

A guide to writing a scientific paper

Writing a paper can be a challenging and daunting task for the inexperienced vet who has not written one before. Professor Emeritus Boyd Jones BVSC FACVSc DECVIM-Ca MRCVS, former professor of small animal clinical studies at UCD, provides some helpful guidelines and suggestions, based on his experience, on what to do and what not to do when preparing a scientific paper for a veterinary journal or other publication

We have all read papers in veterinary journals, as students and as veterinarians since graduation. The information contained in scientific papers is essential for the transmission of knowledge and for our continuing education. Some papers stayed with us because they were easy to read, and delivered their content clearly and succinctly. We understood them, and remembered them. Clarity of writing is not easy. We have all had 'that interesting case', or treated a series of cases with a drug or undertaken special surgery, and we want to tell colleagues about it. Preparing a paper, dissertation or research communication is now a requirement of most course work for master degrees. It takes time and practice

to produce a manuscript that delivers information logically, accurately and in the simplest way possible. Producing a manuscript also involves an understanding of English grammar and the particular conventions of the journal in which the paper is to be published. How can you produce a paper or clinical communication without frustration and be satisfied that, on publication, you have done the job well? The effort put into preparation of a case report or paper determines the quality of the final product. Good scientific writing is accurate, concise and clear. This paper will present some ideas and comments that are based on my experiences writing for publication in journals. I can assure you that there were some difficult times!

BEFORE YOU START

The first thing to do is decide if the material you have is worth publishing. Discuss the case with colleagues to get their opinion. The second important point is to ensure you have all the data/information relating to the case. A literature search in the planned subject area is essential to provide all necessary information and determine if there are any previously published papers on the topic. Thirdly, decide which journal you want to publish in. Obtain a copy of its guidelines for authors and follow these instructions in order to produce your paper in the style required by that journal. Not to do so will create additional editorial work or rejection. Remember, some journals no longer publish case reports in subject areas that have already been published elsewhere. Your paper may be more suited to a particular journal, too. Get advice. Fourthly, think about who contributed to your case/paper, eg. who else did some work to produce the data? If someone did so and you did not pay for the service, you could – and should – ask them to co-author with you. Get agreement regarding authorship at the start, as it will avoid ill will and negative comment later. People are people!

SEARCHING AND ACCESSING THE LITERATURE

How to get quick information is the key and may come before a diagnosis, or after. A popular electronic discussion forum is VIN (www.vin.com). VIN's format can be valuable but there are no limitations as to who participates. Another valuable resource is PubMed (www.pubmed.gov). You get fast access to citations and some abstracts from

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nearly 5,000 scientific journals, including many, though not all, veterinary journals.

Another powerful search engine is CAB Abstracts (www.cabdirect.org), which offers a competitive search of veterinary literature. Abstracts are provided. The downside is that access is only via subscription.

A small, but increasing, number of journals provide open access. University College Dublin library offers access to many relevant journals and library access for UCD alumni and visitors. Information is available from the UCD library website (www.ucd.ie/library). Access is not guaranteed and each application for access is judged on its own merits. The Royal College of Veterinary Surgeons (RCVS) library (www.trust.rcvs.org.uk/library) and information services provide excellent access to key veterinary journals and other library services including literature searches – again, at a cost to members of the RCVS.

International Veterinary Information Services (www.ivis.org) provides a free service that allows access to a number of textbooks and conference proceedings online, eg. Braund's neurology textbook. Remember, conference proceedings often do not deliver evidence-based information.

REFERENCES

So you have accessed suitable references – what now? Read the references! You may read many and discard some, but you must know what they say. It is important to record the information and details of each reference as you use it in the paper. Keeping track of references is easier if you use a bibliographic database such as *Endnote* (www.endnote.com). *Endnote* saves time and you can convert reference notation to the style of different journals if you need to. Otherwise, you must identify the references you quote and insert the authors' name/date in the

manuscript at the correct site and have accurate notation in the reference list.

WRITING THE PAPER

What's the best way to start? It will be different for each of us, but here is one method. Start by writing a rough draft of the whole paper. It is helpful to begin with the section you are most familiar with – the materials and methods or the case history and clinical findings. This section is followed by the results or diagnosis and then the discussion: the explanation of what the results/diagnosis mean. You have usually decided what impact your paper will have, so this is where you say it. The discussion should define the state of knowledge on the subject and how your case or study has changed our understanding. The discussion must not contain results.

The introduction is frequently written after the discussion so that it focuses on the rest of the paper, ie. what is to be introduced. The introduction provides the reasons for the study or publication of your case: the special elements of a case or the objectives of the study/experiment. In addition, it should provide justification for publication based on previously published literature. The introduction must provide the state of knowledge on the subject.

TABLES, FIGURES AND GRAPHS

Where do they go? Their role is to illustrate points made in the text. The text should contain a reference to each table and figure, and what each is intended to illustrate. The caption for each must make sense and refer exactly to what is contained within it. The caption should make sense without reference to the manuscript. Ensure any abbreviations are defined or explained. Figures and tables should be prepared in parallel with writing the draft paper.

Table 1: Commonly misused words and their proper meanings.

Effect & affect	Effect can be a noun or a verb. As a noun it refers to outcome, eg. 'the effects of the drug are dangerous.' As a verb it means 'to bring about': the drug will effect a change.	Affect is always a verb, meaning 'to act upon', eg. 'joint pain affects the gait.'
Principal & principle	Principal may be a noun meaning 'leader' (principal of the primary school) or it can be an adjective meaning 'highest in rank', eg. the principal author.	Principle is always a noun and means 'fundamental truth or law', eg. 'we must understand scientific principles.'
Compliment & complement	Compliment : to praise or admire, eg. 'I compliment you on your clinical ability.'	Complement : things that go together or complete a pair, eg. 'salt complements pepper'; 'the clinic has its full complement of patients.' Also, a heat-sensitive component of serum.
Practise & practice*	Practise is the verb, eg. 'I practise as a veterinarian' or 'I practise my golf swing.'	Practice is a noun, eg. 'he set up practice as a veterinarian.'

*Unless you happen to be in the US, in which case practice is used as a noun and verb!

TAKE A BREAK

Once you have completed a draft, it is best to put it aside before coming back to do some editing. Leaving your draft gives you some opportunity for further thought, so that when you return to the manuscript you are more critical and able to look at it with a fresh outlook.

The next step is the most important: the editing. There could be many rewrites!

EDITING AND REWRITE

This is the time to be critical and ensure what you say is logical and clear:

- You must ensure that what you have written is correct and the original source of the information is accurate;
- Are all sections, sentences, paragraphs necessary? Do they contribute to the overall paper? If they don't – delete!; and
- Juggle the content if required. Shift paragraphs/ sections to a more logical site in the manuscript if this will aid understanding.

The editing process is intended to produce a precise and accurate manuscript. Here are some tips:

- Use words according to their exact meaning. Have a dictionary and thesaurus to refer to – and use them;
- Avoid words that are imprecise, eg. very, much, more, substantially, unremarkable. If they do not convey a clear scientific message, don't use them!
- Don't use multiple words when fewer will do, eg:
 - Red in colour... red
 - Were initiated... began
 - With reference to... about
 - Was found to be... was;
- Short nouns and verbs are powerful and should be used for clarity and exactness in scientific writing. Vary your sentence structure and keep your sentences short: one thought/subject per sentence;
- Get the style right. Make sure all verbs have subjects and all pronouns agree with antecedents. Use active rather than passive verbs. Writing in an active voice eliminates a lot of garbage. Subject – verb – object, ie. the 'doer' before the verb, will automatically provide the active option. For example: 'Normal food consumption was reduced as was water intake' is better written as 'The dog ate and drank less than normal';

- Begin sentences and paragraphs with what is important. Use of the third person is usually unnecessary. 'The author reported...' is cumbersome. Instead, you could use 'Smith (1996) investigated...' Don't be afraid to use 'I' or 'we', eg. 'I (or we) identified...';
- Use complex scientific or technical terms carefully and avoid jargon. Remember, the reader must clearly understand what you mean and have written. Look at what you have written – are the words too complex? Can I write in simpler language? For instance, 'the pharmacological agent induced diuresis and kaliuresis' would be better as 'the drug caused increased water and potassium loss in urine';
- Avoid acronyms and abbreviations if you can. If you use them, identify them according to the journal's instructions to authors. The first time the term is used, write in full and put the acronym in brackets after the term, eg. Veterinary Teaching Hospital (VTH). VTH, the acronym, may be used throughout the rest of the manuscript. However, too many acronyms and abbreviations make a manuscript difficult to read;
- Avoid long sentences;
- Use simple language. The use of long and unusual words is usually unnecessary, eg.:
 - Visualise... see
 - Utilise... use
 - Aetiology... cause
 - Therapeutic armamentarium... drugs
 - Exhibit... show
 - Ambulate... walk;
- Take care not to misuse words. Get your spelling right and use a dictionary any time a word doesn't look right. If you are unsure of a word's meaning, look it up or use another;
- Avoid lazy verbs like 'show', exhibit', 'demonstrate'. These words are often used with non-human subjects, eg. 'the lungs exhibited...', 'the results demonstrated...'. Lungs and results cannot exhibit or demonstrate anything!
- Don't use symptoms with reference to dogs and cats. They cannot have symptoms unless you have a talking cat or dog! Use clinical signs;
- Certain words are often confused:
 - Affect and effect

- Complement and compliment
- Principle and principal
- Practice and practise
- What is your understanding of the meaning of each? See Table 1;
- Don't use 'level' when you mean 'concentration'. 10mg/ml is the concentration of a drug, not a level. Similarly, 20nmol/L is the concentration of thyroxine (T4) in plasma, not the 'thyroid hormone level';
- 'The dog was euthanased' or 'the owners agreed to euthanasia of the dog', not 'the owners agreed to euthanasia'. It is the dog that meets its maker;
- It is often helpful to read your text out loud and watch out for inappropriate punctuation. The sense of a sentence can be completely changed by misuse of a comma or an apostrophe.

FEEDBACK

So you have edited and corrected several drafts. Perhaps a colleague has provided feedback. What next? If you have co-authors, let them read the manuscript and comment. In addition, it is worth seeking comments from someone, a friend or colleague, who can write English! They do not have to be an expert in the subject area of the paper. They can provide helpful criticism of the clarity of your writing – whether it is precise, clear, punctuated correctly and if you

deliver your 'message' in a concise and convincing way. Accept criticism and suggestions – people are trying to help you get it right. A manuscript with many red pen edits is well on the way to a final draft.

GETTING TO THE FINAL VERSION

Once you have considered feedback from others, go through the text again (and again) and be critical. Ask:

- Can the information be presented more clearly?
- Is the manuscript concise and logical?
- Are the tables and figures necessary? Can they be understood without reference to the text and vice versa?
- Does the text answer the objectives proposed in the introduction?
- Do the references say exactly what is ascribed to them? Re-check;
- Is the reference list complete? Are only the references signalled in the text included in the reference list? Only the cited references should be listed;
- Are all the details in the reference list complete, accurate and conform with the journal requirements?
- Have all the abbreviations been explained adequately?
- Have you acknowledged people who have helped you with the study? Write 'I thank...' not 'I wish to thank...';

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1. Gomez-Ar et al. A high protein, high fibre diet improves weight loss in obese dogs. The Veterinary Journal 2013; 185: 294-297. 2. Bostel T et al. Novel dietary strategies can improve the outcome of weight loss programmes in obese chow-wed cats. Journal of Feline Medicine and Surgery 2010; 22: 104-112. 3. White H, Brown T, Green S, Singhward K, Brown J and German AJ. A high protein, high fibre diet designed for weight loss improves satiety in dogs. JAVMA 2007; 292: 1205-1208. 4. Gomez-Ar et al. Low maintenance energy requirements of obese dogs after weight loss. British Journal of Nutrition 2012; 108: 593-596. 5. German AJ et al. Long term follow up after weight management in obese dogs: The role of diet in preventing regain. The Veterinary Journal, May 2011. 6. German AJ, Nelson S, Wessely Dn M, Ford L, Howe AP, Blazyn T, Morris FJ. Sustained Quality of life is relevant to obese dogs that improve after successful weight loss. The Veterinary Journal 2011; Jan; 187: 23-29.

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- Have you followed the convention of the journal accurately?
- Finally – and most importantly – is the manuscript free of errors: grammar, spelling, punctuation, logic and reasoning?

SUBMISSION

All authors must have sighted and signed off on the final draft. Many journals require confirmation that this has been done. Some journals require you to confirm that the paper has not been submitted to another journal or published elsewhere. You may need to declare any conflict of interest due to a commercial product association or financial considerations. Send the manuscript to the editor in the correct electronic format and in hard copy if that is required. Ensure any figures submitted have the appropriate resolution (usually >300 dpi).

THE JOURNAL

The editor will respond by acknowledging receipt of the manuscript. Later, after the referees' reports have been received, you will be told whether the paper has been accepted by the journal. For non-refereed journals you may have correspondence with the editor on editorial matters and content.

You seldom get a paper accepted without changes being required; sometimes these can be substantial. Most referees provide constructive and helpful comments which, if implemented, will improve the paper and bring credit to you. Rejection is harder to accept but reasons will be provided and you have to accept that decision. It happens to all of us! I have a file of rejected manuscripts. You can take on board the criticisms, and rewrite for another journal – or just fester. Don't! The editor and referees are doing their job and you can rescue a paper by rewriting and/or getting more data – whatever is required. The final accepted version will be set in journal format and you will be asked to proofread a pdf copy. It is

important to check punctuation, spelling, numbers, tables, dose rates, etc, to ensure they are correct. Bloopers in scientific writing are amusing – unless they are yours. Not proofreading carefully can lead to errors. Do it well. Most journals will publish the accepted paper on their website before its final publication in hard copy. It's there at last, worth the effort and already stimulating positive feedback from colleagues! It makes you feel good. Writing is not easy and most experienced authors put significant time and effort into preparation of a manuscript. It is difficult in veterinary practice to put aside time to think, to construct your ideas and then to write. You need (dare I say it) 'quality time': time away from clinics and other duties to get the paper done. Good luck!

READING LIST

- Heath T. So you want to write a paper? *Australian Veterinary Practitioner* 2003; 33: 112
- Gross DV, Sis RF. Scientific writing, the good, the bad and the ugly. *Journal of Veterinary Medical Education* 1980; 7: 127-30
- Abbreviations, bloated words, computerspeak, eponyms, jargon, misused words and neologisms. *Journal of the American Veterinary Medical Association* 1995; 207: 156-158
- Truss L. *Eats, shoots and leaves?* The zero tolerance approach to punctuation. London: Profile Books Ltd, 2003 (all you need to know about punctuation)
- www.grammar-monster.com is a great website for English grammar and punctuation

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Reader Questions and Answers

1: BEFORE YOU START WRITING A PAPER YOU MUST DECIDE:

- A: Is it worth publishing?
- B: Do you have all the necessary data?
- C: Have you decided where you want to publish?
- D: Have all colleagues who contributed been contacted?
- E: All of the above

2: THE BEST WAY TO START A PAPER IS TO:

- A: Write a rough draft of the whole paper
- B: Ensure the discussion contains results
- C: Ensure captions for figures are also in the text
- D: The introduction contains a complete literature review
- E: Prepare it all on your own without assistance

3: WHICH PHRASE IS GRAMMATICALLY CORRECT?

- A: The principal was explained
- B: The vet purchased a new practise
- C: The principle was explained to him
- D: The vet practiced surgical procedures
- E: I must complement you on your surgical skills

4: WHICH PHRASE IS ACCEPTABLE FOR PUBLICATION WITHOUT CORRECTION?

- A: The mucous membranes were yellow in colour
- B: The mucous membranes were yellow
- C: The instrument was found to be very useful
- D: Normal food consumption was increased and water intake increased
- E: Joint pain effects the gait

ANSWERS: 1: E, 2: A, 3: C, 4: B