Chapter 1

Essential communication skills

Introduction

This chapter introduces the essential skills necessary for effective communication and which underpin the material covered in the chapters that follow.

Specifically, this chapter will:

- describe the basic features associated with scientific communication: accuracy, conciseness, clarity, and source referencing
- provide guidance on selecting and writing references
- describe the three stages a piece of work passes through before it is ready for submission or presentation: planning, drafting, and revising
- provide some guidance on communicating effectively with your supervisor and research group members.

1.1 The essential features of scientific communication

The essential features underpinning all forms of scientific communication are that the work should be reported accurately and concisely, and that any source material used in compiling the work is acknowledged appropriately.

1.1.1 Reporting your work accurately

You must make sure that your work is free from mistakes and from ambiguous comments. It is unlikely that you will intentionally distort facts and figures. However, it is possible for mistakes to occur unintentionally through carelessness, lack of attention to detail, or if you rush your work. If the work is for assessment purposes, then the consequence will be that you lose marks. If the work is published, then the consequence could

be that you are accused of deliberately misrepresenting your results or other people may waste valuable time attempting to validate your findings. Either way your reputation as a scientist will suffer. To ensure that your work is accurate:

- Use the international system of units (Système International d'Unités, or **SI units**) when expressing units of measurement and use them correctly and consistently.
- Use abbreviations correctly and consistently.
- Use standard scientific nomenclature when using names of chemicals, genes, chromosomes, and taxonomy.
- Give yourself sufficient time to check drafts of your work for spelling mistakes and grammatical and punctuation errors, and to check the accuracy of your references.
- Check the content of your statements to see that there is no reason for others to misunderstand your work.

If you are unfamiliar with the standard formats listed above, then consult the manual *Scientific Style and Format,* published by the Council of Science Editors (CSE 2006) which describes the standard systems and how to use them correctly.

1.1.2 Reporting your work concisely and clearly

When communicating, you should keep your work concise. This means you should not include superfluous terms and sentences that do not add to the understanding of your work. Instead, use short sentences and avoid unnecessary repetition. Try to use simple words as far as possible and avoid needless technical jargon. There are times, of course, when technical words are necessary, but on the whole avoid long and complex terms.

1.1.3 Referencing source materials in your work

During your academic work you will make use of published material (and sometimes unpublished work) in a variety of ways. For example, you may be asked to review an article critically, write a literature review, propose a programme of research, or present your results. Each of these activities requires that you use the work of others to place **your** work in the context of the wider published literature and to support **your** own analysis, proposals, and interpretations. When using the work of others, you must credit the original author(s) by referencing the source in your work. There are different formats for referencing and these are described in section 1.2. If you do not acknowledge the work of others in your work appropriately, then you could be accused of plagiarism. Advice on how to avoid plagiarism is provided in Chapter 3, section 3.4.

1.1.4 Use of the active voice

Traditionally, scientific articles were written in a passive voice. However, it is becoming much more common to communicate science using an active style, and in fact this is preferred by many journals. For example, it is acceptable to say 'we extracted protein

from …' instead of 'protein was extracted from ….' and 'we conclude …' instead of 'it was concluded …' Using active sentences makes communication much more interesting and easier to read. When using an active style of writing, you can use the pronoun 'we' or the pronoun 'I' depending on the purpose for which you are writing. For example, if you are writing a research paper, use 'we' to mean a group of authors. If you are writing a dissertation or thesis, you may use 'we' or 'I'. The 'we' in this context will mean the single author (that is, you and not a group of people). In the case of the dissertation or thesis, the choice between the two pronouns may depend on the preference of your university or department, and you should seek advice from your tutor or supervisor on this before you start to write. It is possible that there are individual journals, departments, or institutions that recommend to their students to report their work using a passive style of writing. In such cases, you must, of course, follow the specific instructions supplied to you.

1.2 Referencing

There are three main reasons for referencing the sources used in your work. One is to credit the original author whose work you are using, the second is to help others identify and locate the source of the information, and the third is to differentiate clearly which part of the work is yours and therefore new, and which is the contribution of others.

There are two parts to referencing completely:

1. Citing the source within the text at the point you refer to it.
2. Listing fully all the sources that you have cited in the text at the end of your writing in the form of a reference list.

1.2.1 Referencing methods

There are several different methods that can be used for referencing, but the two most widely used are the author–date system (also known as the Harvard system) and the numerical system (also known as the Vancouver system).

In the author–date system, the author's surname and the date of publication are given at the relevant point in the text, in parentheses, for each reference cited. All the citations in the text are then placed in a reference list at the end of the work which is organized in alphabetical order by first author's surname. The rules for in-text citation are described in Table 1.1.

In the numerical system of referencing, each reference is cited via a superscript or a bracketed reference number which is inserted at the appropriate point in the body of the text. The reference list is then placed at the end of the work and each citation is listed numerically. The rules for in-text citation are described in Table 1.1.

TABLE 1.1 In-text citation rules for the author–date system and the numerical system of referencing

Author–date system	Numerical system
• If you are citing a source with a single author this can be cited in the text as (Jones, 2005) with the author's surname separated from the year of publication by a comma. If you have already named the author in the text, then only the year needs to be added in parentheses, for example *as discussed by Jones (2005).* • If you are citing a source where there are two authors then both names should be given in the text, for example (Smith and Kent, 2006). • If you are citing a source where there are more than two authors, then the term 'et al.' follows the surname of the first author, for example (Wang *et al.,* 2007). Et al. (an abbreviation of 'et alia') is a Latin term meaning 'and others' and is commonly italicized. • If you are citing two or more different references for the same year and by the same author(s), then each reference should be distinguished from the other by adding a lower case letter after the year. For example the lower case letter 'a' is added to the first 2003 Charnley citation as follows (Charnley, 2003a) and the letter b is added to the second 2003 Charnley citation as follows (Charnley, 2003b). • If you are citing two or more different references which report work on a similar subject matter—the sources can be cited consecutively in the following way (Tsien *et al.,* 1998; Cormack, 1996). You will note that each reference is separated by a semi-colon and ordered in descending chronological order. Ordering in ascending chronological order is also acceptable, but you must always use one style consistently throughout your work. • When citing internet sources in the text cite the author's surname and date in parentheses (if known) or if the personal author is not known then the organization, for example (WHO, 2007).	• The first source cited in your work is allocated number 'one', the second is allocated number 'two' and so on. • If you refer to a source again that has already been allocated a number earlier, then the same number for that particular source is used again. • If you refer to multiple references at the same time, these can be cited together as follows (2,3,4) or (2–4) if they are consecutive. If not consecutive, then they can be cited as (2–4, 14).

1.2.2 Use of reference management software

When compiling reference lists, use reference management software such as EndNote, Reference Manager, or ProCite. This software allows you to:

- Import references from electronic databases directly into a bibliography.
- Organize your references into folders and search and sort through them.

- Insert references into Word documents.
- Format reference lists in different publishing styles.

You are strongly recommended to use reference management software to compile your reference lists. It will make the process less time-consuming and you are less likely to introduce errors into the reference. If you are unfamiliar with how to use a reference software package, then your university may provide training sessions or you can browse the manufacturer's website which will contain information on how to use their software.

1.2.3 Writing references

If you compare reference lists from different sources you will see that there are slight variations in the way in which each reference is written. Some may include the title of articles but others may not (the latter is the style used by the journal *Science*). Some may position the year of publication at the end of the reference, while others may position it after the authors names. Some journals use abbreviated forms of journal titles, while others will use the full journal name. Despite these slight variations in order of arrangement and the amount of information included, all references contain the following essential information: **the names of authors and when and where it was published.** This information is necessary to help you locate the reference. Table 1.2 demonstrates how full descriptions of references for different publication types can be written. The examples presented in the table represent one style of Harvard referencing (see also Pears and Shields, 2005).

If you are writing for assessment purposes, then the referencing style you use may be a matter of personal preference or it may be dictated by the guidelines provided by your programme of study. It is common practice for programmes of study to recommend that descriptions of references are written out in full; that is, to include the title of the article. If you are writing for a particular journal, then the journal will insist that you use their journal style, which may or may not include the article title and may use full or abbreviated forms of journal names. Before using any particular style of referencing it is best to find out what the rules are, so as to avoid having to modify the referencing style later on. If you have to reformat your reference list to conform to the style of a particular journal, this is relatively easy to do if you are using reference management software.

You should know that journal abbreviations follow a standard system. If you are unfamiliar with the standard abbreviation used by a particular journal, then you can check the abbreviation through an electronic database such as Web of Science (Chapter 5). Some basic rules are

- One-word titles are not abbreviated but used in full (e.g. *Science, Biochemistry*).
- Journal is abbreviated to *J.*
- Titles ending in *-ology* are abbreviated to the *l* (e.g. *Toxicology* is abbreviated to *Toxicol*).

TABLE 1.2 How to write complete references for different types of publication in a reference list

Publication type	Information required and order of arrangement	Example
Book	Author(s) surname(s) and initials Year of publication (in parenthses) Title of the book (in italics) Edition (if not the first edition), abbreviated to 'edn'. Publisher's name Place of publication	Brown, T. A. (2004). *Gene cloning and DNA analysis,* 4th edn. Blackwell Publishing, Oxford.
Chapter in an edited book	Author(s) surname(s) and initials Year of publication (in parenthses) Title of the chapter Surname(s) and initials of editor(s) Title of book (in italics) Edition (if not the first edition), abbreviated to 'edn'. Publisher's name Place of publication	Mason, P.J., Enver, T., Wilkinson, D., Williams, J.G. (1993). Assay of gene transcription in vivo. In: Hames, B.D. and Higgins, S.J. ed. *Gene transcription: a practical approach.* Oxford University Press, Oxford.
E-book	Author(s) surname(s) and initials Year of publication (in parenthses) Title of the book (in italics) Edition (if not the first edition), abbreviated to 'edn'. Publisher's name Place of publication Type of medium (in square brackets) URL Date when last accessed by you (in parenthses)	Haines, J.L., Kort, B.R., Morton, C.C., Seidmen, C.E., Seidmen, J.G., Smith, D.R. (2007). *Current protocols in human genetics.* Wiley Interscience, UK. [e-book]. Available at: http://0-www.mrw.interscience.wiley.com.wam.leeds.ac.uk/emrw/9780471142904/home (last accessed 21 May 2007).
Journal article	Author(s) surname(s) and initials Year of publication (in parenthses) Title of article Name of journal (in italics) Volume number (in bold) Issue number (in parenthses) (if relevant) Page numbers	Dawo, M.I., Wilkinson, J.M., Sanders, F.E.T., Pilbeam, D.J. (2007). The yield and quality of fresh and ensiled plant material from intercropped maize (*Zea mays*) and beans (*Phaseolus vulgaris).* *J. Sci. Food Agric.,* **87,** 1391–1399.
Journal article that is available online but is not yet in an issue	Author(s) surname(s) and initials Title of article Name of journal (in italics) Published online Date of publication Digital Object Identifier (doi)	Schmutz, S.M. and Berryere, T.G. The genetics of cream coat color in dogs. *J. Hered.*, published online May 7, 2007. doi:10.1093/jhered/esm018.

TABLE 1.2 Cont'd

Publication type	Information required and order of arrangement	Example
Article in an e-journal	Author(s) surname(s) and initials Year of publication (in parenthses) Title of article Name of e-journal (in italics) Volume number (in bold) Issue number (in parenthses) (if relevant) Page numbers (if available) URL When the material was last accessed by you (in parenthses)	Garrick, D. (2008). Body surface temperature and length in relation to the thermal biology of lizards. *Bioscience Horizons,* **1,** 136–142. Available at: http://biohorizons.oxfordjournals.org/(last accessed 8 June 2008).
Conference papers	Author(s) surname(s) and initials Year of publication Title of article Name of conference Location of conference Dates of conference Publisher and place of publication Page/abstract numbers	Walker, O. and Conner, M.K. (2007). Molecular links between obesity and breast cancer. Experimental Biology 2007 Annual Meeting, Washington, DC, 28 Apr–2 May 2007. *Faseb J.*, **21**(6), A927–A927.
Theses and dissertations	Author's surname and initials Year of publication (in parenthses) Title of thesis/dissertation (in italics) Degree award in brackets, e.g. [PhD] Name of university awarding the degree Location of university	Divan, A. (2000). *p53, life, death and differentiation in retinoblastomas.* [PhD]. University of Sheffield, Sheffield.
Internet sites[a]	Author(s) surname(s) and initials (or corporate author) Year of publication (or when page was last updated) (in parenthses) Title of document (in italics) Medium of publication (in square brackets) URL When the material was last accessed by you (in parenthses)	WHO (2007). *Avian Influenza: situation in China* [online]. Available at: http://www.who.int/csr/don/2007_03_01a/en/index.html (last accessed 5 March 2007).
Audiovisual material	Author(s) surname(s) and initials (or corporate author) Year of publication (in parenthses) Title of publication Medium of publication (in square brackets) Name of publisher Place of publication	The Open University (2007). *In search of syphilis.* [CD]. The Open University, Milton Keynes.

(continued)

TABLE 1.2 Cont'd

Publication type	Information required and order of arrangement	Example
Reports (technical and official)	Author(s) surname(s) and initials (or corporate author) Year of publication (parenthses) Title of publication (in italics) Identifying letters and numbers of publication Publisher's name Place of publication	International Organization for Standardization (1972). *Documentation International code for the abbreviation of titles of periodicals.* ISO 4:1972. ISO, Geneva.
Patents	Name of patentee Title of patent (in italics) Country that granted the patent Patent specification number Date patent granted	University of Leeds. *Nucleic acids nematicides*. GB patent specification EP1780264. 2007.
Personal communication	Personal communications such as e-mail correspondence or telephone conversations should be incorporated in the main text at the point you refer to them as follows: (Zhang, personal communication). If you are citing unpublished data, the format in-text is (Horst, unpublished) or if the manuscript is in prepration (Graham *et al.,* in preparation). Personal communications, unpublished data, and manuscripts in preparation (but not yet accepted for publication) are not listed in the reference list.	

Note: the examples presented in the table represent one style of Harvard referencing only. Specific details may differ according to the instructions provided by your institution or journal: check the instructions before you start to write.

[a] There is no agreed system for referencing web-based sources. However, it is recognized that in addition to the URL, you must include details of when the web page was last updated and when you last accessed the material.

Referencing guidelines

1. You should always use high-quality sources of information which are factually correct, up to date, and reliable. Your major source of information should be peer-reviewed scientific articles published in journals. However, authoritative information such as patent details, government statistics, research legislation and manufacturer's protocols are also appropriate sources of information (Chapter 4).
2. You should cite only those references in your work that you have actually read. For example, if you have read a review article by *Jones* that discusses the work of *Brown*, then you should cite *Jones* as your source and not *Brown*. It is good practice, however, to read the primary article instead of relying on the interpretations of a secondary article when writing your work.
3. You should, as far as possible, cite primary published literature in your work. However, in cases where a comprehensive review article is available, then citation of the review article may be preferable to citing many separate references.

4. When selecting references, consider how relevant they are and include only those that are necessary to understand your work.
5. You must acknowledge appropriately all the material used in your work. This means citing all the sources both in the text (at the point you refer to the source) and in a list at the end of the writing.
6. You must use a single style of referencing consistently throughout your work. If you are writing an assignment for assessment purposes, then it is likely that you will be provided with guidelines on which is the preferred method to use by your tutors. If you are writing for publication in a journal, then you will need to check the journal's instructions for authors to see which style is acceptable to the journal you are aiming to publish with.
7. You must cite all your references completely and correctly, both within the text and in the reference list at the end. This means checking that all the references cited in the text are included in the reference list at the end. It also means checking the details of individual references against the original publication to make sure the reference details are correct as are all journal abbreviations, arrangement of each component of the reference, and the use of full stops, commas, spaces, italics, and bold type.

1.3 The writing process: planning, writing, and revising

Good writing is not only accurate, concise, clear, and referenced, but it should also be complete in content and organized so that it shows a logical progression of ideas. To achieve this, you should give yourself **sufficient time** to **plan**, **write**, and **revise** you work. These three stages are common to all forms of communication and are described in turn below. Each of these stages will be revisited in the context of the different types of communication in relevant chapters that follow.

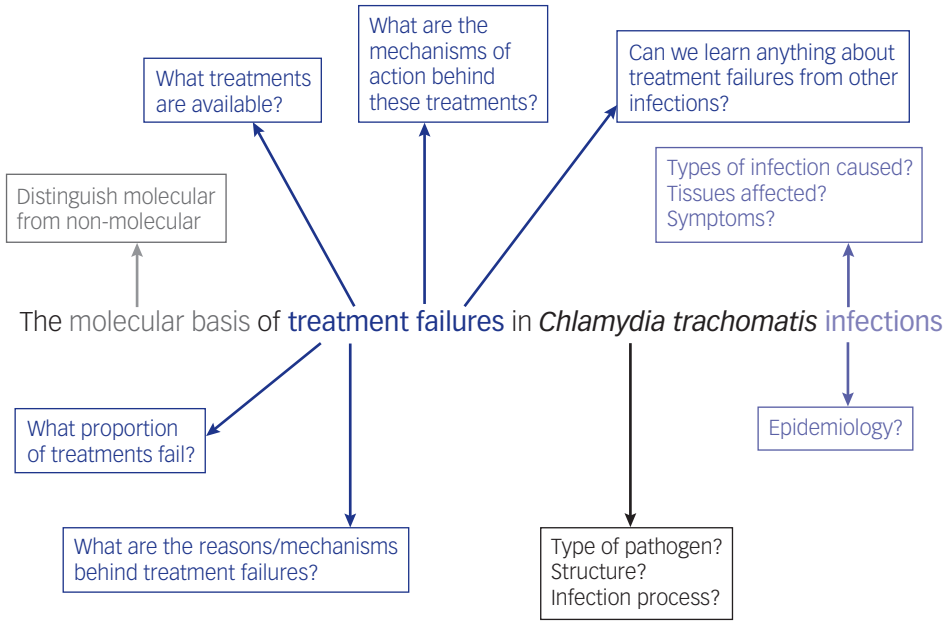
1.3.1 Stage 1: planning your work

Planning a piece of work before you start to write makes the process of writing much easier. It does so by helping you to identify the key points to include in your work and in working out the order in which you can introduce these points. There are a number of techniques you can use to facilitate the planning stages of your work. These include **brainstorming**, the **mind map**, and the **linear plan** (Table 1.3).

What form of planning you use is a matter of personal preference. You may choose to use one of the techniques described here or other methods that you may already be familiar with. In any case, it is worth spending some time on the planning stage as it will ensure you do not omit key points and your writing is logically organized. This will make your work easier to follow and therefore more comprehensible to the reader or listener.

TABLE 1.3 Planning techniques: brainstorming, mind map, and the linear plan

Brainstorming



A simple technique which is often used at the early stages of planning to identify material that may be relevant for inclusion in your work. The aim is to get down on paper your main ideas. In a brainstorming map, the central topic is placed at the centre of the paper and then ideas as they come to you are written down in any order around the central topic. An example of a brainstorm is shown above and in Figure 7.2.

Mind map

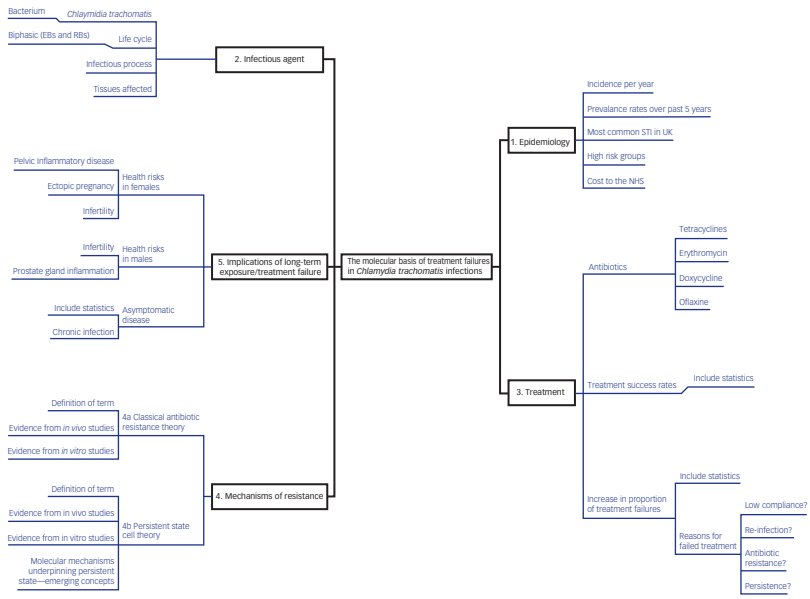


TABLE 1.3 Cont'd

A technique developed by Buzan (1991) which can be used to plan an overview of a topic area and identify relationships between the sub-topics. In a mind map, the main topic is written in a box in the centre of a page. Then, working in a clockwise direction, the sub-topics are written, again in boxes, branching from the centre. Further sub-points then branch off from the main points. Mind maps can be generated by hand, or there are a number of software packages available such as MindGenius that can be used to produce the maps electronically. An example of a mind map is shown above and in Figure 7.3.

Linear planning

A much more traditional form of planning in which the main points are listed sequentially under a series of sub-headings. An example of a linear plan is shown below and in Box 7.1.

Review topic: The molecular basis for antibiotic treatment failures in *Chlamydia trachomatis* infections

Introduction

- Establish importance of the topic (increasing prevalence, increased treatment failures infections and associated health risks)
- Delineate the review content: mechanisms underpinning treatment failures (antibiotic resistance and persistent state cell theory)

Main body

I. Epidemiology and pathogenesis of the disease
   - Causative organism
   - Most common STI in the UK
   - Increasing prevalence in the UK
   - High risk groups
   - Cost to the NHS to treat infections
   - Life cycle of *Chlamydia trachomatis* and survival in host cell……

1.3.2 Stage 2: writing a first draft of your work

Once the planning is complete you can begin to write a first draft of your work. You do not need to write a piece of work from start to finish. You can start with any section that seems the easiest. You could also add sub-headings and then add details below each sub-heading. This can facilitate the writing process, and any sub-headings that you do not require can be removed later during the redrafting stage of your writing. The aim of the first draft is to produce a tentative outline of your work which can be refined and fleshed out with details as you progress through your writing. When writing the first draft, you will need to take into account any guidelines you have been supplied with on the structure of the report or presentation and the word limit. For example, research papers follow a standard IMRAD structure in which the **I**ntroduction, **M**ethods, **R**esults and **D**iscussion are presented sequentially. A literature review, on the other hand, is structured into three conventional parts: the introduction, the main body, and the conclusion, with or without sub-headings. You should therefore ensure you are familiar with any guidelines provided and conform to them exactly.

When writing you may experience 'writer's block', during which your writing stalls. If this happens, do not worry: it is common to most writers. When this happens, try the following techniques:

- Take a break from your writing. You can then return after a break refreshed and ready to continue.
- Work on a different section of your writing. Working on different parts simultaneously can sometimes help clarify other parts and facilitate writing generally.
- Talk to someone about your work. This can also be useful in assisting you in developing your ideas.

1.3.3 Stage 3: revising your first draft

You will need to refine your first draft a number of times before you reach a final copy that is accurate and complete and ready for submission or presentation. When redrafting, do not start revising immediately after you have completed your first draft. Instead, leave it for at least a day and then come back to it and start revising. When revising you need to check:

- The accuracy and completeness of the content of your work.
- The organization and coherence of your writing including spelling, grammar, and punctuation.

Checklists for reviewing your work are included in the relevant chapters that follow. As you refine each successive draft, it will help if you focus on different elements of your writing. For example, the first time you redraft you may focus on the content and rearrange, delete, or add further text. Subsequently you may focus on checking the accuracy of the references. On further readings you may decide to focus on the spelling, grammar, and punctuation. With each successive redraft your work will improve and you will end with a professional final version that is ready for submission or presentation.

1.4 Interpersonal communication: working with your supervisor and as part of a research group

Interacting with and building productive working relationships with your supervisor, your research group members, and other scientists require good communication skills. This section provides some guidance on how to manage your relationship with your supervisor and with members of your immediate research group. Developing and maintaining contact with other scientists working in a similar or related field is discussed in Chapter 15 on networking.

1.4.1 Working with your supervisor

To build a strong working relationship with your supervisor you must first understand what you can realistically expect from your supervisor and what your supervisor expects from you. These expectations will be outlined in your university's code of practice for students. Typically, the role of the supervisor is to **support** and **guide** you through your research and in all aspects of the training surrounding that research. This typically includes helping you define your research question and work plan; approving and making sure you follow a timetable of work; and discussing results and commenting on drafts of your thesis. It also includes assisting you to identify appropriate training such as health and safety and transferable skills. Your supervisor will expect you to work hard, meet deadlines, be independent and show enthusiasm for your work. Some guidelines to help you get the most out of your relationship with your supervisor are:

- Find out what you can expect from your supervisor and what your supervisor expects from you. This means reading your university's code of practice for students and any departmental and research group guidelines. It also means speaking to your supervisor(s) and clarifying what you can expect (and what they expect). By the end of this process, you should have a clearer understanding of your roles and of the practicalities, such as how frequently you can expect to meet with your supervisor on a one-to-one basis, the procedure for contacting your supervisor, and the frequency and format of research group meetings.
- If you have more than one supervisor, then find out what the individual responsibilities of each supervisor are. The following are the types of information you should know. Which supervisor is your first point of contact? Will you have regular meetings with both (all) supervisors or one supervisor? How will you keep the second supervisor(s) informed of your progress?
- Be professional in your relationship with your supervisor(s). This includes attending meetings on time, informing your supervisor if you can't attend a meeting, taking responsibility for scheduling meetings, and completing work according to agreed deadlines.
- Prepare carefully for meetings with your supervisor. Always have a clear agenda of what you will discuss at the meeting and what you expect to achieve by the end. If you are meeting to discuss the progress of your work, then take your data with you (both raw and analysed) and be prepared to describe and explain your findings. Share all the data that you have accumulated since the last meeting and highlight any inconsistencies in your data, any technical problems you've experienced, how you've overcome them, and any other information that will accurately convey the progress of your work. Always keep a record of the meeting, and in particular any objectives you have agreed for further work. This will help to monitor your progress, and the record can be used as evidence that a particular discussion took place if any problems arise at a later date.
- Expect your supervisor to give you critical (but constructive) feedback on your work. Do not become defensive when this happens. The aim is to improve your

understanding and quality of your work. Therefore, consider the feedback you receive carefully and use it to enhance your work.

- You will communicate with your supervisor by e-mail often and for many purposes. These could include arranging meetings, describing how your work is progressing, asking questions, and sending drafts of your work. To communicate effectively by e-mail, follow the guidelines provided in Chapter 2 (section 2.2).
- Your supervisor will expect to see that you are developing stronger analytical and practical skills as your work progresses. Therefore, you should expect your relationship with your supervisor to mature and evolve over the course of your research. This will be reflected in you becoming more independent and less reliant on your supervisor for advice. It could also mean that you meet less frequently on a one-to-one basis to discuss your work.

Most people develop a productive relationship with their supervisor which continues after the programme of study has come to an end. However, if you have concerns about your relationship with your supervisor, then discuss your concerns with your supervisor or seek advice from the support structure that your department has in place for supporting students. This could involve, for example, talking to an advisor (or other identified person) allocated to mentor you during your programme of study.

1.4.2 Working as part of a research group

Research groups are made up of people working on different projects within a particular topic area or on different aspects of the same project. These groups typically consist of PhD and Master's students, postdoctoral research fellows, and technical staff, and are headed by a team leader (also termed the principal investigator or supervisor).

When you first enter a research team, it is important that you learn the ground rules. The following are the types of information you should know. What are the routine jobs and how are they divided amongst the group? Which resources are shared by the group members and which are for personal use? What is the procedure for ordering consumables and booking equipment? Which areas of the lab are for common use and therefore should be cleaned up after use? By contributing to routine laboratory or group duties and by working in a way that does not damage or contaminate someone else's work, you will establish a reputation for being a responsible member of the group. This will also minimize the possibility of tensions arising between you and other group members.

You should also understand the roles of each group member. For example, if there is a senior postdoctoral research fellow in the group, s/he may be responsible for overseeing the daily activities of the more junior researchers or there may be a designated individual for overseeing the booking system of particular equipment. Understanding the roles and responsibilities of each group member will help you respect the role of others and assist you in establishing your role within the group.

In addition, find out the particular area each member in the team is working on (attending research group meetings (see section 1.4.3) will help you learn about the projects

of other group members). This will help you to see how your work fits in with the wider group and you will know who to approach for advice and information when you require it.

You should also understand the culture of the group. In most research groups, each member works on an independent project but cooperates with others in sharing what s/he knows with other members of the group (and with different research groups within the same department or institution). Sharing of information can include recommending literature to read, sharing protocol information, technical expertise, and helping in the interpretation of data. This cooperation between group members is important as it increases research output. Team members can also collaborate with each other on projects (and with other researchers in different groups or institutions) to work on aspects of the same project. Team work can raise complex issues around ownership of data, authorship, and acknowledgement of contributions made by others. These issues are discussed in Chapter 3 as part of the ethics of communication.

On the whole, working as part of a research team is an enjoyable experience and provides you with a support network of like-minded colleagues with whom to share information and experiences. Of course, there can be instances when friction arises between group members. Friction could arise, for example, if a highly competitive member of the group is less willing to share information, or a member fails to contribute equally in routine laboratory duties, or the contributions of a member to a particular project are not acknowledged. Conflict between group members will undermine the effectiveness of the group and it is therefore important that any problems are resolved quickly. It may be possible to resolve some types of conflict by the group members working through the issues themselves. Other types of conflict may require intervention from the team leader. Do not be afraid to ask for help if you are experiencing a situation you have difficulty in handling.

1.4.3 Research group meetings

Most research groups meet periodically, usually weekly, to report their latest research findings to the rest of the group. There are many advantages to the group meeting. One is that it will keep the team leader informed of your work. The other is that in order to present your findings to the rest of the group you will need to analyse and interpret your data, which will help you understand the data and plan subsequent experiments. In addition, your work will benefit from the input of others in the team who will ask you questions about your experimental strategy and the results generated. This will assist with troubleshooting experiments if you are experiencing any difficulties with protocols. A further advantage of the meetings is that you will begin to develop your presentation skills and your ability to receive and give constructive criticism. These skills are a necessary part of presenting your work at scientific conferences (Chapters 13 and 14) and when defending your work at a viva (Chapter 12).

Discussions at research group meetings can be lively and informative. To benefit fully, be prepared to present your latest data and take an active interest in the work of other members of your group. Take your raw and analysed data with you to the meeting and be

prepared to describe and explain your findings. Before the meeting, anticipate the questions you may be asked and think about what your responses could be.

At the meeting, you should expect your group members and supervisor(s) to ask you critical question about your work. The aim will be to establish whether you have conducted the work rigorously and generated data of a high quality. This critical approach to questioning is an essential part of evaluating scientific literature (described in Chapter 6) and is intended to improve the understanding and quality of your work. Therefore, do not become defensive when your work is subjected to critical scrutiny by your peers and supervisor. Instead, listen carefully to the questions asked and provide well-thought-out and reasoned responses. If you do not know the answer to a particular question, then it is entirely acceptable to admit you don't know. However, your inability to answer questions should not be a consequence of poor preparation or a careless attitude towards your work. Overall, you should demonstrate to your supervisor (and to the team as a whole) that you have made an attempt to understand your work and considered what the next stages of your experiments will be.

When giving feedback to your peers on their work, be constructive. This means identifying both the negative and positive aspects of the work and, where the work is weak, outlining the evidence that supports your opinion. The feedback is more likely to be received positively if it is given in this fair and objective manner. Remember, the aim is to help others improve on their work and this is only possible if the feedback is honest and the environment in which it is delivered, supportive.

References

Buzan, T. (1991). *The mind map book*. Penguin, New York.

CSE (2006). *Scientific style and format: the CSE manual for authors, editors, and publishers,* 7th edn. Council of Science Editors in cooperation with The Rockefeller University Press, Reston, VA.

Pears, R. and Shields, G. (2005). *Cite them right: the essential guide to referencing and plagiarism*. Pear Tree Books, Newcastle upon Tyne.