfeld NS. 2001. Gender differences in the systolic blood pressure response to exercise. Am Heart J 121:524-30.

Guyton AC. 2004. Textbook of medical physiology. Philadelphia: WB Saunders. 998 p.

Rowell LB. 1999. Blood pressure regulation during exercise. Ann Med 28:329-33.

The scientific method

- **Observe carefully.** Accurately note all details of the phenomenon being researched.
- **Ask questions about the observations.**
- **Formulate a *hypothesis,*** or preliminary generalization, that explains the observed facts.
- **Test the hypothesis** with additional observation or controlled experiments.
- **If the hypothesis proves accurate, formulate a *theory,*** or unified model, that explains *why*.
- **If the hypothesis is disproved, revise it or start anew.**

http://www.ablongman.com/littlebrown

Visit the companion Web site for more help with writing in the natural and applied sciences.

CSE reference-list models

Books

Periodicals

Electronic sources

Other sources