



## Writing good scientific papers & responding to critiques

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Medical Physics

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### We desire papers that describe:

- developments of novel, state-of-the-art methods for improved medical imaging and therapy.
- a new development or an analysis that makes a significant contribution to scientific and/or clinical knowledge related to Medical Physics.

### A Note about Wording:

- Papers must be written in clear & concise scientific English free of major style & grammatical errors.
- Authors not fluent in English should have their papers edited by an expert in English prior to submission.

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### Components of a Scientific Paper

- Title
- Abstract
- Introduction
- Methods
- Results
- Discussion
- Conclusion
- Acknowledgement
- References

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## TITLE

- Should be attention getting and informative
- Should be brief
- Avoid Acronyms unless commonly used
  - OK: CT, MRI
  - Not OK: "DCE-MRI"
    - use "dynamic contrast-enhanced MRI" instead
  - "SPGRE sequences"
    - use "spoiled gradient echo pulse sequences" instead

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## ABSTRACT

- Extremely important – reader’s first introduction to paper
- Should summarize entire study (Purpose, Methods, Results, Conclusions)
- Results should be quantitative
- Minimize acronyms
- AIP: "should not contain displayed mathematical equations, footnotes, references, graphics, or tabular material"
- Length: ≤ 500 words for research articles & technical reports  
 ≤ 300 words for Technical notes & Medical Physics Letters

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## INTRODUCTION

- Summarize what has been done, what you are doing, why this is important. (Novelty, clinical and/or scientific importance)
- Should include:
  - 1) significance of topic
  - 2) information gap in available literature associated with topic
  - 3) literature review in support of key questions
  - 4) developed purposes/objectives & when appropriate, hypotheses."
    - [Cook C et al., J Man Manip Ther. 2009;17(3):141-147]
- Problems – insufficient literature review or too broad literature review.

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## METHODS

- Should be clear & concise
- Provide enough detail for others to repeat study
- Even if methods described in previous publication, they should be summarized so present paper has sufficient detail to stand-alone.
- Final section of Methods should describe statistical methods used to analyze data.
- Scitable by Nature Education recommendations:
  - Explain the choices you made in your experimental procedure.
  - What is SPECIAL, UNEXPECTED or DIFFERENT in your approach.
  - May use a schematic diagram to summarize method.

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## RESULTS

- Should follow order of methods section and only include results – leave discussion to discussion section.
- Text “should be succinct but should provide the reader with a summary of the results of each table or figure.”
  - S Maloy, Guidelines for Writing a Scientific Paper
  - <http://www.sci.sdsu.edu/~smaloy/MicrobialGenetics/topics/scientific-writing.pdf>

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## Tables

From AIP:

- Should have captions that make the tables intelligible without reference to the text.
- Structure should be clear, with simple column headings denoting all units
- Should be created with Word’s *Insert Table* function.
- Tables created with spaces or tabs will create problems and may be improperly typeset

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## Figures

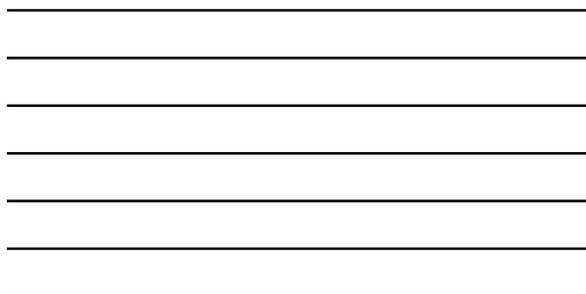
Some recommendations from Deputy Editor Dave Roger's 2013 presentation:

- Figures with captions should be self-contained – readers often skim article looking at figures and tables.
- Tick marks and axes on all 4 sides is ideal
- # ticks commensurate with accuracy
- Helvetica & Arial fonts preferred – easiest to read
- The figures will be reduced to column width (8.5 cm) in published paper – make sure lines are thick enough, fonts & symbols are large enough

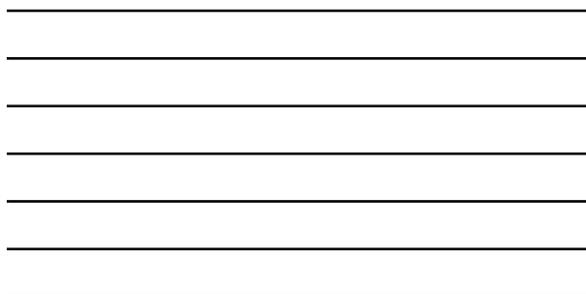


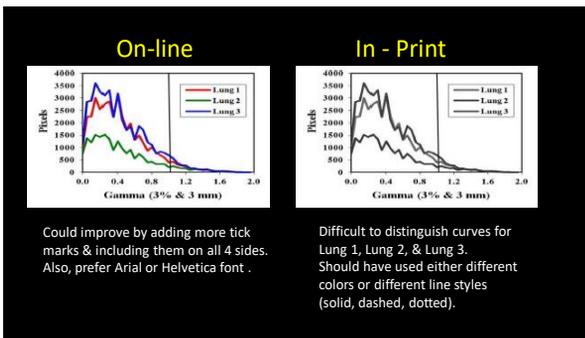
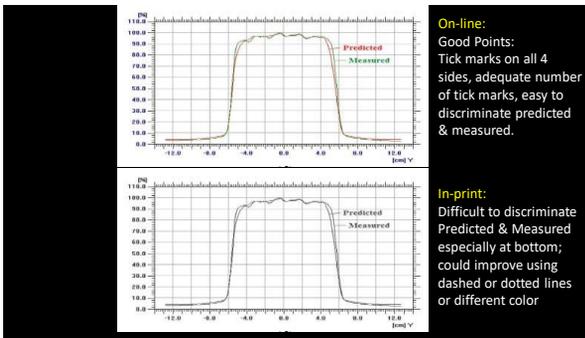
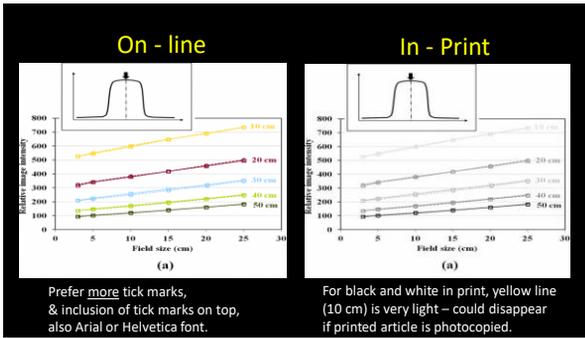
## Line colors & style

- Select line colors that appear well when converted to black and white for published hardcopy journal & for referees who often print with B&W laser printers.
- Choose colors that can be distinguished by those who are colorblind.
- May be better to use dashed or dotted lines in some cases.
- Print fee for color figures in hardcopy journal is \$325 per figure!



Examples of Figures I found in a paper published in Medical Physics that could have been improved:





### Selection of colors to compensate for color blindness

How colors appear to color blind people:

From: <http://jfly.iam.u-tokyo.ac.jp/color/>

Fluorescent micrograph

Fig 5. A typical fluorescent micrograph.

Solve this problem by using magenta (purple) instead of red.

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### Set of colors that is unambiguous to people with and without colorblindness

From: <http://jfly.iam.u-tokyo.ac.jp/color/>

Original	Simulation			Black	for Photoshop, Illustrator, for Word, Power Freehand, etc.			
	Protan	Deutan	Tritan		Hue	C,M,Y,K (%)	R,G,B (0-255)	R,G,B (%)
1				Black	-*	(0,0,0,100)	(0,0,0)	(0,0,0)
2				Orange	41°	(0,50,100,0)	(230,159,0)	(90,60,0)
3				Sky Blue	202°	(80,0,0,0)	(86,180,233)	(35,70,90)
4				bluish Green	164°	(97,0,75,0)	(0,158,115)	(0,60,50)
5				Yellow	56°	(10,5,90,0)	(240,228,66)	(95,90,25)
6				Blue	202°	(100,50,0,0)	(0,114,178)	(0,45,70)
7				Vermillion	27°	(0,80,100,0)	(213,94,0)	(80,40,0)
8				reddish Purple	326°	(10,70,0,0)	(204,121,167)	(80,60,70)

Note: Adobe Photoshop and Illustrator now include option to preview how artwork will appear to people with red/green colorblindness (protanopia and deuteranopia)

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## DISCUSSION

- Summarize main results; discuss how they support or disagree with hypotheses, how they affect the field.
- Sections of discussion section recommended by Docherty & Smith:
  - Strengths & weaknesses of study
  - Strengths & weaknesses in relation to other previous studies
  - Meaning of study
  - Unanswered questions & future research  
[Docherty M, Smith R.. Brit Med J 1999;318: 1224-1225
- PITFALL: overstating significance of findings.
- PITFALL: discussion of extraneous ideas, concepts or information not covered by your topic.  
[Hoogenbroom & Manske Int J Sports Physics Therapy 2012;7:512-7]

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## CONCLUSION

- Not just a restatement of results, but some final summative statements about the outcomes of the study  
[Hoogenbroom & Manske Int J Sports Physical Therapy 2012;7: 512-7]
- Discuss to what extent you have succeeded in addressing the need stated in the Introduction section. [Scitable by Nature Education]
- Focus on what you have found and what your findings mean. [Scitable by Nature Education]
- Include perspective of what could or should still be done. [Scitable by Nature Education]
- Should contain the take-home message.

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## Writing Style

- Treat each paragraph as a thought, with a single clear message
- Make connections between each paragraph or section
- Make transitions so there is no gap in logic
- Cut excessive words (cut, cut, cut)
- Use only words with precise meanings.  
[I've write pretty one day: how to write a good scientific paper, William Wells, J Cell Biol. 2004; 165:757-58]
- Write & revise multiple times
- Minimize use of Acronyms – they make paper difficult to read

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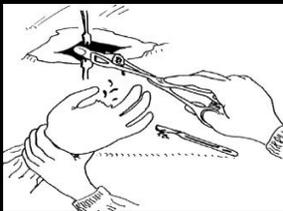
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## Avoid confusing text.

("The index finger of the surgeon is then inserted in the atrium.")



[Goodman NW, Edwards MB. Medical writing. 2nd ed, Cambridge University Press, 1997]

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## Read & Re-read

- Before submitting manuscript, read & re-read for accuracy, proper wording, typos, etc.
- Make sure the numbers in tables are accurate and “add up.”
- Have co-author read paper extremely critically, word for word in text, and line by line in tables and captions to check for errors.

John Eleftheriades, “Twelve tips on writing a good scientific paper,”  
Int J of Angiology 2002;11:53-55

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## Common Manuscript Deficiencies

(based on Bill Hendee’s 2013 Editor’s Presentation at 2013 AAPM)

- Incorrect grammar
- Illogical composition
- Obscure writing
- Verbose writing
- Deviation from AIP Style Manual
- Poor illustrations
- Mathematical and/or physics errors

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- Over-reaching of results
- Inadequate or too extensive literature review
- Multiplication of papers (incremental advances)
- No clear delineation between methods & results
- Inadequate methods section – not enough details for others to repeat study
- Plagiarism and self-plagiarism (WE ARE NOW USING ITHENTICATE)

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## Authors' Response to Critiques

- Point-by-point response to reviewers' comments is required.
- Such a response is respectful of effort expended by referees & helps speed up review process.
- Point-by-point response must contain:
  - 1) Text of original criticism
  - 2) Author's rebuttal
    - For minor changes (e.g., typo), notation "Done" is sufficient
    - For moderate and major changes, authors should include pasted copies of the modified text in the rebuttal letter along with corresponding line numbers in the revised article.
- New (revised) article text must be identified by use of a different font color or by yellow highlighting (Do not use track changes or show deleted text)

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## Example

REFeree #1: "The use of the correction factors for the external rods needs better justification. The way the correction factors are built (eq. 4, 5, 6) it is unsurprising that they yield good results as they are defined to do so. It will be important to test these corrections in realistic conditions (i.e. in patients or on a different phantom). "

RESPONSE: We have modified the text to better explain and justify the use of the correction factors for external calibration. Please note that a single set of these factors are used for all size patients so it is not inherently expected that they will produce good results in all cases.

See lines 302-308 in revised manuscript:

"External calibration is expected to be less accurate than internal calibration because the beam hardening and scatter at the external location (and hence the CT numbers) are different from those at the internal location. For ease of implementation of the DEQCT method, it would be desirable if only the external calibration standards were used and a set of phantom/patient size independent correction factors were derived for transforming the CT numbers of the external calibration standards to those of the internal standards. We ....

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## Authors' Response to Referees

- Be courteous and fair.
- Accept or challenge referees' comments.
- Response should be received within:
  - 4 weeks (28 days) for Medical Physics Letters, and Conditional Accept / Minor or Major revisions.
  - 8 weeks (56 days) for Editorial Decision Deferred.
- In some cases, you can appeal a rejection decision.

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## Concluding Remarks

We look forward to receiving your submissions.

Please also see the "New Instructions to Authors" at <http://medphys.org/Newinstructions.asp>

Note regarding papers based on SPIE and IEEE proceedings papers – may be submitted to Medical Physics, but should be a substantial expansion (e.g., more cases studied, more detail about methods, more analysis (comparison with other methods), etc.)

If you have questions please contact the journal at [journal@aapm.org](mailto:journal@aapm.org)

For style information – see previously published papers.  
Open access papers (free) available at <http://medphys.org/>

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