

# Writing Methods



# Key concepts



- ‘Methods’, ‘Methods and Materials’, ‘Experimental’, ‘Method Description and Validation’.
- In most journals it follows the Literature Review, in others it follows the Conclusions.
- A key skill is to make sure the descriptions are complete and yet are also as concise as possible.
- Write extremely clearly, with generally not more than two steps described in one sentence, and in a logical order.
- The Methods is the easiest section to write so it may be a good point for you to begin writing your manuscript.

# The Methods section should answer most of the following questions



- What / Who did I study? What hypotheses was I testing?
- Where did I carry out this study and what characteristics did this location have?
- How did I design my experiment / sampling and what assumptions did I make?
- What variable was I measuring and why?
- How did I handle / house / treat my materials / subjects? What kind of care / precautions were taken?
- What equipment did I use (plus modifications) and where did this equipment come from (vendor source)?

# The Methods section should answer most of the following questions



- What protocol did I use for collecting my data?
- How did I analyze the data? Statistical procedures? Mathematical equations? Software?
- What probability did I use to decide significance?
- What references to the literature could I give to save me having to describe something in detail?
- What difficulties did I encounter?
- How does my methodology compare with previously reported methods, and what significant advances does it make?

# The Methods ingredients



- Provide enough quantitative information (concentration, temperature, weight, size, length, time, duration etc.)
- Describe everything in a logical order
- Use subheadings to explain the various stages of the procedure
- Ensure that you cover every step required. Because you are very familiar with your method, you may leave out key information either thinking that it is implicit (and thus not worth mentioning) or simply because you forget.

# How should I begin the Methods?



Typical ways include:

## **(a) making a general statement about your method**

The method described here is simple, rapid, sensitive and ...

## **(b) referring to another paper**

The materials used for isolation and culture *are described* elsewhere [20].

Materials *were obtained* in accordance with Burgess et al.'s method [55].

## **(c) stating where you obtained your materials from**

Bacterial strains ... *were isolated* and kindly supplied by ...

Agarose for gel electrophoresis *was purchased* from Brogdon plc (Altrincham, UK).

# How should I begin the Methods?



## **(d) explaining how you found your subjects, i.e. begin with the setting**

Subjects *were chosen* from a randomly selected sample of ...

Participants *were selected* from patients at the Gynecology Faculty of the University of ...

## **(e) indicating where (i.e. a geographical region) your investigation was focused**

Our empirical investigation focused on Tuscany, a central region of Italy, ...

The study *was carried out* in four boulevards in Athens (Greece) and ...

## **(f) referring the reader to a figure which shows the experimental set up**

To highlight the advantages of the system, Fig. 1 shows the ...

## **(g) starting directly with the first step in your procedure**

Frontal cerebral cortices *were dissected* from ...

Core-cell composite materials *were prepared* by colloidal assembly of ...

# What tenses? active or passive?



Most Methods sections are written in the **past simple** using the **passive** form.

The passive is good style here because the focus is on what was done rather than who did it.

In the Methods, the passive is both necessary and appropriate.



# How many actions can I refer to in a single sentence?



It is perfectly acceptable to have **two actions** in one sentence.

## ORIGINAL VERSION (OV)

A first postal invitation to participate in the survey was sent to 26 practices in South Yorkshire. A total of five practices indicated their willingness to participate. Multidisciplinary focus groups in four diverse practices were purposively identified. The identification entailed using a maximum variation approach. This approach was based on socio-economic population characteristics and ethnic diversity. These characteristics were taken with reference to census data.

## REVISED VERSION (RV)

Following a first postal invitation to participate sent to 26 practices in South Yorkshire, five responded positively. Multidisciplinary focus groups in four diverse practices were purposively identified using a maximum variation approach, based on socio-economic population characteristics and ethnic diversity (by reference to census data).

# How many actions can I refer to in a single sentence?



Do not pack too much information in one sentence.

## ORIGINAL VERSION (OV)

The four practices, which had been previously identified as having list sizes between 4750 and 8200, comprised firstly an inner city practice (hereafter Type 1) with an ethnically diverse population for which the team frequently required translators for primary care consultations, secondly, two urban practices with average levels of socio-economic deprivation (Type 2), and thirdly, a mixed urban/rural practice (Type 3).

## REVISED VERSION (RV)

The four practices had a list size ranging between 4750 and 8200. They comprised:

- an inner city practice with an ethnically diverse population, where the team frequently required translators for primary care consultations
- two urban practices with average levels of socio-economic deprivation
- a mixed urban /rural practice

# How can I avoid my Methods appearing like a series of lists?



**S1.** Processes which often occur in lipids include: oxidation, hydration, dehydration, decarboxylation, esterification, aromatization, hydrolysis, hydrogenation and polymerization. Factors that affect the chemistry of these materials include: heat (anthropogenic transformations), humidity, pH, and microbial attacks.

**S2.** Several processes often occur in lipids, including oxidation, hydration, dehydration, decarboxylation, esterification, aromatization, hydrolysis, hydrogenation, and polymerization. In addition, the chemistry of these materials can be affected, for example, by heat (anthropogenic transformations), humidity, pH, and microbial attacks.

# How can I reduce the word count?



Present more than one action per sentence.

## Other ways:

- Assume your readers have basic knowledge of the techniques used in your field, you can thus delete any superfluous information
- Cite a reference rather than detailing the procedure again if any of your methods are fully described elsewhere (in one of your papers or someone else's)
- Use tables and figures to summarize information

# Should I describe everything in chronological order?



Present everything in your experiments, trials, procedures etc. in a way that will make best sense to your reader. However, within a sentence or paragraph, readers should feel they are moving forward chronologically.

- S1. \* The sample, which was filtered and acidified at pH 2, was mixed with X.
- S2. \* The sample was filtered and acidified at pH 2 and then mixed with X.
- S3. The sample was filtered and acidified at pH 2, and then mixed with X.
- S4. The sample was filtered and acidified at pH 2. It was then mixed with X, which enabled the resulting solution to stabilize at ...

# What grammatical constructions can I use to justify my aims and choices?

To introduce your choices:

- *In order to validate* the results, we first had to ...
- *In an attempt to identify* the components, it was decided to ...
- *To provide a way of characterizing* the samples, an adaptation of Smith's method [2011] was used.
- *For the purpose of investigating* the patients previous medical history, we ...
- *Our aim was to get* a general picture of ...
- *This choice was aimed at getting* a general picture of ...
- **This equipment was chosen for its low cost.**
- **This equipment was chosen (in order) to save money.**

# What grammatical construction is used with *allow*, *enable* and *permit*?



## GRAMMATICAL CONSTRUCTION

allow someone or something to do something

allow someone or something to be + past participle

allow + noun

## EXAMPLE

This equipment allowed us to identify X.

This equipment allowed X to be identified.

This equipment allowed the identification of X.

## ORIGINAL VERSION (OV)

Limiting the Xs *allows* the complexity of Y *to be reduced* and permits *the user to control* the deduction process.

The analysis *allowed the characterization of pine resin* as the main organic constituents in the sample to be achieved.

This model *permits the analysis* of X.

The use of these substrates *enabled us to highlight* the presence of several nucleases.

## REVISED VERSION (RV)

Limiting the Xs *reduces* the complexity of Y, and *facilitates control* of the deduction process.

The analysis *showed that pine resin* was the main organic constituent in the sample.

This model *can analyze* X.

With this model *we can analyze* X.

With this model, X can be determined

The use of these substrates:

*highlighted* the presence of ...

*meant that we were able to highlight* the presence of ...

offered a means *to highlight* the presence of ...

# How can I indicate the consequences of my choices and actions?



S1. An evaluation of this initial data demonstrated that  $X = Y$ ,  
**thus giving an insight into the function of Z.**  
**thereby providing a basis for investigating the function of Z.**

S2. An evaluation of this initial data demonstrated that  $X = Y$ .  
**Consequently the next step was to investigate the function of Z.**  
**The next step was thus / therefore / consequently to investigate ...**



# How should I use the definite and indefinite articles in the Methods?



Small pieces of *a Si* (100) wafer and commercial stainless steel (type 304) were used as substrates, fixed to the holder through silver paste.

**Temperature** was controlled at 850°C through **an automatic** PID temperature control (Eurotherm). **Reactor pressure** varied from 4.76 to 4.99 Torr due to the injection processes and to the flash evaporation phenomena. The carrier and reaction gases flux were fixed at 0.8 and 0.1 l/min, respectively. “Tequila blanco” (white tequila) Orendain brand, a clear, un-aged liquor distilled from the juice of blue agave (Agave Tequilana) plant [9], was used **as precursor**.

# Should I write numbers as digits (e.g. 5, 7) or as words (e.g. five, seven)?

This tequila, 80 proof and with C-H-O atomic relationships of 0.37 C, 0.84 H and 0.29 O (Figure 1), was injected at a frequency of 2 pulses per second (500 ms) with an opening time of 4 ms. A total of 21768 pulses were applied in each experiment and a micro dose of  $6.26 \times 10^{-3}$  ml was injected per pulse (Table 1). Temperatures in the evaporation zone and along the vapor transport line were fixed at 280°C. The deposit was studied through a Dilor micro-Raman spectrometer with a 20 mW, 632 nm He-Ne laser equipped with a confocal microscope and a JEOL Low-Vacuum Scanning Electron Microscope (JSM-6060LV), operating at 15 kV, secondary electrons, spot 50 and WD 11 mm.

# Should I write numbers as digits (e.g. 5, 7) or as words (e.g. five, seven)?



Other journals recommend using words for numbers from one to ten, and then digits. However this rule does not apply when the number precedes an abbreviation for a measurement (e.g. 9 mm, not nine millimeters).

Note also that abbreviations for measurements do not have an s when they are plural (e.g. 9 mm, not 9 mms).

Another rule of style prohibits beginning a sentence with a number in digits.

# How should I end the Methods



## **If your Methods has subsections:**

Your first subsection may be a general overview of the methods chosen.

Then in each subsequent subsection you:

1. preview the part of the procedure / method you are talking about
2. detail what was done and justify your choices
3. point out any precautions taken
4. discuss any limitations in your method or problems you encountered
5. highlight the benefits of your methods (perhaps in comparison to other authors' approaches)

# Writing Results



Not all journals require a separate Results section, often it is integrated with the Discussion, under the section title Results and Discussion.

Present results with little or no interpretation or discussion

- Decide what results are representative
- Organize them in a sequence that highlights the answers to the aims, hypotheses or questions
- mention any important negative results

# How should I structure the Results?



The Results should answer the following questions.

1. What did I find?
2. What did I not find?
3. What did I find that I was not expecting to find?  
(e.g. that contradicts my hypotheses)

# How should I begin the Results?



1. Give a general panorama of your surveys, experiments etc. without repeating the details you gave in the Methods section
  - Overall, the results presented below show that ...
  - The three key results of this empirical study are: ...
  - The following emergent themes were identified from the analysis: ...

# How should I begin the Results?



2. Simply go directly to your results, often by inviting readers to look at one of your figures or tables

- Figure 1 shows the mass spectra obtained from an analysis of the two residues. The first residue reveals a .. (Fig. 1a)
- A total of 34 wheat genotypes (Table 1) were screened for ... Responses to increased sunlight varied significantly (Figure 1) ...
- An analysis was made to look for ... To do this, the average times of x and y were compared ... Figures 1–3 show the differences between ...



# How should I structure the rest of the Results?



1. Highlight those results that answer your research question
2. Outline secondary results
3. Give supporting information
4. Mention any results that contradict your hypothesis and explain why they are anomalous

# Should I report any negative results?



YES:

It shows the thing that you were testing doesn't work.

TWO REASONS:

- your hypothesis was incorrect and needs to be reformulated
- you had a bad experimental design and / or low statistical power

Negative data are frequently commented on in the Discussion.

# What tenses should I use when reporting my Results?



the **past simple** is used to report them, often in a **mixture of the active and passive** forms

The care model **was seen** as a credible and holistic approach to the management of depression. GPs **were** keen to avoid ‘over-medicalizing’ and over-prescribing of antidepressants.

GPs and mental health workers **described** very limited access to specialist input for patients with more complex, treatment-resistant or recurrent depression. One incident **was described** by a GP:

“I **tried** recently with a gentleman who has been on antidepressants for four or five years, ...”

# What style should I use when reporting my Results?



S1\*. We **found** that doctors viewed the NHS as having failed to provide adequate services.

Instead we should say:

S2. There **was** a perceived failure of the NHS to provide adequate services.

Three levels of feedback **were looked at** for differences on task persistence. Differences between positive, negative, and no feedback conditions, were minimal and showed no significant findings ... There were larger differences both between genders and in the interaction between gender and feedback conditions. Tables 1 and 2 **show** the averages for these gender differences. Figure 6 **shows** ...

# How should I comment on my tables and figures?



Use the tables and figures to illustrate points in the text, rather than making them the subject of your text.

S1.\* Figure 4 shows the relationship between the numbers of species A and species B.

S2. The abundances of species A and B were inversely related (Figure 4).

# How should I comment on my tables and figures?



## ORIGINAL VERSION (OV)

- 1 As can be seen in Figure 1, levels of intolerance were highest during late adolescence.
- 2 We can see from Table 2 that in the control group, values for early adolescence (13–15) were 6.5. On the other hand, values for mid adolescence (16–17) were 6.7.
- 3 Figure 1 shows that levels of intolerance are 9, 15 and 20 during early, mid and late adolescence, respectively.

## REVISED VERSION (RV)

- Levels of intolerance were highest during late adolescence (Figure 1).
- Values for early adolescence were lower than for mid adolescence: 6.5 versus 6.7 (Table 2).
- Levels of intolerance are highest during late adolescence (Figure 1).

# More examples



## ORIGINAL VERSION (OV)

Figure 1 shows schematically / gives a graphical representation of / diagrammatically presents / pictorially gives a comparison of two components

From the graphic / picture / diagram / drawing / chart / illustration / sketch / plot / scheme that is depicted / displayed / detailed / represented / sketched in Figure 3, we can say that ...

The mass spectrum, reproduced in the drawing in Figure 14, proved that ...

We can observe / As can be seen from Table 3 that ...

From an analysis / inspection of Table 3 it emerges that ...

## REVISED VERSION (RV)

Figure 1 shows a comparison of two components.

Figure 3 shows / highlights / reports that ...

The mass spectrum (Fig. 14) proved that ...

Table 3 highlights that ...

# How should I comment on my tables and figures?



Do not repeat word for word the caption / legend to your figures and tables within the main text. Legends should be as short as possible and be sufficiently detailed to enable your readers to understand the figure or table without having to read your text.



The End



Thanks for Listening