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A Glossary may be included (and is often helpful) in equation-laden articles with many different symbols (such as mathematical modeling or computational papers), specifying the units (and/or dimensions) as well as each definition. The Glossary will usually precede the Methods section.
Materials and Methods

Describe techniques, cell/animal models used, and lists of reagents, chemicals, and equipment, as well as the names of manufacturers and suppliers, including URLs for those supplies obtained online, so that your study can be most easily replicated by others. Also in this section, describe the statistical methods that were used to evaluate the data. If clinical trials were used, a statement of registration is required; also, for all investigations involving humans or animals, a statement of protocol approval from an IRB or IACUC, or an equivalent statement, must be included. All animal or human studies must contain an explicit statement that the protocols were submitted to, and approved by, an institutional review board or committee or that the protocols were performed under a license obtained from such a committee, board, or governing office. (see Use of Humans and/or Animals in Experiments above). See Abbreviations, Symbols, and Terminology (above) for style information.

Results

Provide the experimental data and results as well as the particular statistical significance of the data. APS has published an editorial on the use of statistics (http://physiolgenomics.physiology.org/cgi/content/full/18/3/249), and authors are encouraged to consult it.

Discussion

(Sometimes combined with the results in a section called “Results and Discussion”). Explain your interpretation of the data, especially compared with previously published material cited in the References.

Appendix

An Appendix may be included (and is often helpful) in mathematical modeling or computational papers, e.g., to provide details of a solution strategy.

Acknowledgments

The Acknowledgments section is where you may thank people indirectly involved with the research (e.g., technical assistance, gifts of samples, reagents, or cell lines, loans of equipment or laboratory space, comments or suggestions during the creation of the manuscript). However, it is important that anyone listed here know in advance of your acknowledgment of their contribution, as documented during the submission process.

Current addresses of authors (which may differ from those in the affiliation line) may be included here.

Do not include “promissory notes.” APS Journal policy is against inclusion of implicit or explicit promises that future work will be published.

Do not include dedications (e.g., to persons living or deceased). Dedications of articles are not permitted.

Grants

List the grants, fellowships, and donations that funded (partially or completely) the research. However, industry-sponsored grants should be listed under Disclosures.

Disclosures

Authors are required at the time of submission to disclose to the APS Publications Office any potential conflict of interest, financial or otherwise. See the Conflict of Interest description above, or see the complete details of the APS Ethical Policies at http://www.the-aps.org/publications/authorinfo, which also appears at the end of this document. If the article is accepted for publication, information on the potential conflict of interest, or lack thereof, must be noted by the author in the manuscript file as a “Disclosures” statement near the Acknowledgments section of the paper.

Author Contributions

Include a brief itemized list describing in concise terms how each author contributed to the study. This list must be included in the manuscript file and will be published in the article, if accepted.

Citing Unpublished Observations, Personal Communications and In Press Manuscripts

Submitted papers still in preparation or in peer review and/or any other unpublished materials, observations, or personal communications cannot be included in the reference list, which may only list published work. However, such material can be cited in the text, but at submission, authors will be required to confirm that all individuals acknowledged in the manuscript are aware that they are being acknowledged and approve of the manner and the context of the acknowledgement. This includes, but is not limited to the following circumstances:

• to publish information disclosed in a personal communication or unpublished observation
• to recognize additional individuals who helped in preparation of the manuscript
• for permission from a copyright holder to discuss information that has been accepted for publication but is “in press” and not yet available, online or otherwise.

Reference List

Authors are responsible for accuracy of citations. References must be limited to directly pertinent published works or papers that have been accepted for publication. An abstract, properly identified as “Abstract”, may be cited only when it is the sole source.

Reference lists should be arranged alphabetically by author and numbered serially. The reference number should be placed in parentheses at the appropriate place in the text.

The examples given below are shown with numbers because that is the style for most APS Journals, except for the Journal of Neurophysiology (see note, below, after these examples).

For an exhaustive set of examples for properly citing various types of publications, including articles published on the web, technical documents, congress proceedings, articles with errata/corrigenda, translations, and articles with large groups of authors, go to http://www.the-aps.org/publications/authorinfo/examplerfs.htm.

The style of citation should be as shown in the following examples, with journal name abbreviated as in Medline, PubMed, and Index Medicus. Appropriate templates for your citation management software are available from the respective company web sites.

The examples given below are shown with numbers because that is the style for most APS Journals, except for the Journal of Neurophysiology (see note, below, after these examples). The first is a standard journal reference; the second is a standard book reference; and the third a standard reference to an early view or “prepress” reference, such as the APS “Articles in PresS” (note the use of the “digital object identifier”—doi—in this citation).


Note for reference lists in the Journal of Neurophysiology

Reference lists for the Journal of Neurophysiology should be arranged alphabetically by author. For in text citations, appropriate author name and year for each reference should be included in parentheses at the proper point in the text using the following style (this is ONLY for the Journal of Neurophysiology, NOT for other APS Journals):

• One author (Brown 1982).
• Two authors (Brown and Smith 1982).
• Three or more authors (Brown et al. 1982).

For the in text citations in the Journal of Neurophysiology, here are some other important details. If more than two references are cited by different authors, separate entries with a semicolon (Brown et al. 1982; Smith 1983). If more than two references are cited by the same first author (or single author), use “et al.” where appropriate plus the date, even if the subsequent authors are not the same in all the references (Brown et al. 1982, 1983). Note the use of commas between two consecutive years or nonconsecutive years and do NOT use dashes for ranges (Brown et al. 1982, 1983, 1986, 1987, 1988, 1989). If more than two references with the same year and author(s) are cited, use lowercase letters after the year (Brown 1982a, 1982b). Lowercase letters should be inserted in the same-year references in the reference list.

Figure Captions

Every figure must have a descriptive figure caption, to describe to the reader in sentence form the relevant details of the figure, to place it in the proper context of the manuscript. These textual captions must be listed in order in the manuscript, following the reference list.
Footnotes
Text footnotes should be numbered consecutively throughout. These should be assembled on a separate page as endnotes.

Types of Articles
The APS Journals publish a variety of article types in addition to the regular research papers. For descriptions of the types of articles published in a particular journal, go to that journal’s page at the APS website (http://www.the-aps.org).

Special notes about Physiology in Medicine Series
*Physiology in Medicine (PIM)* is a series of articles published jointly by APS and Annals of Internal Medicine through 2010. The Series was published in Annals and is provided free online to APS through the links below. The aim of this series is to provide practicing MDs and/or researchers an up-to-date physiological understanding of disease with the proper application of new molecular models and tools. Articles published in this series are intended to provide a thoughtful and lucid linkage of science to the patient. The APS Publications Committee is continuing the series, with each journal soliciting PIM articles in their area of focus.

Manuscripts submitted for the PIM series should discuss a relatively narrow aspect of basic physiology as it relates to the pathophysiology or treatment of a specific disease (or group of diseases). The disease in question should be one that the specialist in internal medicine commonly encounters in his/her practice. By emphasizing a strong connection between laboratory research and clinical medicine, we hope to stimulate interest in translational research among clinicians and to encourage medical students and young physicians to follow a scientific pathway in their careers. However, authors should be aware that the PIM articles will be designed to appeal primarily to clinicians who may not be specifically trained in current laboratory methods so that descriptions of laboratory methods and physiological processes must be accessible to an intelligent, medically trained non-expert.

The main point of the PIM article should be to describe how important scientific discoveries or principles have affected our understanding of a disease, with implications for diagnosis or treatment. We intend for these articles to be highly focused, usually making only a few teaching points, but doing so in a way that makes the knowledge stick in the readers’ memory. In addition to describing important aspects of laboratory research that have elucidated physiologic mechanisms, the manuscripts should also detail the ways in which this knowledge has had an impact on our understanding of the way diseases develop, are diagnosed, or treated in everyday practice.

Manuscripts for the PIM series must be evidence based (with appropriate citations) rather than being based on expert opinion, although an expert interpretation of diverging points of view are often illuminating. We encourage the use of glossaries for explanation of terms that might be unfamiliar to the clinician. Liberal use of figures (if scientifically necessary, in color) is also encouraged. We think that manuscripts in this series are often enhanced by collaboration between a bench researcher and a clinician and for this reason, we encourage joint authorship.

Manuscript length of PIM submissions should not exceed 2500 words plus tables and figures, with no more than 70 references. Graphics should be used liberally and should avoid excessive complexity. Because the articles are meant to be informative and to engage the clinician, they should be focused but not definitive, archival reviews. Each manuscript should conclude with a paragraph that summarizes the importance of the discussion for the clinician in easily understandable language. Please refer to the APS web site for the specific APS journal to which the PIM article will be submitted.

Figure Composition
APS uses digital publishing methods throughout the journal production process. Your article will be published both in the print journal and online. We have several specific requirements for digital graphics formats to ensure the best possible reproduction in both media.

Computer screens, laser printers, and offset presses are significantly different devices. The ability to print your graphics well on a desktop laser printer does not mean the image is suitable for composition and production of your article in final form. A detailed set of guidelines is available from APS to help you prepare image files that will provide high-quality reproductions in the APS Journals, both in print and online.

Authors may be asked to prepare new figures if those submitted are not suitable for publication; this will most likely delay publication of the paper. Low-resolution files and inappropriate composition are the most common reasons for delay in publication of accepted manuscripts. Therefore, it is important that authors carefully read the guidelines for figure preparation. The mere appearance of figures on your computer screen may not represent the rigorous standards for final production.

Always prepare original graphics at print publication-quality resolution. If your manuscript is accepted for publication, APS will require the high-resolution files for print output. Use applications capable of creating high-resolution PDF files. Figures should be generated at the size they are to appear in the journal (printed 1:1).

For complete guidelines, go to http://www.the-aps.org/publications/authorinfo/figures/index.htm. These guidelines include important descriptions of inappropriate figure manipulation (and how to avoid these presentation errors), as well as what constitutes unethical manipulation of figures. Fabricating a report of research or suppressing or altering data to agree with one’s conclusions is considered fraud. This includes altering figures in such a way to obscure, move, remove, or introduce information or features.

Use of Animals or People in Photographs
- Photographs of animals or people may be published when scientifically necessary to illustrate a setup or convey the findings of the paper. For a photograph of a person, a signed letter of consent is required from the person or their legal agent or guardian.
- When a diagram is preferable to illustrate a setup, if it is not possible to obtain a drawing, the author should describe the setup in the methods section of the paper.
- Photographs to convey findings may be published when the data are conveyed in the image as in developmental biology or genetic modifications where such photographs are standard practice.
- With respect to other areas, the decision whether to publish a photograph will be based upon the editor’s determination whether the photograph is scientifically necessary.
- The journals should avoid publishing photographs that might be perceived as raising animal welfare concerns. For example, it is preferable to show only the relevant portion of the animal, and photographs should not show blood or people handling the animals except close-ups where only gloved hands are seen.

Tables
Whenever possible, authors are encouraged to submit figures rather than tables. Statistical summary tables should be submitted when possible, rather than tables with many lines of individual values. Lengthy tables of data that cannot be presented in a suitable manner, according to APS standards for print publication, may be extracted and set as a supplement to the online article. These supplements remain an integral part of the article for the reader, as referring text to these tables will remain in the article, and links directly to the supplements will be embedded and prominently indicated at all points of entry to the online article (see Data Supplements, below). Submitted tables should adhere to the following guidelines:

- Tables must not duplicate material in text or figures.
- Tables should be numbered consecutively with Arabic numerals and prepared with the size of the journal page in mind: 3.5 in. wide, single column; 7 in. wide, double column.
- Each table should have a brief title; explanatory notes should be in the legend, not in the title.
- Non-significant decimal places in tabular data should be omitted.
- Short or abbreviated column heads should be used and explained if necessary in the legend.
- Statistical measures of variations, SD, SE, etc., must be identified.
  (Example: “Values are means ± SE.”)
- Table footnotes should be listed in order of their appearance and identified by standard symbols: *, †, ‡, § for four or fewer; for five or more, consecutive superscript lowercase letters should be used.

Mathematical Equations and Modeling
Mathematical aspects of articles normally should be addressed to the many readers of the Journal who are not mathematicians. The presentation should include the mathematical strategy, the assumptions on which the mathematics are based, and a summary of the meaning of the final mathematical statement and its limitations.

Equations
Mathematical equations should be simplified as much as possible and carefully checked.
Use the slant line (/) for simple fractions $(a + b)/(x + y)$ in the text rather than the built-up fraction

$$\frac{a + b}{x + y},$$

which should only be used if the equation is offset from the text as in this example.

Use subscripts or superscripts wherever feasible and appropriate, to simplify the equations.

Please use notation that is consistent with the standard nomenclature in applied mathematics. As an aid to the reader, please state the convention that you are following, especially if it is uncommon.

Symbols should be defined as they first appear in the text, and a Glossary may be included (and helpful) in articles with many different symbols, specifying the units (dimensions) as well as each definition. The Glossary will usually precede the Methods section.

APS style allows punctuation in displayed equations.

**Mathematical Models**

Presentation of the model(s) must be sufficiently clear to allow physiologists with limited experience in modeling to follow the model development, limitations, and physiological relevance. Assumptions concerning the importance of physiological processes included in the model should be clearly stated.

If the model equation(s) require solution, the method of solution should be described in sufficient detail to permit readers to duplicate the solution in their own laboratories. Algorithms from commercial software libraries should be so identified. Details of the solution strategy may be summarized in an Appendix (for an example, see [http://jap.physiology.org/cgi/reprint/96/1/65.pdf](http://jap.physiology.org/cgi/reprint/96/1/65.pdf)).

For simulations, sources or estimation methods for all parameter values should be presented and the numerical values given in the text or a table. A sensitivity analysis must be performed for important parameters (covering ranges of values relevant to the manuscript) to determine how the model predictions are affected by numerical parameter values.

If the model is used to estimate parameter values, measures of the uncertainties associated with the estimated parameter values should be presented.

For models intended for use in a predictive setting, validation of the model with a data set not used for model parameter estimation (i.e., cross-validation) is recommended. Sensitivity analysis or parameter uncertainty determination is an important component of modern modeling practice that allows assessment of the validity of a model.

Results obtained with the model(s) should be compared with appropriate physiological data, either from literature or from new experiments. Simulation results may be examined for prediction of changes or trends in physiological variables similar to those reported for in vitro or in vivo studies. The discussion should include information on the physiological significance of the model study, limitations of the model, and suggestions for new modeling and/or experimental studies.

**Data Supplements**

Video files, extensive tables of data, program code, and similarly cumbersome material that cannot be feasibly published in the standard house style of the journal may be submitted for inclusion in the online journal (without charge to the author). However, only materials that are essential to the reader’s understanding of the manuscript may be submitted as supplemental data. Such material must be submitted for peer review along with the finished manuscript and must meet the approval of the journal Editor. For all supplemental materials, authors should include a caption for each file, explaining the purpose and content of the file.

Material that can be set into an article in standard APS house style of the final-published PDF, such as figures and tables or text (such as methods or results), equations, and other material that can be easily copyedited and typeset into our final-published material PDF page, may NOT be submitted as supplemental material, but must be incorporated into the article as standard figures or tables or relegated to “supporting information” for submission and review purposes only and not for publication.

Questions regarding data supplements may be directed to the Online Production Editor (mgenre@the-aps.org). For microarray data deposits, see above (MIAME Standard for Microarray Data).

**Audio/Video**

Authors are responsible for compiling their own digital video. Each file should be no more than 10 meg in size. Authors may be requested to resubmit their videos with shorter running time, smaller frame size, or lower resolution in order to conform to the recommended file size.

Contact the Online Production Editor (mgenre@the-aps.org) for further assistance or questions.

**Long Data Sets**

Long data tables should be submitted in Microsoft Excel or in Microsoft Word table format. Authors should include a title and legend explaining the content and purpose of each data set.
GUIDING PRINCIPLES FOR RESEARCH INVOLVING ANIMALS AND HUMAN BEINGS

The research described in papers submitted to any of the APS publications that involve the use of human beings must adhere to the principles of the Declaration of Helsinki and Title 45, U.S. Code of Federal Regulations, Part 46, Protection of Human Subjects, Revised November 2009 (http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html). Research involving animals must adhere to APS’s Guiding Principles for the Care and Use of Vertebrate Animals in Research and Training. APS insists that all investigations involving humans or animals reported in its publications be conducted in conformity with these principles and that a statement of protocol approval from an IRB or IACUC or equivalent is included in the methods section of the paper. Editors/Associate Editors are expected to refuse papers in which evidence of the adherence to these principles is not apparent. They reserve the right to judge the appropriateness of the use of animals and humans in experiments published in the journals. Differences of opinion will be adjudicated by the Publications Committee.

WORLD MEDICAL ASSOCIATION
DECLARATION OF HELSINKI

Ethical Principles for Medical Research Involving Human Subjects¹

A. Introduction

1. The World Medical Association has developed the Declaration of Helsinki as a statement of ethical principles to provide guidance to physicians and other participants in medical research involving human subjects. Medical research involving human subjects includes research on identifiable human material or identifiable data.

2. It is the duty of the physician to promote and safeguard the health of the people. The physician’s knowledge and conscience are dedicated to the fulfillment of this duty.

3. The Declaration of Geneva of the World Medical Association binds the physician with the words, “The health of my patient will be my first consideration,” and the International Code of Medical Ethics declares that, “A physician shall act only in the patient’s interest when providing medical care which might have the effect of weakening the physical and mental condition of the patient.”

4. Medical progress is based on research which ultimately must rest in part on experimentation involving human subjects.

5. In medical research on human subjects, considerations related to the well-being of the human subject should take precedence over the interests of science and society.

6. The primary purpose of medical research involving human subjects is to improve prophylactic, diagnostic and therapeutic procedures and the understanding of the aetiology and pathogenesis of disease. Even the best proven prophylactic, diagnostic, and therapeutic methods must continuously be challenged through research for their effectiveness, efficiency, accessibility and quality.

7. In current medical practice and in medical research, most prophylactic, diagnostic and therapeutic procedures involve risks and burdens.

8. Medical research is subject to ethical standards that promote respect for all human beings and protect their health and rights. Some research populations are vulnerable and need special protection. The particular needs of the economically and medically disadvantaged must be recognized. Special attention is also required for those who cannot give or refuse consent for themselves, for those who may be subject to giving consent under duress, for those who will not benefit personally from the research and for those for whom the research is combined with care.

9. Research Investigators should be aware of the ethical, legal and regulatory requirements for research on human subjects in their own countries as well as applicable international requirements. No national ethical, legal or regulatory requirement should be allowed to reduce or eliminate any of the protections for human subjects set forth in this Declaration.

B. Basic Principles for All Medical Research

10. It is the duty of the physician in medical research to protect the life, health, privacy, and dignity of the human subject.

11. Medical research involving human subjects must conform to generally accepted scientific principles, be based on a thorough knowledge of the scientific literature, other relevant sources of information, and on adequate laboratory and, where appropriate, animal experimentation.

12. Appropriate caution must be exercised in the conduct of research which may affect the environment, and the welfare of animals used for research must be respected.

13. The design and performance of each experimental procedure involving human subjects should be clearly formulated in an experimental protocol. This protocol should be submitted for consideration, comment, guidance, and where appropriate, approval to a specially appointed ethical review committee, which must be independent of the investigator, the sponsor or any other kind of undue influence. This independent committee should be in conformity with the laws and regulations of the country in which the research experiment is performed. The committee has the right to monitor ongoing trials. The researcher has the obligation to provide monitoring information to the committee, especially any serious adverse events. The researcher should also submit to the committee, for review, information regarding funding, sponsors, institutional affiliations, other potential conflicts of interest and incentives for subjects.

14. The research protocol should always contain a statement of the ethical considerations involved and should indicate that there is compliance with the principles enunciated in this Declaration.

15. Medical research involving human subjects should be conducted only by scientifically qualified persons and under the supervision of a clinically competent medical person. The responsibility for the human subject must always rest with a medically qualified person and never rest on the subject of the research, even though the subject has given consent.

16. Medical research must be conducted in accordance with acceptable ethical principles and with respect for the dignity and rights of the human subject. The principles should be applied to every phase of the research, from the selection of the research project and the design of the experiment to the selection of the research subjects and the interpretation of the results. The ethical principles should be applied in such a way that the dignity, rights and well-being of the human subject are protected.


17. Physicians should abstain from engaging in research projects involving human subjects unless they are confident that the risks involved have been adequately assessed and can be satisfactorily managed. Physicians should cease any investigation if the risks are found to outweigh the potential benefits or if there is conclusive proof of positive and beneficial results.

18. Medical research involving human subjects should only be conducted if the importance of the objective outweighs the inherent risks and burdens to the subject. This is especially important when the human subjects are healthy volunteers.

19. Medical research is only justified if there is a reasonable likelihood that the populations in which the research is carried out to benefit from the results of the research.

20. The subjects must be volunteers and informed participants in the research project.

21. The right of research subjects to safeguard their integrity must always be respected. Every precaution should be taken to respect the privacy of the subject, the confidentiality of the patient’s information and to minimize the impact of the study on the subject’s physical and mental integrity and on the personality of the subject.

22. In any research on human beings, each potential subject must be adequately informed of the aims, methods, sources of funding, any possible conflicts of interest, institutional affiliations of the researcher, the anticipated benefits and potential risks of the study and the discomfort it may entail. The subject should be informed of the right to abstain from participation in the study or to withdraw consent to participate at any time without reprisal. After ensuring that the subject has understood the information, the physician should then obtain the subject’s freely-given informed consent, preferably in writing. If the consent cannot be obtained in writing, the non-written consent must be formally documented and witnessed.

23. When obtaining informed consent for the research project the physician should be particularly cautious if the subject is in a dependent relationship with the physician or may consent under duress. In that case the informed consent should be obtained by a well-informed physician who is not engaged in the investigation and who is completely independent of this relationship.

24. For a research subject who is legally incompetent, physically or mentally incapable of giving consent or is a legally incompetent minor, the investigator must obtain informed consent from the legally authorized representative in accordance with applicable law. These groups should not be included in research unless the research is necessary to promote the health of the population represented and this research cannot instead be performed on legally competent persons.

25. When a subject deemed legally incompetent, such as a minor child, is able to give assent to decisions about participation in research, the investigator must obtain that assent in addition to the consent of the legally authorized representative.

26. Research on individuals from whom it is not possible to obtain consent, including proxy or advance consent, should be done only if the specific condition that prevents obtaining informed consent is a necessary characteristic of the research population. The specific reasons for involving research subjects with a condition that renders them unable to give informed consent should be stated in the experimental protocol for consideration and approval of the review committee. The protocol should state that consent to remain in the research should be obtained as soon as possible from the individual or a legally authorized surrogate.

27. Both authors and publishers have ethical obligations. In publication of the results of research, the investigators are obliged to preserve the accuracy of the results. Negative as well as positive results should be published or otherwise publicly available. Sources of funding, institutional affiliations and any possible conflicts of interest should be declared in the publication. Reports of experimentation not in accordance with the principles laid down in this Declaration should not be accepted for publication.

28. The physician may combine medical research with medical care, only to the extent that the research is justified by its potential prophylactic, diagnostic or therapeutic value. When medical research is combined with medical care, additional standards apply to protect the patients who are research subjects.

29. The benefits, risks, burdens and effectiveness of a new method should be tested against those of the best current prophylactic, diagnostic, and therapeutic methods. This does not exclude the use of placebo, or no treatment, in studies where no proven prophylactic, diagnostic or therapeutic method exists. Note of clarification on paragraph 29 of the WMA Declaration of Helsinki: The WMA hereby reaffirms its position that extreme care must be taken in making use of a placebo-controlled trial and that in general this methodology should only be used in the absence of existing proven therapy.

However, a placebo-controlled trial may be ethically acceptable, even if proven therapy is available, under the following circumstances: Where for compelling and scientifically sound methodological reasons its use is necessary to determine the efficacy or safety of a prophylactic, diagnostic or therapeutic method; or Where a prophylactic, diagnostic or therapeutic method is being investigated for a minor condition and the patients who receive placebo will not be subject to any additional risk of serious or irreversible harm. All other provisions of the Declaration of Helsinki must be adhered to, especially the need for appropriate ethical and scientific review.

30. At the conclusion of the study, every patient entered into the study should be assured of access to the best proven prophylactic, diagnostic and therapeutic methods identified by the study. Note of clarification on paragraph 30 of the WMA Declaration of Helsinki: The WMA hereby reaffirms its position that it is necessary during the study planning process to identify post-trial access by study participants to prophylactic, diagnostic and therapeutic procedures identified as beneficial in the study or access to other appropriate care. Post-trial access arrangements or other care must be described in the study protocol so the ethical review committee may consider such arrangements during its review.

31. The physician should fully inform the patient which aspects of the care are related to the research. The refusal of a patient to participate in a study must never interfere with the patient-physician relationship.

32. In the treatment of a patient, where proven prophylactic, diagnostic and therapeutic methods do not exist or have been ineffective, the physician, with informed consent from the patient, must be free to use unproven or new prophylactic, diagnostic and therapeutic measures, if in the physician’s judgement it offers hope of saving life, re-establishing health or alleviating suffering. Where possible, these measures should be made the object of research, designed to evaluate their safety and efficacy. In all cases, new information should be recorded and, where appropriate, published. The other relevant guidelines of this Declaration should be followed.

APS GUIDING PRINCIPLES FOR THE CARE AND USE OF VERTEBRATE ANIMALS IN RESEARCH AND TRAINING2

As noted in the U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training, “Procedures involving animals should be designed and performed with due consideration of their relevance to human or animal health, the advancement of knowledge, or the good of society.” The use of animals is also justified to provide scientific, veterinary, and medical training that is not possible through other mechanisms.

Investigators should consider the appropriateness of the experimental procedures, the species of animals used, and number of animals required. Prospective approval of procedures on animal subjects should be obtained from an institutional animal care and use committee (IACUC) or similar oversight body as required under the relevant regulatory authorities. This review should also consider whether the use of animals in a given protocol could be replaced by other experimental approaches such as in vitro studies or computer modeling.

Only animals that are lawfully acquired shall be used in research and teaching. The procurement, transport, maintenance, and use of animals must in all cases comply with federal, state and local laws and regulations. In the United States, animal research may be subject to the Animal Welfare Act, the Public Health Service Policy on Humane Care and Use of Laboratory Animals, or other guidelines established by funding agencies. The PHS Policy requires institutions to use the Guide for the Care and Use of Laboratory Animals4 to develop and implement an institutional animal care and use program.

Analgesics and other techniques should be used to minimize discomfort and pain except when the intervention would compromise experimental goals. Appropriate anesthetics must be used to eliminate sensibility to pain.

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2 The Guiding Principles for the Care and Use of Animals in Research and Teaching were adopted by the American Physiological Society in 1953. They are based upon humane care principles formulated by Walter B. Conn in 1909. The revision was approved by the APS Council on July 16, 2010.

3 URL: http://grants.nih.gov/grants/olaw/references/phs3k.htm#USGovPrinciples

during all surgical procedures. Drugs that produce muscle paralysis are not anesthetics. They must never be used alone for surgical restraint, only when animals are under anesthesia.

If the study requires the death of an animal, humane endpoints should be identified, and an approved method of euthanasia stipulated in the American Veterinary Medical Association’s Guidelines on Euthanasia should be used. Death is acceptable as the endpoint of a study only where euthanasia would compromise scientific outcomes and an IACUC or similar oversight body has approved the exception.

Animals used in research and education must be housed, fed, and maintained in a manner appropriate for their species and their condition. They should also be given appropriate veterinary care.

Personnel who care for or perform procedures on animals must receive training for these tasks. When students or trainees use animals in educational activities or for the advancement of science, such work shall be conducted under the direct supervision of an experienced teacher, investigator, or veterinarian.