

Recommendations for PhD students

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Introduction

This document aims at providing practical information and advices to young scientists, mainly PhD students, in order to help them in their day-to-day work as well as in starting their career as scientists. This is an open document that will be updated every year with readings, thoughts and your involvement and feedback.

This document is subdivided into three parts: 1) Practical aspects; 2) Scientific aspects – although these two aspects are sometimes entangled; 3) Beyond the PhD.

Throughout its different parts the document insists on four crucial and related points:

Timing: nearly all PhD student end up the last 6 months of their 3-year period of PhD in a distress situation, working 15 hours a day under high stress. This is because they did not manage the timing of their activities properly, misunderstood or missed several key steps of the process and the associated duration.

Writing: writing is the major mode of communication in science: ‘verba volant, scripta manent’ (spoken words fly away, written words remain; Latin adage). It must start at the early stage of the thesis (or even better at a much earlier stage). First for exchanging with the PhD supervisor and the PhD committee (discussion are not enough), then for consolidating any preliminary work (review of the literature, introduction, methodology, first results, etc.) even if this will not be the final version used in the thesis or papers.

Communicating: making good science is no more an individual or lonely job. Although a thesis must reflect your personal contribution to science, you cannot reasonably make it all by yourself. You will gain a lot by communicating from the start (and later in your career) with as many people as possible for confronting your ideas, sharing experience, looking for advices, etc. This includes both senior scientists, young scientists and other PhD students.

Organizing: there are many ways to organise your scientific life with efficiency. We will try to help you since every step must be organized (creativity, writing, interactions with colleagues, bibliography...).

I. Practical aspects

1. About Starting

Inquire from the start on the constraints linked to your PhD from the academic and administrative points of view, especially if you benefit from a grant:

- composition and meeting frequency of the PhD committee. Even if this is not compulsory, insist with your supervisor(s) or director(s) to **constitute quickly a thesis committee** that will meet at least twice a year with you to discuss your orientation, advise you, assess your work, etc. This committee should be composed of your close advisers but it should also **include known personalities that are close to your topic**. Interact with your PhD supervisor(s) and your thesis committee, even on a *ad hoc* basis;
- maximum duration of your PhD registration and grant, delay between manuscript submission and authorisation to defend, and finally the defence itself;
- language(s) to be used for the manuscript and the defence. If you are not registered in an English speaking University but if this University does accept manuscripts in English, consider the option of writing your **thesis in English**. This will ease your work for incorporating your papers in your thesis or, later on, for deriving papers from your thesis;
- number of compulsory scientific papers (usually accepted) that you should write, with details on the type of review and your rank as co-author
- rules for constituting the PhD evaluation panel and derogations of absences the day of the defence (no chance to get a derogation for yourself!).

2. About Reading

- **Read** literature on your topic, trying to find the right balance between not enough and too many references. There should be a **fair amount of recent publications cited** in your thesis, indicating the interest of the scientific community on such topic. Start with books, as recent as possible, but do not necessarily read all the chapters. As far as general concepts and theory are concerned, prefer highly ranked journals (high impact factor). But do not hesitate to dig into local and sometimes old publications or reports if you need data or local knowledge (retrospective studies can bring important lights, e.g. in ecology when analysing ecosystem dynamics. In any case **have a critical mind when looking for references!**
- **Reading notes** should relate to your own topic and ideas, and should be organised as soon as possible. Think that (almost) everything that you are reading should contribute to your future writing.
- **Read (and listen, speak and write) in English** as much as you can, and not only on scientific topics. This will help you in expressing yourself in this major scientific language. You can deeply regret that your mother language is not (or no more) the dominant scientific language, but do not dream that you will be able to change the course of history: this is a long-term trend; it will take tens of years before another language – if any – becomes predominant and it might not be yours...

3. About Writing

- **Write by yourself a first draft of your detailed thesis project** as soon as possible (usually you start with a short project written by your supervisor). This will ease the interaction between you and your thesis committee.
- **Scientific writing is not a trivial exercise**. There are some rules, tricks and tips (see a list of useful references on the subject, in particular the first choice recommended by

C. Hollingworth, a famous co-editor: Day, R.A., 1998). Writing in general is difficult for everybody and the earlier you will start writing the sooner you will get a feedback on where you stand. Writing is an exercise, so you need to exercise everyday. The more you write, the less difficult it will be. And never say that you will write your PhD at the end (this will become too challenging). For instance you could start your every day work by writing for about one hour before reading your email! When you stop the writing, stop when you have an idea to develop and keep this idea for the next day, then it will be easier to start again. Writing is a daily work for scientists, which helps them structure their ideas and which promotes new ones.

- **Write** your first draft of the introduction and **rewrite** your detailed project as soon as possible (before the end of the 3rd month). The project should have now a realistic time schedule with milestones (experiments, chapter completed, paper submitted, etc.).
- Try to **finish up the writing of a chapter (or corresponding paper)** before moving to the next.
- **Make use of the tracking mode and comments facilities** available in most word processors when you exchange texts and drafts.
- **Do not underestimate the time** necessary for writing (you will soon realise that new ideas come with writing and that this often leads to start new analysis, processing, experiments or modelling), for polishing your figures, construct the reference list and edit your thesis. In total all these activities will require at least 6-8 months depending on your own writing ability (and these should not be the last ones!). With very few exceptions, all PhD students are short of time during the last months of their thesis and work after hours more than reasonably, experience high stress and often have to postpone their defence with all related administrative and financial problems.
- Your **first paper should be submitted 18 months** after the start of your PhD. This is very short!
- When **choosing the journal** in which you will publish, seek advice for the best trade-off between highly ranked journals (impact factor), the correlated risk of having your paper rejected and the delay of publication (or at least of official acceptance). Also seek advice on how to write, present ideas and submit from scientists who already published in the journals you are targeting. Please note that some journals favour or impose either a UK or a US spelling (select the appropriate spelling checker dictionary in your word processor and be consistent throughout your manuscripts).

3. About Organising

- If you do not have access to commercial bibliographic databases and article providers, make use of free ones (see Appendix 2) and request reprints or pdf files directly from the authors, from your supervisor or from a distant library you are affiliated to.
- Implement automated bibliographic alerts based on your own keywords (see Appendix 2).

- **Organise properly your reference list**, reading notes and reprints (or pdf files) from the start; if not you will waste a lot of time in the end. Make use of dedicated software (Procite, EndNote, etc.).
- Prefer statistical software that use **batch files** or command files over those using only scrolling menus. With the latter, it will be difficult for you (and others!) to repeat your processing.
- **Organize properly your data**, scripts of models and outputs, using a consistent numbering of files and folders. Keep a log-book (or log file) of the successive changes you make on the data set (additions, corrections), scripts or statistical processes.
- **Format your data** in such a way that others will have access to them: make sure your data are expressed in standardised units, match a standard format, are quality checked and are sufficiently documented to ensure they are reusable for future studies (e.g. raw data).
- **Backup** your data, reference lists, batch files and scripts at least twice a week. Your hard-disk can crash at any time, even if your computer is new; your computer might be stolen, etc. There are many options of automated backup, either on an external disk, a flash disk, DVD, CD, a distant disk of the network (synchronise option in Tools of Windows Explorer), etc. It is more difficult (but less important if you got your script saved) to save gigabytes of model output.

II. Scientific aspects

Remember the definition of the word *thesis* (*from the Oxford Dictionary: 'a statement or theory put forward to be maintained or proved'*), you will have to defend a theory, a concept or at least an idea. A PhD is an intellectual exercise: it must relate ideas, concepts, data and patterns together, and it must show that you linked things that had never been linked before in a comprehensible manner.

1. About Creativity

- Scientific writing and construction of a career: people will know your work and ideas through your papers. As a young scientist it is always difficult to interact with experienced (old!) professors; it will become much less difficult if you have publications to present (one may interact more easily through ideas that are published).
- Do not hesitate to engage **discussions** with senior scientists, both specialised in your geographical area and in your scientific domain worldwide (do not be shy as scientists are always very busy but are always open for discussion). Also discuss with younger scientists and other students who share the same concerns and problems as you.
- **Science is about surprise:** Learn from the unexpected as scientific interest sometimes lies in what 'does not work' or in 'outliers'; learn from anecdotes (e.g. S.J. Gould). In most results, particularly in ecology, we learn from what

‘does not work’ (e.g. outlier in regression). This way you will learn from your experiments and avoid an excess of focus that can prevent you from learning from the data (which is a serious drawback) and from anything else.

- **Do not think that everything has already been found in the past** and that your contribution will be minor. Discoveries will come with perspicacity and with your obstinacy in looking at old problems in a fresh way.
- **Small and tractable little things:** do not try to develop big, unsolvable and difficult question that are around (even though you should keep them in mind!). Start with something small that will help you to realize that to organize your scientific creativity you need to address a specific (apparently small at the beginning) solvable question that is tractable and that will attract the attention of your peers (you will be an expert of this little thing).

2. About structuring efficiently your creativity

- **Do it now (not later):** The best results are always obtained with economical means: try to avoid delaying things until ‘more data’, ‘more understanding’, ‘better models’ are available. We often say that we need more time to achieve what we want to do (even Darwin used this trick when writing the ‘origin of species’!). But time does exist and is limiting our abilities; we must cope with this and realise that what we do not do now might not be achieved in the future unless we start it now. You will come to realise that most of the time we have too many results, data... to develop our ideas and that the argument of delaying the writing is often used as an excuse for not doing things at all.
- **Efficiency: one paper = one idea and one idea = one paper:** An article or a PhD is a contribution to already existing ideas, concepts or frameworks. You do not create something new out of the blue but from an existing knowledge. Be parsimonious as you will have difficulties to publish a paper that contains two or more ideas (people will get confused and referees will reject it). Simplicity is beautiful.
- **Make concise papers:** a concise paper is easier to write and read.
- **Enjoy writing:** it is a condition to write a good paper that people will enjoy reading and that will thus stand more chance of being widely read.
- **Writings as a cumulative process:** You must not fool yourself and think that the paper you are writing is something essential for humanity (do not mistake it for the Grail or the *grand Chef d’Oeuvre*!). A paper is a contribution to what already exists; it derives from the work of many people worldwide (this is not depreciative!). A paper can contribute to the building of a *Chef d’Oeuvre* (but even to a master, such a building takes at least a pile of ten publications, not just one!).
- **Remember that a good idea (hypothesis) does not exist if you do not write a full argumentation and demonstration** that will comfort it (the paternity of an idea is attributed to the one who first fully documented it, not the one who talked about it, e.g. Konrad Lorentz got his Nobel price on imprinting, a process that was known before him but not fully demonstrated).

- **Use your writings as the forefront product of your creativity** and use them as the currency for discussion and communication.
- Try to **promote the comparative approach** and never say ‘this does not work in *my* ecosystem’; think ‘big’ and try to generalise your results. If something is different from what is found by others, you must at least have strong arguments to defend your personal views!
- **Validate results** using different and appropriate techniques, not just one (theories, statistics, and models) and by collaborating with colleagues both within and beyond your own discipline.
- **Have a strong technique in hand as science is nowadays very demanding in new and challenging techniques.** But never forget that while art without technique is a bad habit, the converse is also devastating! Do not be fascinated by the subject, the tool or the concept alone, but by all three together...
- **Ideas that structure our activities are qualitative** (even though their validation and our daily work – from 9⁻ to 5⁺ are based on quantitative approaches most of the time).
- **Link the disciplines between themselves: this is a real challenge.** For example linking ecology with evolution might help to explain the observed diversity, complexity, structure, and dynamics of the ecosystems. Every idea must be related to a theory, e.g. Dobzhansky (1973): ‘nothing in biology makes sense except in the light of evolution’. Thus when advocating for a theory, explore if this is consistent with other theories, approaches or disciplines.
- **Science is about novelties and challenges:** Avoid the ‘me too!’, and be innovative, but at the same time secure some conventional chapter(s) in your thesis (be pragmatic!). There is always a tendency after reading a good paper to tell oneself: I will do the same in my ecosystem, in my model etc. This is a natural tendency, but in a scientific world, where redundancy is more and more frequent, we should try to take risks in developing new ideas, new concepts and new methods. This is fun, scientific, and most of the time taking risks pays off!
- **Avoid plagiarism and misuse of the Internet.** There is a great danger to copy/paste from the Internet (sometimes from great people!). You must read and exploit many new ways of collecting information and knowledge. However, do not forget that you must digest, synthesise and reformulate any input, and that you must deliver your own views. Be cautious, software exists that can spot instantly a misuse of the Internet (and this misuse would be detrimental to your career).
- **‘Empowerment’:** think your results are going to (and should) be used by others. You do not work only for you or your supervisors. You must produce science that your colleagues can make theirs. This means that raw data, ideas, synthetic tables, theoretical figures, critical reviews... are appropriate and useful for the whole community.

III. Beyond the PhD

- **Science requires a long-term involvement: work with long-term constraints** (framework, objective, conceptual idea, ‘jardin secret’) and try to be free in the short term. Obstinacy is important to scientists. Charles Darwin wrote in his ‘Autobiography’, in *The life and letters of Charles Darwin edited by F. Darwin. 1887*: ‘Therefore my success as a man of science, whatever this may have amounted to, has been determined, as far as I can judge, by complex and diversified mental qualities and conditions. Of these, the most important have been— the love of science— unbounded patience in long reflecting over any subject—industry in observing and collecting facts—and a fair share of invention as well as of common sense. With such moderate abilities as I possess, it is truly surprising that I should have influenced to a considerable extent the belief of scientific men on some important points’.
- **Always have several papers in the pipeline** (always have two or three papers under writing).
- **There are always many ways to do science**; adopt your own way, but get the inspiration from the great authors (Darwin, Cuvier, Lamarck, Huxley, Margalef, Beverton, May, Holling, Gould, Van Valen, Pauly, Pimm, Mayr...). Mayr wrote (*as cited by Provine in TREE Vol.20 No.8 August 2005*): ‘In your work, both on Dobzhansky and on Wright, please always remember that a scientist’s achievement may lie in many different areas: As an innovator (new discoveries, new theories, new concepts), as a synthesiser (bringing together scattered information, sharing relationships and interactions, particularly between different disciplines, like genetics and taxonomy), as a disseminator (presenting specialized information and theory in such a way that it becomes accessible to nonspecialists [popularizer is a misleading term]), as a compiler or cataloguer, as an analyst (dissecting complex issues, clarifying matters by suggesting new terminologies, etc.), and in other ways.’

Appendix 1: Course in Scientific Writing

Useful Books – Short List by C. Hollingworth

Updated 1 May 2003

Scientific writing

Alley, M. (1996) *The Craft of Scientific Writing* (2nd edn). New York etc.: Springer-Verlag. £18.50 p/b, xvi + 282 pp. ISBN 0–387–94766–3. Written for physical scientists and engineers. Good in parts, but the selection of references and the two chapters on illustrations are poor. Turk and Kirkman (1989) would be a better choice.

Barrass, R. (1978, reprinted 1986) *Scientists Must Write: A Guide to Better Writing for Scientists, Engineers and Students*. London: Chapman & Hall. £9.99 p/b, xiv + 176 pp. ISBN 0–412–15430–7. Clear and concise, although sketchy in parts.

Day, R.A. (1998) *How to Write & Publish a Scientific Paper* (5th edn). Cambridge: Cambridge University Press. £12.95 p/b, xiv + 223 pp. ISBN 0–521–65879–9. Widely used text, with particularly good brief chapters on tables and figures. **A clear first choice.**

Kenny, P. (1982, reprinted 1993) *A Handbook of Public Speaking for Scientists and Engineers*. Bristol & Philadelphia: Institute of Physics (IOP) Publishing. £14.95 p/b, xii + 181 pp. ISBN 0–85274–553–2. Excellent guide. Valuable chapters on planning and writing oral presentations, preparing notes from which to speak, using visual aids, building self-confidence, improving delivery, etc.

Lindsay, D. (1995) *A Guide to Scientific Writing* (2nd edn). Melbourne: Longman. £7.99 p/b, x + 126 pp. ISBN 0–582–80312–8. Introductory guide with good, basic chapters on seminars and theses. Disappointing lack of detail on tables and figures.

Medawar P.B. 19XX. Advice to young scientists. Bradford Books.

O'Connor, M. (1991, reprinted 1999) *Writing Successfully in Science*. London: Chapman & Hall (E. & F.N. Spon). £12.50 p/b, xi + 229 pp. ISBN 0–419–25240–1. Good book. Concise discussions of theses, tables, figures, seminars, posters, grant proposals, CVs etc. Needs to be updated.

Pauly D. 1994. On the sex of Fish and the gender of scientists. Chapman & Hall Fish and Fisheries Series 14.

Turk, C.C.R. and Kirkman, J. (1989, reprinted 1995) *Effective Writing: Improving Scientific, Technical and Business Communication* (2nd edn). London: E. & F.N. Spon. £11.99 p/b, x + 277 pp. ISBN 0–419–14660–1. Much good advice, with emphasis on technical or business reports. Good chapter on table and figure design.

University of London Careers Service (1994, reprinted 1996) *How to Write a Curriculum Vitae* (3rd edn). University of London Careers Service, 50 Gordon Square, London WC1H 0PQ. £5.00 p/b, 51 pp. ISBN 0-7187-1242-0. Written for grads and postgrads. Sound advice and clear, well-explained examples. Highly recommended.

Style guides

Choose books on English usage that will help you to write clearly and simply: lofty, artistic style is less important.

Carey, G.V. (1958, much reprinted) *Mind the Stop*. London: Penguin. 126 pp. £5.99 p/b, ISBN 0-14-051072-9. Excellent book on punctuation. See also Trask (1997).

Fowler, H.W. (1996, revised 1998) *The New Fowler's Modern English Usage* (revised 3rd edn, edited by R.W. Burchfield). Oxford: Clarendon Press. £17.99 h/b, xxvi + 864 pp. ISBN 0-19-8690263. Often available cheaply through book clubs.

Kirkman, J. (1992) *Good Style: Writing for Science and Technology*. London etc.: E. & F.N. Spon. £12.50 p/b, viii + 221 pp. ISBN 0-419-17190-8. Valuable chapter on writing for people whose native language is not English. Good chapters on special style for writing instructions, descriptions and explanations (e.g. in technical documentation). Useful supplement to Turk and Kirkman (1989).

Strunk, W., jr & White, E.B. (2000) *The Elements of Style* (4th edn). New York etc.: Longman. p/b, xviii + 105 pp. ISBN 0-205-30902-X. Famous classic. Cheap and highly recommended.

Trask, R.L. (1997) *The Penguin Guide to Punctuation*. London etc.: Penguin Books. £6.99 p/b, x + 162 pp. ISBN 0-14-051366-3. More modern than Carey (1958). Clear, straightforward advice, with lots of examples of good and bad usage; assumes no previous knowledge of punctuation. Includes useful odds and ends like how to use italics and bold effectively.

Weiner, E.S.C. & Delahunty, A. (compilers) (1994) *The Oxford Guide to English Usage* (2nd edn). Oxford and New York: Oxford University Press. £4.99 p/b, xii + 306 pp. ISBN 0-19-280024-8. Sensible and easy to use. Often available cheaply through book clubs.

Zinsser, W. (1994) *On Writing Well: An Informal Guide to Writing Nonfiction* (5th edn). New York: HarperCollins. £8.99 p/b, x + 300 pp. ISBN 0-06-273303-6. Widely used guide to writing non-fiction – for example, sports, humour, travel articles. Full of sensible advice on cultivating a clear, simple style, on choosing the right word, on organizing your text logically, on getting rid of clutter. Does not treat matters such as tables and figures.

Technical guides

Technical matters are summarized in the better style and writing guides. The following books give more detail. The full book list shows more specialised books.

Briscoe, M.E. (1996) *Preparing Scientific Illustrations: A Guide to Better Posters, Presentations, and Publications* (2nd edn). New York: Springer-Verlag. £17.00 p/b, xii + 204 pp. ISBN 0-387-94581-4. Good general introduction to designing and producing clear, legible drawings and photos. Has chapters e.g. on slides, posters, and molecular graphics.

Crothers, J.H. (1981) On the graphical presentation of quantitative data. *Field Studies*, **5**: 487-511. Old fashioned but shows many useful and unusual ways to display data, especially from field surveys.

Dictionaries

Some journals require British spelling, others American. A modern, brick-sized dictionary (e.g. Concise Oxford) is usually adequate.

Dictionaries often claim to be up-to-date – check the date on reverse of title page, check some words from your discipline, and choose one you find easy to use. Compare entries for the same word in different dictionaries. Oxford dictionaries are well regarded but you may prefer e.g. the Chambers series.

A thesaurus (often called Roget's thesaurus) helps to find the precise word, but some are easier to use than others. As a general rule, those arranged alphabetically are faster to use. Try a few out before buying. On-line versions are worth considering, if up-to-date.

The Compact Oxford Dictionary – do not confuse with the (much better) *Concise* dictionary.

The Concise Oxford Dictionary of Current English (10th edn, ed. J. Pearsall, 1999). Oxford: University Press. £17.99 h/b, xx + 1666 pp. ISBN 0-19-860259-6. Excellent desktop dictionary, clearly laid out and with good definitions. Available on CD-ROM (ISBN 0-19-860326-6).

The Oxford Dictionary for Scientific Writers and Editors (1991). Oxford: Clarendon Press. £14.95 h/b, 389 pp. ISBN 0-19-853920-7. Excellent book for serious writers – cannot be your main dictionary as it does not give detailed definitions. Handy and authoritative guide to spelling (e.g. “gramme – use gram”), abbreviations, and much else. Needs to be updated.

The Oxford English Reference Dictionary (2nd edn, ed. J. Pearsall and B. Trumble, 1996). Oxford: University Press. H/b, xxii + 1780 pp. ISBN 0-19-860046-1. Next size up from the *Concise* and often available cheaply through book clubs.

Grammar books

Many grammar books are complex and boring. You may not need one very often, and can usually rely on a library to have something appropriate.

Shertzer, M. (1986) *The Elements of Grammar*. London: Collier Macmillan. About £5.00 p/b, viii + 168 pp. ISBN 0-02-015440-2. Clear, straightforward introduction to basic English grammar. Strong chapter on punctuation (but beware that American and British conventions can differ). Useful checklists; good index.

Taylor, J.A. (1990) *Chambers English Grammar*. Edinburgh: W. & R. Chambers Ltd. £2.95 p/b, x + 118 pp. ISBN 0-550-18034-6. Clear, simple introduction.

Appendix 2: Free Internet addresses for bibliography

Google scholar (different from Google, for students and scientists ; provides references but also full pdf files):

<http://scholar.google.com/>

Google Print (look for keywords or expression in books ; but you will not get the full book content for free!):

<http://print.google.com/>

FishBase (A Global Information System on Fishes - MNHN) :

<http://ichtyonb1.mnhn.fr/search.cfm>

Fishstat (fish landing database from FAO with related references):

INIST (facility to search and order scientific papers, by CNRS, France):

http://www.inist.fr/index_fr.php

HORIZON (references and some pdf files published by ORSTOM – IRD):

http://www.bondy.ird.fr/pleins_textes/

TEL-CCSD (Full text of French Phds):

<http://tel.ccsd.cnrs.fr/>

PASTEL (full text of PhD theses from French schools of engineers in Paris):

<http://pastel.paristech.org/>

PERIODICS (searches for references of French scientific journals for large audience):

<http://www.univ-pau.fr/SCD/PERIODIC/>

Scirus (Elsevier; searches for references and sometimes provides free pdf)

<http://www.scirus.com/srsapp/>

Scientific Editions webpages (will provide you facilities to searches for references in their different journals, but only free access to abstract; will also offer you an automated alert system based on your own keywords). E.G.:

<http://www.blackwell-synergy.com/>

<http://www.sciencedirect.com/science/>

<http://www.nature.com/nature/>

<http://www.sciencemag.org/>

<http://www.rsmas.miami.edu/bms/>

Additional Internet addresses can be found on the (French) IRD web page:

<http://www.mpl.ird.fr/documentation/bases.html>