

## Twelve Steps to Writing an Effective Materials and Methods

San Francisco Edit

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In the Materials and Methods section you explain *clearly* how you conducted your study in order to: (1) enable readers to evaluate the work performed and (2) permit others to replicate your study.

You must describe exactly what you did: what and how experiments were run, what, how much, how often, where, when, and why equipment and materials were used. The main consideration is to ensure that enough detail is provided to verify your findings and to enable the replication of the study.

You should maintain a balance between brevity (you cannot describe every technical issue) and completeness (you need to give adequate detail so that readers know what happened).

This should be the easiest section to write. If you need help beginning, please read our article *Twelve Steps in Developing an Effective First Draft* at <http://www.sffedit.net/newsletters.htm>.

Since each journal has different requirements, review the journal's guidelines before beginning to write this section. The steps listed here are a general compilation of these requirements.

1. Order your procedures chronologically or by type of procedure and then chronologically within type of procedure using sub-headings, where appropriate, to clarify what you did. It is up to you to decide what order of presentation will make the most sense to your reader.
2. Use the past tense and the third person to describe what you did. For example: "The sample was incubated at 37°C for 3 days." - NOT: "I incubate the sample at 37°C for 3 days."
3. Describe your experimental design clearly, including the hypotheses you tested, variables measured, how many replicates you had, controls, treatments, etc.
4. Explain why each procedure was done. Reference may be made to a published paper as an alternative to describing a lengthy procedure.

5. Identify the source of any specific type of equipment, a specific enzyme, organism, or a culture from a particular supplier, which is critical to the success of the experiment.
6. Describe in detail any modifications to equipment or equipment constructed specifically for the study and, if pertinent, provide illustrations of the modifications.
7. Precisely quantify measurements (all metric) and include errors of measurement.
8. Describe the dates and the site where your field study was conducted including physical and biological characteristics of the site, if pertinent to the study's objectives.
9. Identify treatments using the variable or treatment name, rather than an ambiguous, generic name or number (e.g., use "healthy donors" rather than "group 1").
10. If required by the journal, mention the approval for the study by the relevant ethics committee(s) and the informed consent of the subjects.
11. Describe statistical tests and the comparisons made; ordinary statistical methods should be used without comment; advanced or unusual methods may require a literature citation.
12. Show your Materials and Methods section to a colleague and ask whether they would have difficulty in repeating your study.

Other points to consider when writing the Materials and Methods:

1. Don't mix results with procedures.
2. Omit all explanatory information and background - save it for the discussion.
3. Don't include information that is irrelevant to the reader, such as what color ice bucket you used, or which individual logged in the data.