Want to learn how to present your research successfully? This practical guide for students and postdocs offers a unique step-by-step approach to help you avoid the worst, yet most common, mistakes in biology communication. Covering irritants such as sins of ambiguity, circumlocution, inconsistency, vagueness and verbosity, misuse of words and quantitative matters, it also provides guidance to design your next piece of work effectively. Learn how to write scientific articles and get them published, prepare posters and talks that will capture your audience and develop a critical attitude towards your own work as well as that of your colleagues. With numerous practical examples, comparisons among disciplines, valuable tips and real-life anecdotes, this must-read guide will be a valuable resource for both new graduate students and their supervisors.

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Contents

Preface  page xi

PART I  Basics

1. Writing a scientific article and getting it published  3
   The standard scientific article  4
   Title  7
   Summary or abstract or (rarely) synopsis, and keywords  10
   Symbols and abbreviations  12
   Introduction  12
   Materials, study area, and methods  16
   Results  18
   Discussion  21
   Conclusions  23
   Acknowledg(e)ments  23
   References (or literature cited)  24
   Tables and figures  25
   Supplementary materials  26
   Latin names of organisms  26
   What journal should I choose, and how many articles should I write?  28
   How long does it take to write and publish an article?  37
CONTENTS

vi

Some advice 39
  After choosing a target journal, and up to the first public
draft 39
  Revision of the first public draft 44
  Submission to your target journal 45
The editor and the publishing process 47
The editor’s duties 53
Proof correcting 54
Intellectual property: copyright and patents 58
The digital electronic future 62

2. Speaking about your work 69
  Writing a summary 70
  Preparing what to say 70
  Visual aids 73
    Slide order and design 74
  Practising and refining 80
  On the day but before your talk 81
  The performance itself 82

3. Making and displaying a scientific poster 87
  The title and summary 88
  Preparing the poster content 89
  Designing and laying out the poster 92
  Before leaving for the meeting 97
  Setting up and tending the poster 98

4. Scientific authorship 101
  How many authors does it take to write an article? 101
  Who qualifies as an author? 107

PART II Improving

5. Style in writing 119
  The arrangement of ideas and words 124
  ‘Proper words in proper places’ 125
    Guidelines 128
CONTENTS

Punctuation and typographic details: the journal’s rules 135

Punctuation 136
Punctuation that affects structure: comma, semicolon, colon, and stop 137
The apostrophe 139
Hyphens and dashes 140
Enclosures 142
Footnotes, endnotes, and other jumps 143
Prefixes to people’s names 144
Abbreviations and italicised words 145
Dates and clock time 146
Typefaces and fonts 147
Special characters 152

6. Frequently misused words and technical terms 157

Frequently misused words 158
Frequently misunderstood technical terms 177

7. Quantitative matters 189

Numerical values 189
Symbols 192
Units and multipliers 193
Dimensions and equations 200
Dimensions must balance 200
Combining units and dimensions 201
‘Equations’ that are not: when dimensions do not balance 202
Using dimensions to decide what to do: an example 205
Expressing the name and value of a variable 206
More about dimensions 208
Dimensions of the coefficients in a polynomial 208
Dimensions other than [M], [L], [T] 209
Inferring the dimensions of a parameter 210

8. Managing error 211

The sorts of error 212
Mistakes 213
CONTENTS

9. Data interrelations 243
   Interpreting P values 243
   Are two means significantly different? 246
   Correlation, regression, and functional analysis 250
      Correlation 250
      Regression 251
      Functional relations and analysis 253
   A better way? 257
   ‘Significance’ and ‘importance’ 260
   ‘Common sense’ 260

10. Tables and figures: the evidence 261
   Tables 263
      Table heading 265
      Table layout 266
      Table furniture 270
      Data items in a table 271
   Figures: graphs 273
      Design: general 275
      Arrangement of multiple graphs 278
      Design elements 278
      Types of graph 290
   Figures: other line diagrams 294
   Figures: images 294
      What image manipulations are acceptable? 294
## Appendix to Chapter 10: colour modes, resolution, and file formats

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour modes</td>
<td>297</td>
</tr>
<tr>
<td>File formats and image resolution</td>
<td>300</td>
</tr>
</tbody>
</table>

## 11. Citing and referencing

### Citations

- Author-date system
- Citation-number and reference-number system

### References

- Abbreviated titles of journals

## ENVOI

### Bibliography and references

- Bibliography
- References

### Index

- 327
This book grew out of a repeated need, as graduate supervisor, referee (reviewer), and editor, to comment about irritants such as:

- the sins of ambiguity, circumlocution, confusion, inconsistency, vagueness and verbosity;
- misuse (or distractingly poor use) of words such as content, decimate, impact, level, light intensity, paradigm, parameter, and ratio;
- quantitative matters such as equations that didn’t equate, ludicrous precision of numerical values, misleading bar charts, graphs with inaccurate axis labels, nonsensical ‘log scales’, and undefined error bars;
- statistics-related misuses such as the difference between standard deviation and standard error, statistical fishing expeditions, the meaning of a ‘P-value’, and confusion among correlation, regression, and functional relations;
- incomprehensible talks and unattractive, or even repellent, posters.

What follows includes my gleanings during four decades as a university biologist: the things I wish now that I had known when I started out. It is mostly about broadcasting for the first time the results of original work in the biosciences (the inelegant umbrella term ‘bioscience’ embraces all the disciplines that work on living
things, including biochemistry, molecular biology, genetics, microbiology, biology, botany, zoology, anatomy, morphology, physiology, ecology, and applications in, for example, medicine, psychology, and soil science. This book is intended mainly for those beginning a career in bioscience research. If you are such an apprentice or journeyman then I hope that you learn from the mistakes I made at your age. Established bioscientists may also find things to interest them.

Some of what follows is elementary and you will know it already (but your colleagues may not). You will also find less familiar matter, some of it difficult to locate and some original. Knowledge about topics such as significant digits and the combination of errors is rare among bioscientists. The text contains sufficient detail for you to try to understand why these things are as they are. I also include more about the basis of simple statistics than you might expect because this is an area frequently criticised by editors and referees. Some of this will be of more help in designing your next bit of work than in reporting that already done. You will not find anything about grant applications, or how to seek approval from an ethics committee, or literature searching, or making a risk assessment, or journal clubs, or networking, or the need to keep wide interests, or any of the other activities that may contribute to a career in science.

Many of the examples come from the ecological end of the molecular-to-ecological range of the biosciences because that is where my research has been, but most of the principles they illustrate apply across the whole of the biological (and often other) sciences. Some examples are from fields outside bioscience in the hope that you may more easily concentrate on the principle they illustrate rather than the content. Yet others I have invented or modified from the original source.

In many places I have used a didactic (instructional) – or even imperative (commanding) – tone to save space and your time, and have assumed a ‘typical’ journal or scientific meeting. Yet many of the topics are more complex than I describe, or are contentious, or differ from subject to subject (biochemistry to ecology), journal to
journal, or meeting to meeting. Science publishing is in ferment, so some things may be out of date or irrelevant in your particular field, and many of the views are personal. You may well disagree with them. Good, for that is the high road to enlightenment. Presenting bioscience research is an art and, as with any art, you improve with practice, thought, and discussion. I hope to stimulate in you a critical attitude to the writing, speaking, and posters of other people as well as to your own.

A didactic approach may easily result in lists and a cookbook: ‘(1) Do this, then (2) do that.’ This is the style of most instrument manuals and many books about scientific writing. My experience has been that one uses an instrument more effectively if one understands how it works, and why things should be done, and which of them must be done in order or with all possible care, and which are less critical. So in this book I have included explanations, discussion, and a good deal of background and parenthetic matter in the belief that the more you know and understand the better your own reporting will be.

I experiment with three unusual features. The first concerns parenthetic material.

Footnotes are a nuisance; endnotes are worse (Chapter 5). I therefore use indented panels like this one to contain parenthetic material that is cued by superscript geometric shapes ▶, ●, ■, and so on in the immediately preceding paragraph. Solid geometric shapes are easier to return to than letters or special typographic symbols such as ‘§’.

Second, where a figure contains more than one independent graph the conventional order is from the top left as if reading text. But in this book the graphs are usually ordered from the lower left, across, then upper left and across. This puts the first part of the explanatory caption (below the figure) nearest to the graph that it concerns, and orders whole figures in the same way that one reads a single graph (start at the lower left corner).
And third, to shift your focus occasionally from reading to reflecting I have included a few questions in boxes (this one is borrowed from Lewis Carroll’s ‘The Walrus and the Carpenter’):

**QUESTION:**
Why is the sea boiling hot, and do pigs have wings?

**IMPORTANT NOTE** for those struggling to present their first few articles, talks, or posters, and anxious to know the basics. The book is in two parts (Figure P.1 below). **PART I: BASICS** contains four chapters. One of the first three (‘1. Writing and publishing an article’, ‘2. Speaking about your work’, and ‘3. Presenting a poster’) should be sufficient to help you to get started: one learns best by doing. Chapter 4 (‘Scientific authorship’) discusses the rewards and some of the hazards of authorship.


I recall with gratitude the late Cyril Mummery who set me on this road and the late Tony Fogg who encouraged me along it.

I thank, and so may you, those who have helped me: Brian Moss and Dick Webster for constructive criticism (and uncounted improvements) throughout the book; Alexandra George, Peter Grubb, Steve Ketteridge, Andrew Leitch, Richard Nichols, Håkan Rydin, and Tony Walsby for equally helpful improvements to one or more chapters; Alan Crowden for encouragement in finding a publisher; and at Cambridge University Press, Vania Cunha, Dominic Lewis, Ilia Tassistro, and especially Anna Hodson, for easing the book into print.

Finally, I thank all the individuals in that shadowy muttering crowd of those whose ideas or practices I have absorbed without remembering or even knowing the source. May they forgive me.

The defects that remain are, of course, my own. I welcome corrections and other amendments.
FIGURE P.1 Structure of this book. Chapters in Part II contain detail useful for the ones in Part I.