Writing for Publication in Veterinary Medicine

A Practical Guide for Researchers and Clinicians

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CONTENTS

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PREFACE

Writing for Publication in Veterinary Medicine is designed to help residents, graduate students, and early-career faculty in veterinary medicine gain independence and confidence in writing and publishing scientific articles. Writing and publishing, the final steps in the scientific method, take place within the global community of authors, reviewers, editors, and readers. By presenting your work to others in the public forum of a peer-reviewed international journal, your research becomes part of the scientific record and contributes to the advancement of knowledge. Despite its essential role in the research enterprise, scientific writing rarely is taught explicitly in veterinary or graduate curricula. *Writing for Publication in Veterinary Medicine* is intended to help fill this gap by helping you plan, organize, write, submit, revise, and publish your work.

Why publish? Your research and clinical observations are important. In addition to disseminating knowledge, scientific articles promote thought and debate, change practice, and stimulate future research. In academia, publication is essential for career advancement because it documents research quality, productivity, and accountability. Scientific articles also document the first publication of original results. If your work remains unpublished, who will know that you did it?

How are writing and publishing in veterinary medicine different than in other disciplines? In many ways they're not; however, *Writing for Publication in Veterinary Medicine* aims to add relevance to existing resources by using examples from clinical and diagnostic veterinary research, focusing on veterinary journals, and emphasizing terminology and professional practices pertinent to veterinary medicine.

English is the primary language of science. This can present a barrier for authors in many parts of the world, but writing well in English is a challenge faced by native and non-native speakers alike. As editors, we cannot over-emphasize the importance of submitting a well-written manuscript, and we offer guidance on writing with clarity, conciseness, and precision to effectively communicate the message and details of your study. We hope this publication will enhance your writing experience and lead to articles that reflect your experience as a writer and as a clinician-scientist in veterinary medicine.

We gratefully acknowledge the valuable role mentors and peers have played in our own writing and publishing. Our aim is for *Writing for Publication in Veterinary Medicine* to contribute in an important way to yours.

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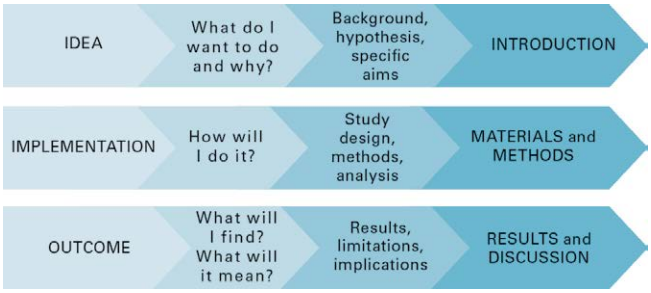
A GOOD MANUSCRIPT STARTS WITH GOOD SCIENCE

The rationale and hypothesis (or research question), study design and data analysis, results, and strengths and limitations of a research study roughly parallel the Introduction, Methods, Results, and Discussion sections of a manuscript. Thus, from the conception of a project the framework for a manuscript is born. The time and effort spent in planning a study or clinical report is the best investment you can make in laying the groundwork for publishing your work: a well-written manuscript cannot compensate for poor study design or conclusions not supported by the evidence.

Conceiving and implementing a research study prepares you to organize and write a manuscript.



Developing a Research Question

A research study usually is initiated in the form of a question: Why does hemolysis occur? Is this new anthelminthic effective? Which surgical procedure is better for correcting patellar luxation? Research questions are stimulated by clinical experience, discussions with colleagues, a reading of the literature, and previous research findings. Learning to ask questions means learning to think critically and creatively, questioning assumptions and developing the scientific curiosity to probe deeper. Thorough review of the literature is essential to avoid simply repeating work that already has been done; research should expand, challenge, or improve on existing knowledge. A good research question should have a strong rationale or justification for pursuit: it should fill a gap in existing knowledge, be relevant and important, and for many research studies lead to a hypothesis that can be tested. A hypothesis forms the cornerstone of a research study; it is what you *postulate* to be true. Specific aims define the exact steps you will take to gather information that will prove or disprove the hypothesis.

Designing the Study

Your study design must be appropriate for answering the research question. Prospective, retrospective, and descriptive study designs, as well as randomized clinical trials, cohort studies, meta-analyses, and other types of studies, approach a problem in different ways; each has strengths and limitations. Consult with someone experienced in designing studies before you start. Also consider these questions:

- Will your study involve experimental or client-owned animals? Institutional approval and client consent are essential for ensuring the ethical and humane use of animals in research. Some journals, e.g., *Journal of Small Animal Practice*, do not publish studies that use experimental animals; thus, be aware of this when selecting your target journal. If your study includes human subjects, e.g., in educational research, approval by an institutional review board (IRB) may be required.
- How will variables such as time, treatment, and underlying disease be handled? What major and minor outcomes will you analyze, and what is the necessary number of samples? Consult with a statistician on appropriate statistical methods and do a power analysis to estimate sample size. Some journals provide advice on statistical analysis.
- What potential problems do you anticipate and how will you address them? For example, if you plan to enroll 50 horses in a prospective study over a one-year period, what will you do if this number falls short? What is the potential impact on the results? All studies have limitations, but it is important to anticipate problems and to ensure they will not substantially affect the quality and interpretation of results or the validity of the conclusions.

> *As you plan your study, eye it critically through the lens of a future peer reviewer, and make adjustments accordingly.*

Once your study design is completed, ask your colleagues for additional input and for help in identifying potential flaws. On the positive side, keep in mind the strengths of your study and how the expected outcomes could have practical applications for veterinary practice and important implications for animal and human health. Now is the time to adjust your study design, prior to conducting the study!

Using Reporting Guidelines

Reporting guidelines provide standards on how to report research studies so they are transparent, accurate, and complete. Consult reporting guidelines *prior* to beginning your study to help ensure that the planning and implementation of your study design don't overlook key elements that are essential in the reporting process. Reporting guidelines include checklists, flowcharts, and procedures developed by panels of experts to help document and validate the methods and results. Reporting guidelines relevant to veterinary research include:

- CONSORT for clinical trials
- REFLECT for clinical trials involving food animals
- STARD for studies of diagnostic accuracy
- ARRIVE for studies involving animal experimentation
- STROBE for observational studies in epidemiology
- PRISMA for systematic reviews and meta-analyses

With the exception of REFLECT, reporting guidelines were developed for medical research, and only a few veterinary journals have formally adopted them. However, the key principles are relevant and important, and the guidelines serve as a helpful template and valuable reminder of what constitutes accurate, unbiased, and complete reporting.

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TYPES OF SCIENTIFIC ARTICLES

Not all journals define articles in the same way. Check your target journal for guidance and browse through a few issues to get an idea of the types of articles published. Often, the type of article (e.g., original research, case report, review) is identified on the title page of an article. The title page also may indicate the date the manuscript was received, the date it was revised, and the date of acceptance; this information can give you an idea of whether an article underwent peer review prior to publication.

Peer-Reviewed Original Articles

Peer-reviewed original research and clinical observations can be communicated in full-length articles, systematic reviews, brief communications, and case reports.

- **Full-length original research articles** follow a standard format that is the prototype for scientific writing and typically include Introduction, Methods, Results, and Discussion sections. Organization and writing of original research articles are the primary focus of this monograph. Although length may vary, original articles should contribute substantive new information with a clear major focus.

> *When deciding whether to publish one or more papers from your study, keep related parts together that convey the same message. Dividing your work into many small papers fragments the literature and makes it difficult for readers to find and understand your work.*

- **Systematic reviews** use a defined objective approach to search and assess the literature on a single research question, sometimes through meta-analysis. Organization and length vary, but the search strategy should be defined in the Methods section, including explicit inclusion and exclusion criteria. Because systematic reviews synthesize the results of several studies, they are important in evidence-based veterinary medicine.
- **Brief communications** describe limited or preliminary original research and are appropriate when the amount of new information and methods don't warrant a full-length article, e.g., to convey the results of a pilot study. Because they are short, brief communications are typically less structured than full-length articles. **Technical reports** call attention to a focused method, software program, or other technical application or procedure.
- **Case reports** describe a single case or a series of cases. They document rare, unique, or previously unreported conditions or findings, novel diagnostic or therapeutic approaches, or recognition of a new disease pattern. They sometimes include supplementary *in vitro* investigations but are less structured than research articles. Some journals no longer publish case reports because they have limited applicability and are cited less often than original articles. However, a well-documented case can be useful to those in clinical practice, help hone clinical investigative skills, and serve as a valuable educational tool for trainees.

Other Articles

Journals publish many other types of articles, which may or may not be peer-reviewed. These include review articles, editorials, letters to the editor, research abstracts, consensus papers, and special features.

- **Review articles** use comprehensive analysis and citation of original research to critically synthesize and organize knowledge on a contemporary topic. A good review conveys the current status of research in a field and stimulates new ways of thinking about a subject. Review articles in some journals, such as in *Veterinary Clinics of North America*, are solicited and evaluated by an editor but are not usually peer-reviewed. Review articles in other journals, such as *Veterinary Pathology*, are peer-reviewed similar to original research articles and even when solicited are not guaranteed acceptance.
- **Letters to the editor** respond to a previously published article, report an observation, or raise an issue relevant to readers; most editors-in-chief welcome them. Letters are indexed and citable and provide an important public forum for discussing divergent views; response letters often are solicited. Editors reserve the right to publish or reject a letter based on content and professional presentation.
- **Editorials/commentaries** may be solicited in response to one or more articles published recently in the journal or may address a topic important to readers or the discipline. Editorials and commentaries help us think critically about new findings and their implications and focus our attention on important scientific issues and the status of research and education in our field.
- **Conference abstracts** summarize data from oral or poster presentations at a scientific meeting and are an important way to share new results. Research described in an abstract is considered preliminary original work intended for eventual publication as a research article (although this does not always occur).

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SELECTING A JOURNAL

To guide the approach, format, and style of your manuscript, select a journal before you begin to write. The number of veterinary journals—more than 250 worldwide—gives you plenty of options. Publishing in a variety of journals demonstrates the relevance of your work to different audiences and disciplines as well as your ability to work with different journals and editors.

Journal Scope and Target Audience

To ensure a journal is a good fit, check its aims and scope, browse recent content, or contact the editor, and keep in mind that the title of a journal is not always a clear indicator of its content. Veterinary journals can have a broad scope, e.g., "to advance veterinary medical knowledge" (*Journal of Veterinary Internal Medicine*), or a narrow scope, such as the animal eye (*Veterinary Ophthalmology*); others define scope by defining their audience, e.g., veterinary practitioners. Manuscripts deemed out of scope are usually rejected without review.

Identify your target audience – the readers to whom you want to direct your writing – by choosing either a general or a specialty journal. The appropriate audience depends on the main message or angle of your manuscript. For example, a study of the diagnostic evaluation of alopecia would be appropriate for a small animal practice journal, whereas a study of immunohistochemical features of the canine hair cycle would be more suited to a dermatology journal.

The *Journal of the American Veterinary Medical Association*, *Veterinary Record*, and the *Australian Veterinary Journal* are examples of national journals that publish on a wide array of topics and serve diverse veterinary constituencies. Many veterinary research journals, such as *Veterinary Research Communications*, *Veterinary Research*, *BMC Veterinary Research*, and *The Veterinary Journal* are general journals that publish articles aimed at a broad audience. Veterinary specialty journals may be species-specific (e.g., *Journal of Avian Medicine and Surgery, Small Ruminant Research*) or discipline-specific (e.g., *Veterinary Anaesthesia and Analgesia, Veterinary Parasitology, Veterinary Surgery*), and articles are intended primarily for veterinarians in those specialties.

Specialty journals published by associations, societies, or colleges support their membership and define their community by publishing articles and reports of interest to the group. They may also serve as a vehicle for trainee publication and as a resource for trainees preparing for certifying examinations. Specialty journals might permit the use of discipline-specific terminology or provide reporting guidelines to set the standard for their discipline. *Veterinary Clinical Pathology*, for example, has guidelines on how to conduct and report studies on determining reference intervals and on laboratory method comparisons.

For some manuscripts, a journal published in a specific geographic region or in a language other than English will reach the audience most in need of the information. For example, a study on the prevalence of a parasitic disease in cats in São Paolo would be highly relevant to Brazilian veterinarians and more accessible to them in a journal that publishes in Portuguese as well as in English, such as *Revista Brasileira de Parasitologia Veterinária* (*Brazilian Journal of Parasitology*).

Keep in mind that the readership or audience of a *journal* consists largely of its subscribers or those who receive it as part of their membership in an organization. Subscribers might browse the table of contents and read your article even when it is not directly related to their area of interest. The readership or audience of an individual *article* includes scientists and health professionals working in the same research area; they typically find your article by database searches for key words. Thus, although online journals are changing the way we relate to readers and articles, in some cases the audience is still important. Your target audience should include readers who are best able to judge and value your work. If you are unsure of the best journal for your work, consult with an experienced mentor.

Visibility and Access

The more widely a journal is indexed online, the more accessible it is to readers, giving authors a wider audience for their work and potentially increasing citations. Some indexes (e.g., Google Scholar and Index Copernicus) are open to virtually all journals; others (including MEDLINE/PubMed, AGRICOLA, and CAB International) are more selective, based on standards of journal quality and scope. Citation indexes (e.g., ISI Web of Science and SCOPUS) also have selection criteria. Regional indexers (e.g., African Journals Online, Index Medicus for the Eastern Mediterranean region, Index Medicus for Latin America, and the Excellence in Research for Australia Initiative) facilitate worldwide access to regional veterinary journals that might otherwise be difficult to find.

Online publication is now standard for most veterinary journals and greatly increases access to your article. Abstracts are usually freely available online for all journals; access to full-text articles usually requires either a subscription (individual or institutional) or open access.

Open-access journals are those whose articles are freely available online to all readers. Several established models of open-access journals can be found in the publishing industry. The most common is fee-based open access (often called the "golden road"), which requires payment from the author for publication; payment could be through an employer or through a research grant, and these fees can be substantial. "Green road" open access, on the other hand, is based on self-archiving in a university or discipline-specific repository or in an archive such as PubMed Central. The latter is an initiative from the National Institutes of Health (NIH) that requires archiving of all articles resulting from NIH-funded research, regardless of the journal in which they are published. No-fee open-access journals are usually subsidized by an institution or government agency; some raise revenue from advertising or society membership. In addition to open-access journals, many subscription-based journals provide open access to selected articles as a way to draw readership. Authors also may be given the option to make their individual article open access (within a subscription-based journal) provided they pay a publication fee. Subscription-based journals also may make all or most articles freely available online after a specified embargo period (e.g., one year). Many publishers provide free or reduced rate journal subscriptions to developing countries through participation in the HINARI, INASP, and AGORA projects.

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A plethora of open-access journals now exists; like subscription-based journals, open-access journals vary in quality, so authors should carefully consider their benefits and drawbacks before targeting them. Many open-access journals are highly reputable, with strong editorial oversight, rigorous peer review, and editorial boards composed of recognized experts. Others, termed "predatory journals", exploit the model by exacting high fees without having legitimate peer-review processes, editorial boards, or publishing services. Authors should be aware of predatory journals and investigate the reputation of the publisher and the quality of a journal in advance of submitting a manuscript.

Quality and Prestige

What are the "must-read" journals in your field? The quality of a journal depends on the quality of its scientific articles and authors, the quality of the journal's editorial board and policies, the rigor and quality of its peer-review process, and the quality of the print and online publication itself, including text, tables, and images. Quality is not easy to quantify, as noted below in the section on metrics. Experienced mentors are often the best source of information regarding the quality and prestige of a journal in your field.

Metrics and Ranking

Journal metrics are intended to quantify the quality and impact of a scientific journal based on how often its articles are cited by other articles. The **impact factor** was originally developed to aid librarians in selecting journals for their collections, with citations acting as a surrogate for how often articles in that journal are read and used. However, the impact factor is now widely used to indicate the quality of individual scientific articles in a journal and to establish discipline-based journal rankings, leading some authors to select a target journal based primarily on its impact factor.

We encourage you to consider journal metrics as only one factor among many when deciding where to publish a manuscript.

The impact factor is calculated each year by measuring the average frequency of citations to articles published by a journal in the previous two years. Impact factors are calculated for journals indexed in the Thomson-Reuters ISI database and are published in *Journal Citation Reports* (http://thomsonreuters.com/products_services/science/free/essays/impact_factor). Impact factors vary widely by discipline and reflect the citation practices, size, and interdisciplinary connections of its research community. Citation rates also are affected by article type, self-citations, and other variables; most journals acquire the majority of their citations from just a few articles. Impact factors also are easily manipulated, mostly by self-citation, and Thomson Reuters recently banned several journals from receiving an impact factor because of excessive self-citation.

Other journal metrics include the **EigenFactor**, which uses the same data as the impact factor but over a longer (5-year) window of time and which, unlike the impact factor, does not include self-citations; the **SCImago Journal Rank** (SJR), which measures citations per article using Elsevier's SCOPUS database; and **SNIP**, or Source-Normalized Impact per Paper, which measures the journal's citation impact in context (it corrects for how frequently citations occur across research fields). **SJR** and **SNIP** lay claim to increased transparency, as the database used in their calculation is available to librarians and researchers.

Metrics can measure the overall influence of a journal, but don't necessarily correlate with journal quality or the quality of individual articles or authors. In 2012, a group of editors and publishers drafted the *San Francisco Declaration on Research Assessment: Putting Science into the Assessment of Research* (http://am.ascb.org/dora/). Among the recommendations was "the need to eliminate the use of journal-based metrics, such as Journal Impact Factors, in funding, appointment, and promotion considerations." Thomson Reuters is now unveiling a new set of metrics (InCites) that links impact factors with article-level data. Article-level metrics along with "altmetrics" (alternative metrics) based on social media and other web-based environments are growing rapidly as potential benchmarks of research quality and impact.

Practical Aspects

Journals differ in their submission and review processes, time to publication, publication costs, and publication services, information that often is available on a journal's website. For authors who want their work to be available to readers as soon as possible, the time it takes for peer review and the time from acceptance to publication may be important factors in selecting a journal. Some journals publish the date a manuscript was received and accepted on the title page of an article, which gives you an idea of the time it takes for peer review. Many journals limit the time authors can take to respond to peer-review comments and revise their manuscript; authors who do so expeditiously can help shorten the time to publication. Online publication preceding print publication also significantly reduces the time from acceptance to publication. Although not a feature of most veterinary journals, accelerated review and rapid publication are offered by journals in highly competitive fields. Some journals also offer fast-track publication for articles that have been accepted and are well written, thus requiring minimal editing by the journal's editorial staff. Conversely, publication may be delayed owing to poor writing and the need for extensive editing.

Publishing a peer-reviewed, edited, formatted article in print and online is an expensive process. Not all journals have publication charges, as costs are included in subscription fees. However, some veterinary journals recoup publication costs by charging a handling fee when a manuscript is submitted; others have page charges or charge for color plates. Some journals offer the option of publishing color only online, without cost. Journals such as the *Journal of Wildlife Diseases* offer lower publication costs to members in their affiliated society. For open-access journals (and articles), authors usually are required to pay publication fees that support the cost of publishing an article; these fees can be substantial, but may be waived for authors in low-income countries.

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Factors to consider in selecting a journal

FACTOR	QUESTIONS TO CONSIDER
SCOPE AND AUDIENCE	
Aims and scope	Is your manuscript within the scope of the journal?
Target audience	Whom do you wish to reach? General practitioners? Clinical specialists? Researchers?
Article types	Does this journal publish the type of article (e.g., case report) you have written?
Geographic area	Is your article important to a specific geographic area or is it relevant to a broad international audience?
Language	Does your target audience read English?
VISIBILITY AND ACCESS	
Indexing	Is the journal indexed? Where?
Online publication	Is the journal published online?
Access to articles	Is a journal subscription required to access your article?
QUALITY AND PRESTIGE	
Editorial board	Who are the editorial board members? Are they recognized experts in the field?
Authors	Who publishes in the journal?
Production quality	Does the journal publish high-quality images, tables, and text? Are the website and online articles easy to navigate?
Peer-review process	Is peer review single- or double-blinded? How many reviewers evaluate your manuscript?
Reporting standards	What are the journal's requirements for conducting and reporting clinical trials, studies of diagnostic accuracy, and other types of studies?
Ethical policies	What are the journal's requirements for reporting on the ethical care and use of animals and for human subjects research?
METRICS AND RANKING	
Rejection rate	What percentage of submitted manuscripts is rejected?
Impact factor and other metrics	Where does the journal rank among similar journals?
PRACTICAL ASPECTS	
Submission process	Is your manuscript submitted online and can you track its progress through the peer-review process?
Time to publication	What is the average time from submission to acceptance? From acceptance to publication?
Publication costs	Are there submission or publication costs?
Publication services	What publication services (e.g., article metrics) does the journal offer?

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WRITING YOUR MANUSCRIPT

Approach to the Writing Process

There is no single best approach to writing. Writing requires focus, time, and discipline and is best done when you are actively engaged in the study or soon after the project is completed. Find a quiet or otherwise conducive environment and remember that even the best writers must revise their work many times. Early in the process it can be helpful to set aside larger blocks of time to immerse yourself in writing, resources, and analysis. Once you've begun, maintain your momentum and progress by setting yourself weekly deadlines, leaving a few days between revisions to gain perspective and reflect on what you've written.

Writing a manuscript entails these main steps: 1) organizing your main ideas, 2) writing a first draft, and 3) editing your manuscript. The main message of a study is embodied in the results: to identify the main points conveyed by your results, summarize your findings and prepare the figures and tables early in the process. Writing isn't just about documenting what you already know; it also involves exploration of your results, how best to present them and how to frame them in a broader context. As you prepare your results, you will learn a lot about them and what they mean, helping you to hone your message.

Writing is a recursive process—one involving repeated revisions of both the individual parts and the whole manuscript—in which you will discover new insights into your work.

Your primary goal as you sit down to write is to complete a rough draft of the entire manuscript. It's fine to write quickly and messily: the goal is to get everything down on paper without worrying too much about the writing itself. Once written, you can focus on revision, which is just as important as the initial writing. Revisions can be made on individual sections as you write, but eventually should involve the entire manuscript to ensure it is consistent internally and conveys a clear and focused message. Changes in one section of the manuscript often require subsequent revisions in other sections of the manuscript to maintain this cohesion. While writing, keep your audience in mind based on the target journal you selected.

Determining Authorship

It is best to determine authorship and author order at the time a study is planned and before it is conducted; to account for changes in contributions, author order may be revisited during the study or after the manuscript is written. *All* authors should play a role in drafting and editing the manuscript and must indicate their approval and accept responsibility for the final version. Make sure co-authors agree with the main focus of the manuscript and the selected target journal. Ensure author names are spelled correctly and use middle initials to facilitate database searches. Include degrees and certifications only if the journal requires them. Author affiliation (department and institution) should be that at the time the work was done; some journals also publish current affiliations if they have changed.

An author is someone who has made "substantive intellectual contributions" to study conception and design or data acquisition, analysis, and interpretation and who takes responsibility and accountability for at least part of the work.
International Committee of Medical Journal Editors (ICMJE)

Don't dilute your own contribution by including authors whose contributions are insignificant or nonexistent. Simply acquiring funds or overseeing the laboratory or study group does not warrant authorship; nor should authorship be used to reward friends or family members or to acknowledge those in positions of power. "Guest" and "gift" authorship, whereby an individual is included as an author but did not contribute substantively to the work, is unacceptable. Equally unacceptable is the omission or exclusion of an individual whose contribution warrants authorship, so-called "ghost" authorship. No single formula for authorship applies to all situations, so consult with an experienced mentor.

With the exception of the first author, who typically is the person primarily responsible for the study and the writing, there are no explicit guidelines regarding author order. The last author is often, but not always, the senior author or the mentor of the first author. The second author also is sometimes a mentor to the first author or is the person who contributed second-most effort to the study. Some journals recommend that authors be listed in order of decreasing contribution; others require a description of the contribution of each author upon submission of the manuscript. Some journals publish these contributorships together with the article and also identify one or more authors as guarantors of the integrity of the work. This practice is not widespread in veterinary journals, but it can be expected in the future as editors work to promote accountability and ethical authorship practices.

Contributions that don't warrant authorship can be recognized in the Acknowledgments section of a manuscript. An acknowledgment is appropriate, for example, for a veterinarian who referred a case (without contributing substantively to the report or study) or for purely technical support, support from a department chair, or assistance in writing the manuscript. Include the affiliations of acknowledged individuals.

Guidelines for Authors

Read your target journal's guidelines or instructions for authors before you begin to write and again before you submit the manuscript. Follow the guidelines closely: failure to explicitly follow the Author Guidelines can delay processing of your manuscript and even lead to rejection. Author Guidelines usually include:

- Technical specifications such as article types, formatting, word limits, and reference style
- Requirements for adherence to reporting guidelines
- A description of the peer-review process
- Editorial policies, such as ethical requirements for animal use and policies on duplicate publication

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Some journals also provide guidance on writing, statistical analysis, and nomenclature. Author Guidelines vary considerably from journal to journal; check the most recent version and consult a recent issue of your target journal to see examples of format and content.

Organizing and Writing Your Manuscript (IMRaD)

Scientific manuscripts that describe research studies have a similar and consistent format, with minor variations depending on the journal, discipline, and type of article. IMRaD is the acronym for the major sequential sections of a research manuscript:

- Introduction
- Methods
- Results and
- Discussion

IMRaD headers are useful for preparing an outline of your draft manuscript, although it is not necessary to write the sections in order. First, draft a working title and abstract to serve as scaffolding that can be revised as you work. The Methods are factual reporting and therefore are usually easiest to write next. Follow with the Results (which help you focus on the main points of the study) and then the Introduction, ending with the Discussion, which is best written after completing the other sections. Cite references as you write, using temporary notations or an automated reference manager. To avoid inadvertent plagiarism, avoid copying words or sentences directly from your references.

Although review articles and case reports use different formats, most articles have the same beginning elements (title, key words, abstract) and end elements (acknowledgments, references, tables, figure captions, and figures), usually in that order.

Title and Key Words

Together with the abstract, the title is the most frequently read part of your article and is also used in database searches. Readers often use the title to decide whether to read an article, so titles should be accurate, informative, succinct, and representative (not misleading). Indicative titles state the nature of the study (e.g., "The effect of treatment on metabolic acidosis in small ruminants"), whereas informative titles deliver the message of the study (e.g., "Rapid treatment decreases mortality in small ruminants with metabolic acidosis"). Some journals specify in the Author Guidelines which type of title to use. Be descriptive, use specific terms, and avoid abbreviations and proprietary names. Some journals request a short title (running title) to use in the page header of the article.

Judicious selection of four to six key words that *differ* from the words in the title is important because these key words guide indexers and publisher search engines. Some journals also require a list of abbreviations at the beginning of the manuscript.

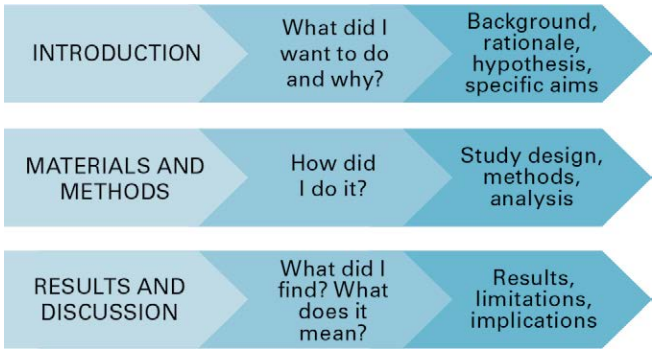
Abstract

The abstract is the most accessible, functional, and read part of an article. Therefore, a well-written abstract is critical for conveying the most important aspects of your research; it should stand alone and provide context as well as results. Abstracts are typically 250-350 words with strict word limits enforced by journals. Structured abstracts use headers (e.g., Background, Objectives/Hypothesis, Methods, Results, and Conclusions/ Clinical Importance) to subdivide the content and mirror the major sections of a manuscript; unstructured abstracts are usually a single paragraph. Even if not required by your target journal, structure gives shape to an abstract and helps you remember to include all the necessary and important information. By organizing information in a recognizable pattern a structured abstract also helps readers and reviewers understand your work.

Abstracts should include one or two sentences of background that provide the context and rationale for the study; the purpose or objectives of the study; a brief description of methods; a summary of the main results, including data and probabilities (specific statistical tests need not be listed); and one or two sentences of the main conclusions and implications (never simply state, "This will be discussed").

Abstracts should primarily reflect the new work and findings in the article; therefore, the results are the most important part, followed by methods. Don't summarize the literature or cite references; rather, use the background and conclusions to frame the findings in a broader context. If you draft your abstract before you write the body of the manuscript, be sure to revise your abstract when you complete the manuscript and after you have finished other revisions: all data and text should be consistent.

The sections and content of a manuscript mirror the research study.



Introduction

The Introduction is a form of persuasive writing intended to convince the reader that the subject is important and the study is warranted. It should be limited to two or three paragraphs; some journals have word limits for the Introduction. Begin the Introduction with the broad importance of the topic and what is known, then narrow your focus to specific gaps in knowledge, problems, or controversies that are relevant to your study. In the last paragraph of the Introduction, explicitly state your hypothesis and specific objectives. End with a sentence that reiterates how your study will address the gaps or problems you identified earlier. We don't recommend that you summarize your study findings at the end of the Introduction, although this is done in some journals. The Introduction should build a compelling argument and rationale for your study; it should not be a comprehensive review of the literature.

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Here is an example of the recommended structure and flow of an Introduction for a study on hyperthyroidism.

Hyperthyroidism is a prevalent disease that affects the quality and longevity of life in old cats.

↓

Current treatment options incur serious complications, such as thrombocytopenia.

↓

A new treatment has promise for avoiding hematologic complications, but its efficacy has not yet been fully evaluated.

↓

We hypothesized that the new treatment would be as effective as the old one and prevent hematologic complications. Our objectives were: 1) to compare the effectiveness of the new treatment with current medications in a cohort of hyperthyroid cats, using T4 as an indicator of effectiveness and 2) to monitor the platelet counts of treated cats to compare the occurrence of treatment-associated thrombocytopenia.

↓

This approach will provide the evidence needed to support implementation of this new treatment option, improving the quality and longevity of life for cats with hyperthyroidism.

Materials and Methods

In this section, describe the study methods in logical order and in sufficient detail to allow others to judge the validity and generalizability of the study and to reproduce the study. For readers working in your research area, Methods can be the most important section. In addition to study design and analytical methods, statistical methods and statements regarding ethical animal use should be included in this section.

Clearly define your study as either prospective (planned prior to data collection) or retrospective (planned after data collection) and the specific type (e.g., randomized clinical trial, cohort study). When relevant, indicate whether reporting guidelines have been followed. Use subheaders (e.g., Study Design, Reference Population, Analytical Methods, Statistical Analysis) to categorize the main sections of the Methods; if the study design is complex, consider using a flow chart to define your steps. Specify where and when the study was conducted. It is insufficient to simply cite another study to rationalize study design, as not all published studies are properly designed; rather, the design should be based on the hypothesis and objectives of your study.

Describe your sample population and patient selection. When using client-owned animals, state the method and site of animal accrual or sample selection and provide inclusion and exclusion criteria; clearly define groups. If pertinent, describe explicitly how selection was randomized. State the time period (month/year to month/year) during which the study was conducted. Be sure to include all factors pertinent to the study, such as breed, age, sex, and body weight. If "healthy" animals were used as a control population, describe clearly how health was determined. If wildlife populations are used, indicate their location, the methods of capture and restraint, and which necessary permits and agency approvals were obtained. Specify clearly the ways in which animals were used and housed and the institutional, national, or international guidelines that were followed to ensure humane and ethical animal care.

Provide all details of sample and data collection, handling, and analysis. For example:

- Studies involving blood sampling should include the timing of collection, fasting status, venipuncture site, volume collected, tube used, storage (duration and temperature), and methods and units of analysis. Be sure to consider the imprecision of analytical methods and to report the validation, performance characteristics, and commercial name and generation (version) of assays.
- Imaging studies should provide details about image acquisition, orientation, and sequence.
- Therapeutic studies should provide drug dosages, frequency, and route(s) of administration.
- Studies using scoring systems (e.g., body condition and sepsis scores) or subjective measures should clearly define the system and indicate who performed the scoring, their qualifications (if relevant), and whether they were blinded to other information in the study. Be sure to include intra- and inter-observer differences.

Don't describe standard or unmodified methods in detail; cite references instead. Provide the brand, manufacturer, and source of all instruments, products, medications, and reagents, according to journal style; some journals include manufacturer information in the text, whereas others use footnotes or endnotes.

Describe in detail the methods of statistical analysis as well as the software program and version used to analyze the data (citing references as needed). Statistical terms and variables should be defined. If pertinent, describe how data were tested for normality, what tests were applied, and how statistical significance (the alpha value) was defined. Include appropriate indicators of variance and uncertainty, including confidence intervals.

Results

Results should be described briefly in the text, with the most important findings conveyed in tables and figures when appropriate. The key is to present your findings with clarity and precision, but without interpretation (which occurs in the Discussion section). Organize the sections of the Results logically and in parallel with Methods.

When reporting quantitative data, report only the number of digits provided by the precision of the measuring device (an additional digit can be added to the SD or SEM). For example, albumin concentration is reported to one decimal place, whereas ALT activity is reported to the nearest whole number. Don't report data solely as percentages; the numbers from which the percentages were derived also should be indicated. Use of conventional or international (SI) units should follow journal guidelines.

When reporting statistical significance, report the actual P value for individual comparisons (or < for multiple comparisons). P values need not be reported for post-hoc tests (following ANOVA, for instance), but you should indicate which groups differ. Where multiple statistical tests are used, it is useful to refer to the statistical test used following the P value in the text. When differences are not observed and the results don't have an impact on the conclusions, it may be appropriate to state "data not shown."

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When citing tables and figures, avoid using a separate sentence. Rather, cite the figure or table at the end of a sentence that summarizes the main finding. For example, instead of stating, "Figure 1 shows the articular fracture," state: "The articular fracture was characterized by a crescent-shaped lucency (Figure 1)." Make sure all tables and figures are cited and in the proper order.

> *Data presented in a table or figure should be summarized, not repeated, in the text.*

Discussion

In this final section you will discuss your results in the context of the study objectives and the literature and draw conclusions or generalize your results to other populations. Most studies are not perfect; they encounter obstacles, either anticipated or unforeseen. To the extent your data are still valid and important, public recognition of the limitations helps the reader understand the usefulness of your study. In comparing your work with other studies, include citations only to relevant literature; don't cite every paper on the topic. Avoid speculation and don't simply restate your results or information already presented in the Introduction. Not every result from your study needs to be discussed. Focus on the strengths and limitations of your study and comment on any unusual or unexpected findings. Suggest directions for future research based on the outcomes of your study.

The Discussion section is often the most difficult to write, in part because the format and content are highly study-dependent. **The first paragraph is a continuation—not a repetition—of the Introduction** and should encapsulate the most important and new findings of the study or case; indicate whether your hypothesis was correct or your research question was answered and whether your objectives were achieved. The last paragraph should state the main message(s) of the study and whether future studies are warranted: What conclusions and implications did you draw from your findings? What has your study contributed to the scientific community? The paragraphs in the middle can parallel the order of the results or lead from the most to the least important finding in the study, using a new paragraph for each discussion point. Always begin paragraphs with a strong topical sentence and follow with supporting sentences.

References

To provide an evidence-based context for your work, references should be relevant, accurate, and focused on the primary literature (peer-reviewed journal articles). Be sure to use the journal's reference style for citing references in the text and for the bibliography itself; use the correct abbreviations for journal names (you can search for a journal's abbreviation at the National Center for Biotechnology Information: http://www.ncbi.nlm.nih.gov/nlmcatalog/journals). Note that some journals limit the number of references. For articles published in another language, include the original title but follow it with a bracketed English translation of the title.

You are responsible for the accuracy of all references, including citation details and the information being attributed to that citation. Don't propagate citation errors found in other papers (there are many) and don't cite a reference based only on the abstract or because it was referenced in another paper. Minimize citation of non-peer-reviewed sources, such as book chapters, review articles, and proceedings; they can include unverified or anecdotal information. Cite only the most recent edition of textbooks and avoid citing abstracts except for very recent studies, as they contain limited information and only preliminary results. If you obtained critical information through a personal communication, identify the individual by name and affiliation in parentheses in the text and obtain his or her permission to be cited. Forward that written consent to the journal editor.

Tables and Figures

Tables and figures group data visually; they should add value to the data by emphasizing important features (such as trends over time) and by organizing and summarizing complex data (such as detailed numerical or statistical results). Tables and figures should be self-explanatory and stand on their own without reference to the text. In addition to conveying results, tables and figures also can be used in the Methods section, e.g., to illustrate study design or a complex procedure. Readers browsing your article will focus on the tables and figures to extract key information about your article. Because journals vary in their requirements, be sure to check the guidelines for your target journal when preparing your tables and figures.

Tables should convey only one or two main points and table titles should contain sufficient information to describe the content. Footnotes (according to the journal's style) can be used to define abbreviations and provide information about data, groups, and statistical analysis. Verify significant digits and ensure percentages add up to 100%. Always include measures of variance, such as SD and confidence intervals. In laying out your tables, keep horizontal lines to a minimum and avoid vertical lines.

Plots and graphs should include appropriate measures of variance, e.g., error bars, as well as appropriate scales to avoid distorting the data. Axes should begin at zero if the analyte measured can have a value of zero. Consider the best way to display the data; for example, dot plots may show the distribution of data better than a histogram would. Simple and uncluttered figures convey your message more effectively than complex ones. Unless color is essential, the figure should be in grayscale on a white background. Similarly, use symbols rather than colors to designate groups or lines. For accurate readability, label axes using a sans-serif font, such as Helvetica or Arial. Make sure graph details are large and clear enough to be visible when the figure is reduced to one-column width in the printed journal or PDF.

Images should be representative and sharply focused. Some journals require an internal scale marker. Histologic sections should be oriented properly (e.g., skin biopsies should have the epidermis at the top); images of parasites should appear on a white background. Be certain the magnification is adequate to portray the features of interest. Add arrows or other indicators to facilitate understanding; label multi-part figures clearly (e.g., A, B, …) and ensure that each part is described in the caption. Crop images to omit extraneous space and emphasize key points, but don't alter or crop in ways that would convey false information.

During the submission and review processes, most journals accept color images in RGB format (red, green, and blue light with millions of colors using an additive process), which is a rich color mode used in online publication. However, color images are published in print

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in CMYK format (an ink-based mode using cyan, yellow, magenta, and black inks and a subtractive process), resulting in color changes and loss of subtle detail. For examples of the same images in RGB and CMYK formats, see http://www.nature.com/nature/authors/gta/3c_Final_artwork.pdf. If you are submitting your work to a journal that is published in print, it is best to convert your image from RGB to CMYK mode in advance to determine how the color and details of your image are affected. If the result is unsatisfactory, consult the publisher for assistance.

Figure captions should be listed on a separate page at the end of your text document. Begin each caption with a title stating what the graph, plot, or image conveys, e.g., "Bland-Altman plot of RBC counts obtained from two hematology analyzers" or "Helical computed tomography images of T11 from the mid-vertebral body", followed by a brief description of the findings in the figure. Any abbreviations or symbols used in the figure should be defined, and pertinent statistical information should be provided. For microscopic images, indicate the tissue, type of preparation (e.g., imprint), species (if not obvious from the article), a brief description of what the image shows, and stain, including the chromagen for immunostains. In the absence of a scale marker, specify the final magnification or the objective lens for photomicrographs. If a colleague who is not a co-author has provided the figure, you may acknowledge the individual in the caption.

Appendices and Supplemental Material

Some journals permit inclusion of supplemental online materials (text, data, tables, figures, videos, appendices), allowing you to include information of interest to select readers while keeping your article succinct. For example, videos of procedures, such as echocardiography, may be supplemental to an article in the *Journal of Veterinary Cardiology*. The supporting materials are reviewed along with the manuscript, but you are responsible for their content and functionality.

Acknowledgments and Disclosures

In addition to acknowledging the names and affiliations of individuals who contributed to the study, all sources of funding, gifts, and donated materials and equipment should be acknowledged, including the reference numbers of grants. Many journals also publish a separate statement at the end of an article to disclose any financial or other relationships on the part of the authors with organizations, corporations, or other entities that are related to the subject or content of the study. Some journals include a statement of prior presentation of your data, e.g., at a conference.

Common pitfalls in writing and how to avoid them

PROBLEM IDENTIFIED BY EDITOR OR REVIEWER	SOLUTION
INTRODUCTION	
Too long; includes extensive literature review	Limit the Introduction to 2-3 paragraphs and cite literature directly relevant to your study.
Lacks internal structure that builds a compelling rationale for the study	The Introduction should lead the reader from the broad importance of the topic to the specific gaps in knowledge that warrant your specific study.
Lacks hypothesis/research question or specific aims	Be sure to state your hypothesis/research question and the specific objectives of your study at the end of the Introduction.
MATERIALS AND METHODS	
Methods not presented in logical order or don't match specific aims	Present methods in a logical order that matches your study design; this order may be different than the order in which you collected data. All methods should be linked to one or more of the specific aims of the study.
Insufficient detail about study population	Define study population completely (species, breed, age, sex, body weight, definition of "healthy").
Details of methods insufficient to permit replication of the study or evaluate validity	Provide details of study design, sample collection, analytical methods, scoring systems, and statistical analysis.
Results reported in the Methods	Whenever a method is described, the outcomes should be considered as results. *Example*: When a method for the selection of cases is described, the number of cases included in the study is a result. *Example*: When a method is being developed as part of a study, the methods used to evaluate the method are included in the Methods section, whereas the results of the evaluation are included in the Results.

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PROBLEM IDENTIFIED BY EDITOR OR REVIEWER	SOLUTION
RESULTS	
Results don't match Methods	For every method there should be a result and for every result there should be a method; they should be in complete agreement.
Results don't match the specific aims	All results should be linked to one or more of the specific aims of the study.
Methods included in the Results	Don't repeat methods or introduce new methods in the results.
Redundancy between text and figures or tables	Don't repeat specific data in the text that already are presented in a figure or table. Instead, summarize the data in the text briefly while citing the figure or table.
Interpretations made in the Results	Report data dispassionately. Avoid using terms like "only", "nearly", "excellent," or "poor" unless you are reporting correlations or agreement and have defined your terms. Simply report the findings and leave the interpretation for the Discussion.
TABLES AND FIGURES	
Titles/captions not informative	Tables and figures should stand alone without needing to reference the text to understand them.
Data too simple to require a table/figure	Scrutinize your table/figure to determine if it is really necessary and adds value to the data.
Graph does not accurately represent the data	Be sure axis scales don't exaggerate differences and data are presented in the most complete way possible.
DISCUSSION	
Too long and main message lost; fails to begin with most important/novel findings in the first paragraph and end with broad implications in the last paragraph	The Discussion should lead the reader from whether or not you proved your hypothesis or answered your research question (first paragraph) to how your results can be understood in the context of the literature (middle paragraphs) to the broad implications of your study (last paragraph). Middle paragraphs should focus on important findings and limitations.
Text from the Introduction repeated in the Discussion	Don't repeat your reasons for doing the study in the Discussion; you've already described these in the Introduction. Rather, focus on the results and what they mean. *Think of the Discussion as a continuation of the Introduction.*
Limitations not addressed	All studies have limitations. Anticipate limitations that will be identified by reviewers and address them in the Discussion.
Results repeated in the Discussion	Avoid repeating statements of results in the Discussion; rather, think ahead to what you want to say about particular results – were they unanticipated? confirmatory? limited by sample size or analytical methodology? Incorporate that thought into the leading sentence of a paragraph. Don't cite tables or figures in the Discussion unless to point out a specific finding related to interpretation of the results.
New results included in the Discussion	Don't introduce new data in the Discussion. A new table or figure should be included in the Discussion only when it involves the literature being discussed, such as a table summarizing published findings in relation to the findings in your study.

Organizing and Writing a Case Report

Case reports are less structured than a research article and may be limited to Case Presentation and Discussion sections. In some journals, a brief introduction or background may precede the Case Presentation to explain why the case is important and being reported. Abstracts for case reports should begin with salient information about the animal(s), methods used in the investigation, the findings, and the novel information gained. Journal styles differ, so refer to a recent issue of your target journal.

The Case Presentation should provide a logical and orderly—not necessarily chronological—description of the case, including history and presenting signs, physical examination, clinical and diagnostic testing, specialized testing or investigations (if relevant), differential diagnoses, treatment, and outcome and follow-up. To merit publication, a case must be well documented to support the diagnosis and conclusions. The Discussion should briefly encapsulate the most important and new findings of the case, discuss your case in the context of similar cases, note limitations in case documentation, and end with the take-home message. A case should not be written in the same format or style as for a certifying examination. Rather, a case submitted to a journal should focus on the new or novel findings that warrant its publication in the scientific literature; thus, do a literature search early on to ensure that your case has novel findings. Case reports that lack sufficient novelty or supporting evidence usually are rejected for publication.

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REVISING YOUR MANUSCRIPT FOR READABILITY AND COMPREHENSION

Scientific articles differ from creative writing: they are intended to effectively communicate the results of a research study. A consistent pattern of organizing content (i.e., IMRaD) and clear, concise, and precise writing help achieve this goal by improving readability and comprehension. Don't assume your audience is informed on the topic; be explicit so readers don't need to infer your meaning. Don't hesitate to consult an English grammar reference when you are uncertain about correct usage. To detect errors and unclear phrases, experienced writers highly recommend that you **read your manuscript aloud** before finalizing it. For similar reasons, have a colleague unfamiliar with the study read your article and provide input on clarity and comprehension.

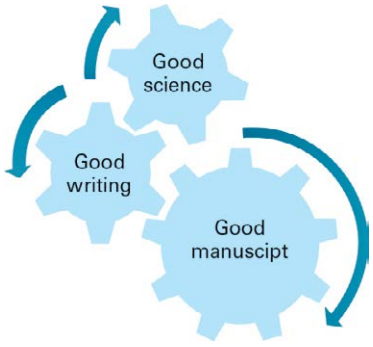
From First to Final Draft

Writing is a recursive process involving cycles of revising that lead to a cohesive message: manuscripts usually undergo multiple revisions! After completing your first draft, revise it a few times for accuracy and organization. Make sure:

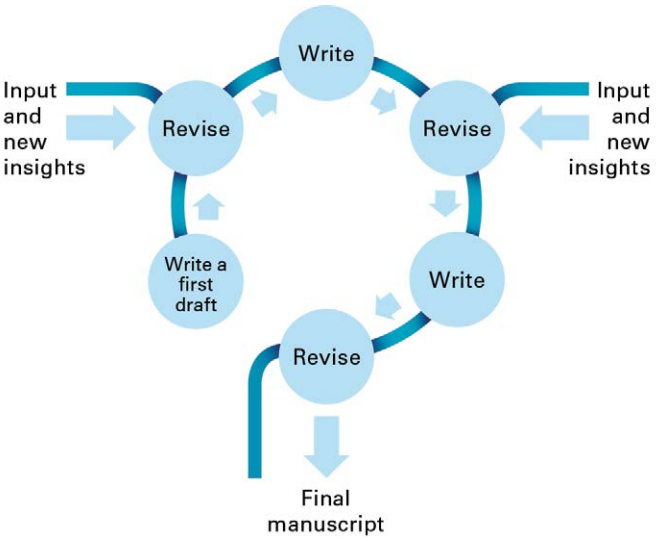
- Information is complete
- Facts and figures are accurate
- References are correct
- Terminology is consistent
- Sections of the manuscript are organized properly and form a coherent whole

Then give your revised manuscript to a faculty mentor or an experienced colleague who can provide useful feedback to help you in further revision. Use subsequent revisions to incorporate their suggestions and to polish the draft and the writing. Send your newly revised manuscript to your co-authors for review and give them a deadline to respond (and a reasonable extension if needed); timely cooperation is an essential part of authorship.

Before finalizing your manuscript, proofread it carefully and make all necessary corrections in spelling, grammar, punctuation, and format, checking again the Author Guidelines. Send the final version to all of your co-authors when you submit the manuscript for publication. Writing is a collaborative process in which all authors participate.



Writing is a recursive process involving cycles of revising that lead to a cohesive whole.



Be Clear and Concise

Write simple sentences that convey a single thought and keep paragraphs short. The more complex the study, the more important it is to use simple language to describe it. Delete unnecessary words and omit repetitious words and phrases. For example, revise "is known to be present" to "is present" and "was found to improve" to "improved". Choose simple words to convey concepts, e.g., "used" rather than "utilized" or "employed"; and "had" rather than "exhibited." Be assertive, rather than cautious, avoiding weak words like "might" and "tend to". Keep abbreviations to a minimum and limit their use to standard abbreviations or those necessary to shorten long, often-repeated phrases. Although two-letter abbreviations may be used, three-letter abbreviations are easier to read and are less likely to cause confusion.

Choose Your Voice

In the past, most scientific articles were written in the passive voice; for example, "A unique strain of the organism was isolated." However, many journals and editors now encourage use of the active voice, which helps bring the writing to life and improves readability. The active voice, for example, "We isolated a unique strain of the organism…", is less wordy and more direct. The passive voice should be used when the subject is unknown (e.g., "Future studies are indicated" – but you're not sure who will do them), when the subject is unimportant (e.g., "Blood was collected" – but who collected it is not important), or when you want to emphasize the object rather than the subject (e.g., "DNA was first isolated by…." – with the emphasis on DNA rather than one who isolated it).

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Tense, Syntax, Grammar, and Punctuation

A scientific article describes work that has been completed. Therefore, the past tense should be used when referring to the work done in the study. The present tense is often used for statements referring to established knowledge, for example: "Malignant melanomas *are* usually metastatic"; however, past tense is used when attributing specific knowledge to someone else: "Coombs *found* that RBCs coated with globulin would agglutinate with the addition of anti-globulin." The present tense also may be used to convey general conclusions from your study that are broadly applicable, such as, "Based on the results of our study, vaccination is an effective method of control for infectious keratoconjunctivitis in cattle."

Syntax refers to how words are combined to form phrases and sentences. Important considerations include using a verb to indicate action, placing modifying words close to the word they modify, and avoiding stacked modifiers. The journal's copyeditor will correct small grammatical mistakes once your manuscript is accepted for publication; however, if grammatical mistakes impair understanding of scientific meaning (or are interpreted as sloppiness), unfavorable reviews can result even when the scientific quality is high. Make sure subjects and verbs agree (singular vs. plural), nouns are not used as adjectives, and sentences have parallel construction, i.e., the same pattern of words is used in a series.

Avoid indiscriminate capitalization and keep punctuation to the minimum needed for readability and comprehension. Capitalization rules for animal breeds vary among veterinary journals; some use the official American Kennel Club spelling for canine breeds. Don't place commas indiscriminately in your text. However, to ensure clarity, place a comma before the "and" in the last item in a series (serial or Oxford comma). Use apostrophes appropriately and don't use them to form a plural.

Be Precise

Your goal is to communicate effectively, so avoid the use of jargon that some readers may not understand. If you submit your article to *Veterinary Radiology & Ultrasound*, your primary audience may understand a phrase like "low attenuation focus in the liver," but it may not be clear to a generalist or non-specialist. Avoid shortcuts, such as "the cytospin was stained", instead of "the cytocentrifuged sample was stained." Always avoid slang, clichés, figures of speech, and idioms that are used in spoken language but are not appropriate in a scientific article.

Understand the difference between similar words (e.g., parameter vs. variable, comprise vs. compose, maximum vs. optimum) and choose the correct one. When describing manifestations of disease in an animal, **clinical signs** is more accurate than **symptoms** (and **subclinical** is more accurate than **asymptomatic**), as symptoms are sensations felt and reported by a human patient. When a comparison is involved, describe changes as "higher" or "lower" rather than "increased" or "decreased". Use specific rather than vague words to convey your meaning; for example, the sentence "Treatment affected clinical aspects of the disease" is imprecise. Affected how? What clinical aspects? A better sentence is "Heart rate returned to normal with treatment." Use of correct and specific words will enhance comprehension of your writing.

Pre-Review for Language

If English is not your native language, ask someone skilled in scientific writing in English to critically review your manuscript prior to submission. It's worth the investment in time and money. In our experience, one of the most common reasons for immediate rejection of a manuscript is unclear writing because of language. If your work merits publication, it merits close and detailed attention by a native English speaker. Some journals offer suggestions for editorial assistance for non-native English writers. Check the journal homepage for resources.

Best use of language to avoid common errors

WRITING ASPECT	EXAMPLES
SYNTAX	
Use verb to indicate action	Wordy, poor syntax: "Examination of the dogs was performed by the clinician." Good syntax: "The clinician examined the dogs."
Place modifiers next to or close to words they modify	Unclear: "Antibiotics used to treat food animals banned by the FDA included…" (did the FDA ban the food animals?) Better: "The FDA will restrict use of the following antibiotics in food animals…"
Avoid noun clusters and stacked modifiers	Stacked: "purified pro-oxidant vitamin-deficient fish oil diet" Better: "pro-oxidant diet containing fish oil, but deficient in vitamin E"
Position "only", "just", and "almost" correctly	Incorrect: "We *only* recorded EKG tracings for 2 dogs" (means we did nothing else but obtain tracings). Correct: "We recorded EKG tracings for *only* 2 dogs."
Avoid use of "this", "that", "it" when what those words refer to is not clear	"Different sampling techniques were used, and time to analysis was 10-30 minutes. *This* resulted in wide variation in the results." What does "this" refer to?
Avoid use of "there is" and "there are"	Wordy: "There are many causes of tachypnea..." (now another sentence is needed to list those causes) Better: "Causes of tachypnea include…"

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WRITING ASPECT	EXAMPLES
GRAMMAR	
Match singular and plural subjects with singular and plural verbs, respectively	Data, criteria, media, and bacteria are plural nouns. "The data *are* …."
Avoid using nouns as adjectives	Incorrect: *cat* diseases Correct: *feline* diseases
Ensure sentences have parallel construction	Not parallel: "Dogs in Group 1 had a lower heart rate and cardiac output was increased compared with dogs in Group 2**."** Parallel: **"**Dogs in Group 1 had a lower heart rate and higher cardiac output than dogs in Group 2**."**
PUNCTUATION	
In English, use a period (full stop) and not a comma as a decimal point	0.03 (not 0,03)
For "it's" and "its", use an apostrophe to indicate a missing letter, but no apostrophe to indicate the possessive	"It's (It is) important to obtain a complete medical history…" vs. "The kidney and its function…"
Don't use apostrophes to form plurals	RBCs, not RBC's
PRECISION	
"That" and "which"	"That" defines the word before it and is almost always the correct word. "Which" introduces a parenthetic statement that could be offset by commas.
"Compare to" and "compare with"	"To" asserts a similarity, as in "tumor x compares to tumor y in its metastatic potential"; "with" means analysis for both similarity and differences, as in "the metastatic potential of tumor x was compared with that of tumor y".
"Percent" and "percentage"	"Percent" is used with a number ("10 percent of the cattle were febrile"); "percentage" is used without a number ("a small percentage was febrile").

SUBMITTING YOUR MANUSCRIPT

First Impressions Count!

To increase the likelihood that your manuscript proceeds to peer review, ensure it is complete, correctly formatted, well written, well organized, and free of spelling and language errors *before* you submit it. Use your computer's grammar and spell-check functions. They aren't foolproof, but they are a useful first step in your proofreading process. Your manuscript may have scientific merit, but if the first impression suggests a lack of attention to detail, its scientific credibility and readability are undermined and might lead to rejection or a harsh review. Editors must prioritize submissions and will prefer to use a reviewer's time more effectively on carefully prepared manuscripts. In addition, some journals offer a fast track to publication for manuscripts that both meet scientific standards and are well written.

Unless instructions for your target journal indicate otherwise, the entire manuscript should be double-spaced, including references and figure captions. Use continuous line numbering to facilitate reference to specific lines in the manuscript. Tables and figures should be clear and accurate and should be placed at the end of the document or submitted as separate files, not placed within the text. Follow the Author Guidelines exactly for your target journal. Attention to these details demonstrates that you understand the process (as well as the science) and that you value the time of the editors and reviewers. In other words, read the Author Guidelines again before you submit your manuscript!

Online Submission

Most journals have online, or at least e-mail, submission processes and no longer require a paper copy. The online submission process can sometimes take more time than you expect – perhaps one to two hours. It requires you to set up log-in and password access, enter data into defined fields, and upload electronic files. Prepare for this by having everything ready, including the institutional affiliations and email addresses of your co-authors, all manuscript files in the required formats, and a good Internet connection. Online submissions can be saved while in progress, but by completing the submission in one or two sessions you can avoid having to relearn the process. When emailing a submission, know the size limit for files and ask for verification of receipt.

Author Guidelines:
required reading...every time you submit a manuscript

The Author Guidelines will indicate the types of acceptable files. For text and tables, Word files are often used, but some journals accept rich text format (RTF) or other types of text

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formats. In most online submission systems, a PDF of the manuscript is created that merges the text, table, and figure files into a single file for the reviewer. Problems in creating this PDF may be encountered if files are corrupted or when older versions of software are used. Some journals will also alert you if the resolution of your figures is too low. Use the "Help" feature for assistance in troubleshooting the online submission system or contact the managing editor of the journal.

Submitting Digital Images

"Art work," including drawings, graphs, images, and photomicrographs, should be submitted as digital files. High-resolution TIFF files are preferred for publication, but JPEG, PowerPoint, and Excel files are often acceptable for the review process as long as high-resolution files are available for publication; be sure to check the Author Guidelines for your target journal to ensure files are in the correct format for submission. Color and half-tone images should be acquired at a minimum of 300 pixels per inch (ppi) and line art at 1200 ppi for optimal print resolution (resolution cannot be increased once an image has been acquired). Color images will be converted from RGB to CMYK mode for print publication (see Images, pp. 11-12); CMYK is not as rich a palette as RGB, especially in the purple spectrum, and images may require adjustment by you or a technical assistant. Size the images appropriately; except for multi-part figures, most are published as one-column width.

Cover Letters and Corresponding Authors

A brief cover letter to the editor is an opportunity to emphasize the importance or novelty of your work and to explain why it is appropriate for this particular journal (especially if this is not obvious from the title or abstract of your manuscript). Cover letters also can be used to verify authorship, original publication, and the corresponding author, although most electronic submission forms ask for these verifications separately.

Checklist for submission of your manuscript*

DOCUMENTS AND CONTACTS: HAVE THIS INFORMATION AVAILABLE BEFORE YOU SUBMIT
☐ Cover letter with a brief description of the work and its importance
☐ Signed copyright transfer agreement (some journals request this only after acceptance)
☐ List of potential conflicts of interest for all authors
☐ All author names, affiliations, and contact information, including email addresses
☐ Names of contact and corresponding authors†
☐ Names and contact information of preferred or non-preferred reviewers (may be optional)
VERIFICATIONS: BE PREPARED TO CONFIRM THE FOLLOWING DURING SUBMISSION
☐ Author contributions warrant authorship
☐ All authors have approved the manuscript
☐ The manuscript has not been submitted for consideration by another journal
☐ The manuscript has not been previously published (previous publication of an abstract or other form should be disclosed)
☐ Conflicts of interest have been disclosed for all authors
☐ Pertinent ethical guidelines have been followed
MANUSCRIPT
☐ Manuscript is double-spaced, has continuous line numbers, and is in correct file format
☐ Article type matches one of the article types for the journal
☐ Title is descriptive and succinct; a short running title is provided
☐ Author order is correct; author names and affiliations are complete and correct
☐ Corresponding author and contact information are indicated on the title page of the manuscript†
☐ Abstract follows word limit and is formatted correctly (structured or unstructured)
☐ Key words are listed and don't duplicate words in the title
☐ Format of text (headers, word limits) is correct for article type
☐ A statement of compliance with institutional guidelines for care and use of animals is included in the Methods section (if applicable)

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☐ Text has been carefully proofread for spelling and grammatical errors
☐ Text has been carefully proofread for proper use of English
☐ In-text citations of references are correctly formatted (e.g., superscripted numbers, author names in parentheses)
☐ Acknowledgments provide name(s) and affiliation(s) of individuals and sources of funding and support
☐ References in bibliography are correctly formatted
☐ Tables are correctly formatted and stand alone without reference to the text
☐ Figure captions are complete and stand alone
☐ Figure files are in correct format (e.g., TIFF) and of appropriate resolution
SUPPLEMENTARY MATERIALS
☐ Supplementary material for review purposes only (optional)
☐ Supplementary material for online publication (optional)

* Formats for submission vary, so follow the guidelines for your target journal.

† It may be possible to designate a separate contact author and a corresponding author, although these are often the same person. A contact author handles all communication, including copyright transfer and disclosure forms, about the manuscript as it moves through peer review, revision, and production processes. The corresponding author is ultimately responsible for the final manuscript and is indicated on the title page of the manuscript and in the published article. Contact information for the corresponding author is published so readers can request a PDF or ask questions about the article after publication.

UNDERSTANDING PEER REVIEW AND THE EDITORIAL PROCESS

Purpose and Types of Peer Review

Peer review provides editors with an independent assessment of the quality, validity, and importance of a manuscript. Although peer review is not a perfect system, it is the best process we have to help editors evaluate and prioritize manuscripts. Peer review also helps authors improve the quality of their manuscripts through constructive advice on study design, data analysis and presentation, writing, and other aspects of the manuscript's contents. A well-defined and rigorous system of peer review demonstrates that an article has undergone critical evaluation and passed muster with knowledgeable experts.

Peer review in veterinary journals is usually single-blinded, meaning that reviewers know the identity of the author(s), but the identity of the reviewers is not revealed. Some veterinary journals, such as the *Journal of Veterinary Emergency and Critical Care* and the *Equine Veterinary Journal*, use double-blinded peer review, meaning that the reviewers are also blinded to the identity of the authors and their institutions. A double-blinded system requires that information identifying the authors be removed from the manuscript.

Working with Journal Editors

The editor-in-chief oversees all aspects of the journal and is usually assisted by associate editors, section editors, or other subeditors. You will interact with one or more of these editors many times during the submission, review, and publication processes. Be proactive in your communication; pay attention

Writing and publishing are collaborative processes.

to which editor is signing correspondence, and don't hesitate to contact that individual by telephone or email when you have questions or are seeking advice about any aspect of the process. The editor-in-chief has a "big picture" view of the journal's multiple missions and bears responsibility for all final decisions as well as the long-term direction of the journal. Therefore, when deciding whether and when to publish your manuscript, the editor will consider all recommendations as well as the relevance of your article, its timeliness, its educational value, the balance of themes and types of articles, competing viewpoints, and emerging topics that define the journal.

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How Does Peer Review Work?

The peer-review process works best when it is prompt, constructive, and focused on the major scientific points of the study. Peer review is essential for identifying major or fatal flaws in study design or analysis that could affect the validity of the results and conclusions. A reviewer's expertise is also needed to ascertain that the work is new and contributes to the field. Reviewers are asked to comment on the quality of organization, presentation, and writing, especially if it interferes with clear understanding of the content.

What do reviewers look for?

- Is the information important?
- Is the material original?
- Are the research, methods, and data valid?
- Are the conclusions reasonable?
- Is the writing clear?
- Are the tables and figures appropriate?
- Are the references up to date and relevant?
- Is the content appropriate for the journal's readers?

Peer reviewers in veterinary medicine are almost always volunteer experts who expend considerable time and effort on a manuscript. Depending on the subject or study, two to four peer reviewers will usually evaluate a submission. Reviewers are expected to maintain confidentiality about all aspects of the manuscripts they review.

You may be asked to identify reviewers or indicate preferred and non-preferred reviewers when you submit your paper; editors will consider these suggestions along with other options to achieve an objective and balanced review. Suggested reviewers should be experts in your field, perhaps those you have cited in your manuscript or know from conferences. Don't suggest individuals with whom you have had recent collaborations, grants, or co-authored papers, or who are at your own institution; these relationships present a conflict of interest and preclude eligibility as reviewers. Consider alerting the editor to conflicts of interest with potential reviewers in your cover letter. For non-preferred reviewers, limit your list to one or two individuals and include a brief justification (e.g., personal bias, serious objections to your research approach) in your cover letter.

Reviewers are advisory to the editor, who makes the final decision about a manuscript. Editors will often qualify concerns raised by reviewers and add points that were missed. Thus, peer review is multilayered and involves several individuals, rendering it a sometimes time-consuming or inefficient process that can take several weeks to months (four to eight weeks is typical). After eight weeks, you may contact the editor or managing editor to politely inquire about the status of your manuscript. In the end, peer review is usually fair and results in an improved manuscript.

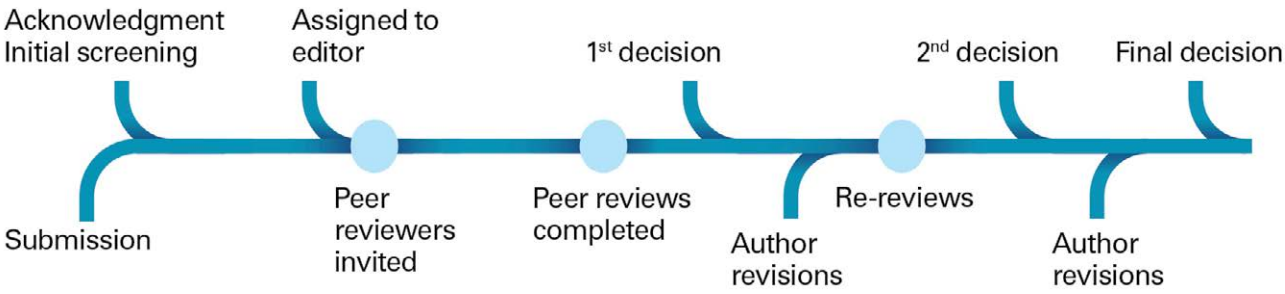
As an author, you might be interested in becoming a peer reviewer yourself! Editors often identify peer reviewers based on their publication record, so you may be asked to review a manuscript once you have published a few papers and become known in your field. You can also convey your interest in becoming a reviewer to your faculty mentor who may be able to guide you in how to review a paper and who can recommend you to journals as a reviewer. You can also create a user account for a journal's online submission system and include in your profile key words that represent your areas of expertise. You may contact the editor and offer to review manuscripts for the journal after providing your qualifications. Once you become a peer reviewer, continued requests to review will depend on the need for your expertise and on the quality and timeliness of your reviews.

Responding to Reviewer Comments

Scrutiny of your work by peers can be intimidating! It is rare for a manuscript to be accepted without revision and no study is perfect – there is always room for improvement. That said, receiving a long list of comments from reviewers can be disheartening. If you set them aside for a few days before responding, you will be able to judge them more objectively and will probably realize that some good points were raised.

Respond completely, politely, and with evidence to each of the reviewers' comments. The email message you receive with the editor's decision will usually include guidelines and a deadline for your response, which should be followed closely. Just as clarity is important in your manuscript, it is also important in your response to the review. In a separate document or response letter, for each major and minor comment indicate whether you made the change requested, the nature of the change, and where in the manuscript the change was made (line and page number). If the revisions are few, highlight or track them in the manuscript file (if there are many changes, tracking can be distracting to reviewers; follow the journal's guidelines in this regard). These two steps – providing an itemized description of

The peer-review process follows a similar timeline for most journals.



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your responses and indicating your revisions in the manuscript file – will permit reviewers and editors to evaluate your responses quickly and accurately.

Most suggested changes should be made, but if there are points with which you strongly disagree, provide a rebuttal and include your reasons for not making the suggested change. If reviews are unclear or conflicting, feel free to contact the editor to obtain clarification or advice. Always respond in a professional and non-confrontational manner, even if you feel a reviewer was unnecessarily harsh. If you are unable to meet the deadline for completing your revisions, contact the editor in advance to request an extension. If major revisions are recommended, the revised manuscript will likely be sent again to the peer reviewers. Sometimes an original reviewer is not available, and the revised manuscript is sent to a new reviewer, who may make additional recommendations. Keep in mind that a request for revision is not a guarantee of acceptance.

Handling a Negative Decision

Rejection is always disappointing but happens to all of us at some time in our careers. As with reviewer comments, put the decision letter on hold for a few days and then focus objectively on the reason for rejection, not on your emotional response. Journals that receive a high number of submissions often have high rejection rates.

Common reasons for manuscript rejection include:

- The manuscript does not adhere to Author Guidelines
- The topic is not within scope
- There are fatal flaws in the study design
- The study does not provide sufficient new information
- The quality of the writing is poor

A rejection is a final decision; don't revise and send your manuscript back to the same journal without first discussing this with the editor. If you feel strongly that the criticisms can be addressed or you have strong justification for questioning the rejection, consider an appeal. Perhaps the reviewers failed to understand the main concept or relevance of your article or appeared to have a bias that was disadvantageous to you. The editor reserves the right to uphold the rejection or rescind it, and a willingness to reconsider a decision carries no guarantee of a change in that decision.

If you decide to revise your manuscript and submit it to another journal, you should:

- Address previous reviewer comments
- Prepare a new cover letter
- Update the literature search and references
- Reformat the manuscript according to the new journal's Author Guidelines

After Acceptance: Editing and Page Proofs

Congratulations – your manuscript is accepted for publication! Check the acceptance notice carefully to find out the next steps. Many authors believe the publication process ends with acceptance: not so! This is usually the point at which various forms are due (e.g., copyright transfer, disclosure) and when your accepted (or preliminarily accepted) manuscript undergoes editorial review. Editing can be technical or substantive and could involve additional revisions in wording and terminology, figures and tables, organization, and references. These edits mean more work for you, but usually result in a manuscript that is more readable and of higher quality. Once you submit the necessary forms and complete your final revisions, your manuscript enters the production process.

Some journals, like *BMC Veterinary Research*, publish unformatted and unedited versions of a manuscript immediately after acceptance, but most veterinary journals first send the manuscript to the publisher for copyediting and layout. Copyeditors make additional (usually minor) changes and corrections and ensure your manuscript is formatted according to the journal's style. Once formatted, page proofs of the article are sent to the corresponding author (in PDF format) that show how the final manuscript will appear in print. Be sure to read the instructions that accompany the proofs and note the deadline for making corrections (often only 24-48 hours). This is your final opportunity to correct mistakes, including potential errors introduced during copyediting; it's *not* the time to introduce new data, text, tables, or figures. If you need more time to correct the proofs, contact the editor or publisher.

Once you (and the editor) have approved the proofs, your article is ready for publication. The online publication of your article, which often occurs ahead of print publication, is the official version of record (it is assigned a DOI [digital object identifier], is indexed, and can be cited by others). Journals that are published solely online usually publish articles in the order in which they are finalized; print journals may compile articles in the order in which they were submitted or may group them in an issue with related or complementary articles.

After Publication

Your article's journey does not end with publication! In fact, publication is when life really begins for your article, which now can be read, discussed, cited, and lead to new studies and investigations. Many post-publication options are available that promote and track your article and its citation by others, provide free access to a PDF of your article for you and your co-authors, and permit you to provide free access to the article to a limited number of colleagues. The publisher might also include your article in a future themed "virtual issue" and will be able to track how often your paper is downloaded and by whom. In some situations, it may be acceptable to post your article to an institutional repository, but be sure to check first with your university and publisher. The final accepted version of a manuscript that acknowledges NIH funding or support must be deposited in PubMed Central (by you or by the journal's publisher) as part of the NIH Public Access Policy.

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PUBLICATION ETHICS

The scientific enterprise, including writing and publication, is built on a system of trust among readers, authors, editors, reviewers, and publishers. Ethical principles and editorial policies help establish and uphold this trust.

In veterinary journals, ethical issues fall into four major categories:

- Inappropriate re-use or reproduction of original work
- Research integrity
- Disclosure and transparency
- Animal use

Although ethical policies and practices vary among countries and institutions, most veterinary journals adhere to strict international standards, including those developed by the International Committee of Medical Journal Editors (ICMJE) and the Committee on Publication Ethics (COPE). These and other organizations provide ethical guidelines for the conduct and reporting of research.

Inappropriate Reproduction of Original Work

Original work should be published only once. Journals will not usually consider a manuscript if it has been submitted or published elsewhere; this ensures the information has a clear and single source and citation. It is unacceptable to submit your manuscript to more than one journal at the same time, hoping for acceptance at one. It also is unacceptable to publish someone else's work as your own (plagiarism), to publish all or part of the same work in more than one journal (duplicate publication), or to use copyrighted information without appropriate permission.

Plagiarism

Plagiarism is the misrepresentation of someone else's work as your own. It is unacceptable to use another person's data, figures, tables, or text without clear and appropriate attribution. Sentences, paragraphs, sections, and even unique words or phrases taken from previously published work should not be used without modification or direct quotation. Rather, you must understand what you read and then paraphrase it in different terms. In an environment where "cutting and pasting" is easy and information is readily available online, publishers and editors are scrutinizing manuscripts more closely for plagiarism, often using specialized software that identifies duplicative text. Published work that is subsequently found to have been plagiarized may be retracted by the journal, and the author's institution may be notified of the occurrence.

Duplicate (Dual, Redundant, or Self) Publication

Duplicate publication is the re-use of your own data or text in more than one publication. Most, if not all, veterinary journals state they will consider only work that has not been published elsewhere. What constitutes permissible previous publication differs among journals; editors may request a copy of the previously published work and consider its distribution, the amount of overlap, and the nature of the differences. Theses or dissertations, for example, are not usually considered as previous publication. Some veterinary journals strictly limit previous publication to an abstract of 250-300 words. Thus, before publishing your work in any form, whether print or online, be sure to first check the guidelines for your target journal to ensure they don't preclude consideration of your manuscript.

Frequently in veterinary medicine, an author will consider submitting a manuscript that contains data that have been published previously in extended abstracts or conference proceedings. As many journals don't accept this type of overlap, check with the editor-in-chief of the journal before moving forward. Republication of an article in a different language is dual publication unless the source and citation of the original article are clearly noted *and* the editors of both journals agree to re-publication. Reviewers and editors often recognize duplicate publication during the review process, and journals can use the same software for detecting dual publication as for plagiarism. If an article is found to be duplicative after publication, a formal process exists for retracting the redundant article and correcting the literature; depending on the situation, the editor also may contact the author's institution.

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Research Integrity: Fabrication or Falsification of Data and Images

Manipulation or misrepresentation of data is unethical. Journals, editors, and readers expect your reporting of a clinical or experimental study, including data, figures, and references, to be honest and accurate. Editors are obligated to investigate allegations of potential fraud and, if verified, may retract the published article and inform the author's institution.

The routine use of digital images and the potential to change or manipulate images using photo-processing software has led to stricter guidelines about what is acceptable. The U.S. Department of Health and Human Services Office of Research Integrity has useful guidelines for best practices in image processing (http://ori.hhs.gov/education/products/RIandImages/guidelines/list.html). Images can be manipulated only when the entire image is affected, altering the overall size or color balance, for example.

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However, details within the image, such as a cell, structure, or band within a gel, should not be modified separately, as this is 'creational' information consistent with the manufacture of data. If you have any questions as to what changes are acceptable, consult the editor of your target journal.

Disclosure and Transparency

Most journals require authors to disclose relevant financial, legal, and personal affiliations, benefits, and competing interests. Depending on the journal, you may be required to disclose these in the manuscript, a cover letter, or a disclosure form. All or some of these disclosures may accompany the published article. Full disclosure includes:

- Sources of funding, donations, and support from companies, foundations, and government agencies for the study being reported
- Author associations with commercial entities in the general area related to the work, including paid presentations or continuing education supported by a drug company
- Nonfinancial relationships such as being a board member

The objectivity and credibility of a research article rely on open and transparent disclosure. For example, knowing a veterinarian owns substantial stock in the pharmaceutical company that manufactures the drug being evaluated in a study might affect your critical assessment of the findings, especially if they are favorable. Disclosure does not imply or assert that bias has occurred; rather, it informs readers and those involved in the review and publication process about relationships that could have a bearing on the information being reported. Even the perception of a conflict of interest can damage both a journal's credibility and your own.

Disclosure and transparency guidelines also apply to reviewers and editors. Reviewers are expected to disclose potential conflicts of interest before agreeing to review a manuscript, and editors must remove themselves from decisions involving articles in which they have had a role or where there is a potential for bias. Editorial decisions about manuscripts must be independent of political or financial interference from publishers, executive boards, funding agencies, and advertisers.

Reporting Research Involving Animal Use

The health and welfare of animals is the guiding principle of the veterinary profession. In addition to laboratory animals, veterinary researchers often study client-owned animals, including companion animals, horses, birds, and livestock, and publicly-owned animals, such as zoo and wildlife populations and animals in shelters. When writing a journal article, it is important to convey clearly the steps taken to ensure the ethical and humane treatment of all animals used in the study.

National and international guidelines define the welfare of laboratory animals. The ARRIVE reporting guidelines emphasize the importance of reporting key information in the Methods and Results sections to help readers understand why and how animals were used. A consensus statement by the International Association of Veterinary Editors provides Author Guidelines for veterinary journals that publish studies involving animals, including client-owned animals. These various guidelines help address institutional, cultural, and disciplinary differences in the ethical use of animals in research.

Detailed reporting of animal use, the institutional approval process, and adherence to national and international standards provides the information necessary for reviewers, editors, and readers to ensure that ethical guidelines have been followed. Journals published in some countries, including the United Kingdom, have especially stringent guidelines for animal use that must be considered at the time a research study is being planned, as authors will be held to such guidelines when a manuscript is considered for publication.

When client-owned animals are used in clinical research, owner consent is necessary to ensure that owners can opt out if desired and that ethical guidelines are followed. Journal policies on the ethical use of animals and animal samples in clinical research may follow those established by national agencies or committees, veterinary teaching hospitals, or university committees on the care and use of animals. Be sure to inquire about and follow policies relevant to your study and institution at the time you are planning your research.

Reporting Research Involving Human Subjects

Investigators who conduct research that involves human subjects must comply with certain regulations to ensure protection of human subjects with respect to privacy, safety, and rights of the participants. Some, but not all, of these research activities require review and approval by an institutional review board (IRB). Examples of human subjects research relevant to veterinary medicine include evaluation of educational programs or teaching tools; research involving questionnaires, surveys, interviews, or focus groups; and epidemiological studies. Consult your university's Office of Research as well as the National Institutes of Health (http://grants.nih.gov/grants/policy/hs/) for information on research involving human subjects and to ascertain what your obligations are. The Office for Human Research Protections (http://www.hhs.gov/ohrp/) is a good resource for information about ethical and regulatory policies.

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THE IMPORTANCE OF ADVISORS AND MENTORS

Mentors play an important role in your career development, including providing advice and experience with scientific writing. Seeking advice from your mentor is an important way to gain valuable feedback when writing a manuscript. In addition, just as a research study can involve collaboration with multiple faculty, staff, or individuals at other institutions, the writing process also is collaborative and can involve various advisors, co-authors, and peers, as well as mentors.

Facilitating Feedback

Getting feedback in the early stages of writing can be facilitated by setting finite tasks about one or more sections of your manuscript, e.g., organizing a table or creating a figure. In sharing an early draft, briefly state specific queries or concerns you want your mentor to address. This focuses your mentor's input on aspects of your paper most in need of attention. You can then incorporate the advice and make any necessary adjustments to other parts of the paper. Eventually, when a complete first draft is ready, your mentor can review the entire manuscript and provide advice on specific sections as well as on the whole.

Two types of feedback are particularly useful in scientific writing: response-centered and advice-centered feedback. By providing both types of feedback your mentor can help you understand your strengths and weaknesses in writing so you can apply what you learn to future manuscripts. **Response-centered feedback** places the responsibility on you to make revisions based on your mentor's (or another reader's) reaction to what they read. Response-centered feedback describes the positive aspects of the manuscript, the problem areas in need of improvement, and questions that arise where clarification is needed. This feedback might relate to the clarity of the main message, organization of the manuscript, the use of language, details in the Methods or Results sections, or interpretations and conclusions. After considering the reader's responses to your draft, you can then develop your own solutions to address them. **Advice-centered feedback** provides you with specific recommendations for revising and improving your manuscript, such as changes in wording or organization or how best to present your results.

Both types of feedback have value and provide you with a model for providing feedback to others.

A progression of feedback that begins with the major strengths, weaknesses, and questions and focuses later on specific details enables you to tackle larger organizational and content issues first, before worrying too much about grammar and wording. Writing involves many cycles of revising and rewriting that incorporate increasingly granular layers of feedback. Early input from peers or colleagues—even those not familiar with your area of research—together with sustained interactive effort with your mentor will help ensure your manuscript is well organized, the writing is robust, and the individual parts come together as a cohesive whole with a clear message.

Peer Review as a Mentoring Tool

Peer review is an effective mentoring tool, and mentors may use constructive peer review in a variety of ways to help guide you and improve your writing skills. They may:

- Ask you to review a draft manuscript authored by someone else to help you learn to identify strengths and weaknesses in organizing and writing
- Help you learn how to convey a compelling message in scientific writing by reviewing articles that represent effective scientific writing
- Provide examples of well-written and substantive peer reviews
- Use journal clubs to reinforce best practices in critically reviewing a scientific paper
- Devote a journal club session to practicing how to organize and write an effective peer review
- Encourage you to take advantage of online tutorials or university workshops on scientific writing

Mentored writing through peer review provides you with a strong model as you become a clinician-scientist who writes and reviews papers independently in the future and as you begin to mentor others.

LOOKING TO THE FUTURE OF SCIENTIFIC PUBLISHING

Ways of writing, reviewing, publishing, and accessing scientific articles and journals continue to evolve. New forms of data sharing are being explored, and open-access publication has led to numerous new publishing ventures and models. Although most, if not all, veterinary journals rely on traditional peer review to ensure the quality and credibility of published articles, new models based on the emerging collaborative nature of public commenting are becoming more common.

Metrics for rating the quality of articles and journals also continue to be developed and challenged, while at the same time institutions are increasingly focused on these numerical measures. Search engines, such as Google Scholar, enhance the "intelligent" retrieval of information, and ongoing efforts to increase the visibility of non-English language journals are underway.

As these and other changes occur, your ability to publish high-quality scientific articles will continue to depend on well-planned research, organized and well-written manuscripts, effective peer evaluation, and ethical integrity. We hope *Writing for Publication in Veterinary Medicine* will help guide you in this process as you build your professional career.

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SELECTED RESOURCES

Writing Guidelines

Day RA, Gastel B. *How to Write and Publish a Scientific Paper*. 7th ed. Santa Barbara, CA: Greenwood/ABC-CLIO, LLC; 2011

Day RA, Sakaduski N. *Scientific English: A Guide for Scientists and Other Professionals*. 3rd ed. Santa Barbara, CA: Greenwood/ABC-CLIO, LLC; 2011

European Association of Science Editors. *EASE Guidelines for Authors and Translators of Scientific Articles to be Published in English*.
http://www.ease.org.uk/publications/author-guidelines

Sabin WA. *The Gregg Reference Manual*. Tribute edition. New York, NY: McGraw-Hill; 2011

Strunk W Jr, White EB. *The Elements of Style*. 4th ed. Needham Heights, MA: Allyn & Bacon; 2000

Texas A&M University Writing Center. Reading aloud.
http://writingcenter.tamu.edu

Reporting Guidelines

Bossuyt PM, Reitsma JB, Bruns DE, et al. Toward complete and accurate reporting of studies of diagnostic accuracy: The STARD initiative. *Clin Chem*. 2003; 49:1-6

CONSORT: Transparent Reporting of Trials.
http://www.consort-statement.org

EQUATOR Network. The resource centre for good reporting of health research studies.
http://www.equator-network.org

Kilkenny C, Browne WJ, Cuthill IC, Emerson M, Altman DG. Improving bioscience research reporting: the ARRIVE guidelines for reporting animal research. *PLoS Biol*. 2010; 8:1-5

Moher D, Altman D, Schulz K, Simera I, Wager E. *Guidelines for Reporting Health Research: A User's Manual*. Wiley Blackwell/BMJ Books and EQUATOR Network; 2014

REFLECT (Reporting Guidelines for Randomized Controlled Trials for Livestock and Food Safety).
http://www.reflect-statement.org

Organizations

Author Aid. Supporting developing country researchers in publishing their work.
http://www.authoraid.info

COPE: Committee on Publication Ethics.
http://publicationethics.org

International Committee of Medical Journal Editors.
http://www.icmje.org

International Association of Veterinary Editors.
http://www.veteditors.org

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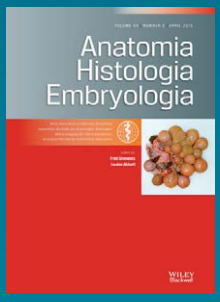
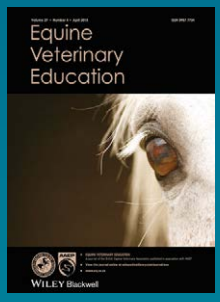
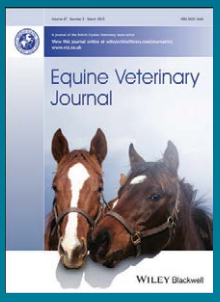
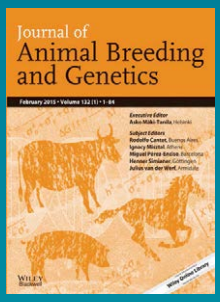
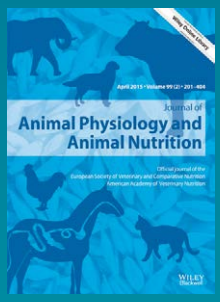
Wiley Journals in Veterinary Medicine and Animal Science

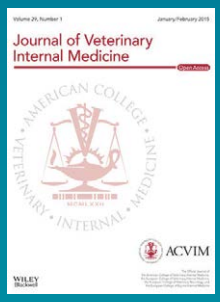


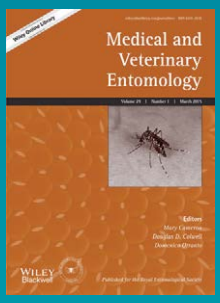


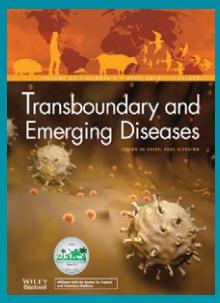


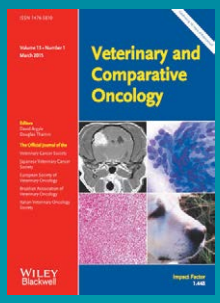


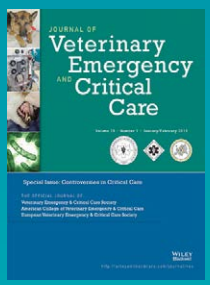


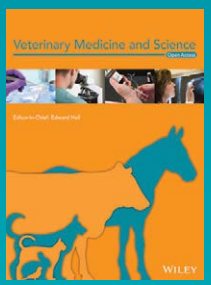


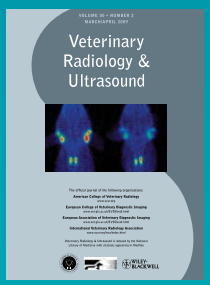


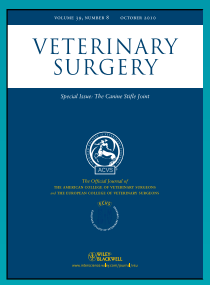


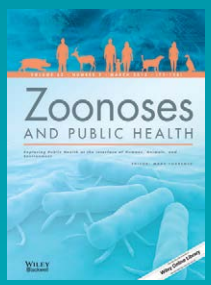












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