MACMILLAN
SCIENCE COMMUNICATION

Foundation Scientific Writing and Publishing Workshop

A training course provided by **Macmillan Science Communication** in collaboration with:

About Macmillan Science Communication

- Sister division of Nature Publishing Group (NPG)
- Exclusive access to the editorial, design and production expertise of NPG, which includes *Nature* and *Scientific American*
- Custom science publishing, communication, consultancy, and training solutions, as well as author services

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Dr. Myles Axton

- Chief Editor, *Nature Genetics*
- PhD from Imperial College London
- Research positions at Dundee University and MIT's Whitehead Institute
- Editorial roles at Nature Publishing Group since 2003

Trainers

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Dr. Wayne Peng (彭贤巍 博士)

- Formerly an Associate Editor, *Nature*
- Over 10 years in research
- Worked at Nature Publishing Group since 2008
- PhD in genetics and developmental biology from Columbia University, USA
- BSc, MSc from Taiwan National University

Workshop content

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Planning your paper
Outline
Motivation
Content
Novelty

Writing
Sentences
Paragraphs
Flow of text
Style of writing

Elements of a paper
Abstracts and titles
Introduction
Methods
Results
Discussion and conclusions

Submission and publication
Choosing a journal
Submitting your paper
Editorial processes
Peer review
Getting accepted
Appeals

Ethics in scientific publishing
Plagiarism
Fabrication
References and citations

Agenda

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9am to 12.45pm

- Welcome notes and introductions
- Taking research from bench to paper
- Creating an outline and preparing to write
- Graphs and Figures
- Constructing sentences
- Elements of Writing Style
- Titles and abstracts

1.30pm to 5.45pm

- Writing an enticing introduction
- Presenting and discussing the results and concluding your paper
- Authorship
- Editing, revising and finalising
- Choosing and submitting to an appropriate journal
- The editorial processes and peer-review
- Journal decisions
- Plagiarism and other ethical issues

Course objectives

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By the end of the course you should:

- ✓ Understand successful science writing techniques
- ✓ Know how to organize, outline and plan papers
- ✓ Be able to construct effective sentences and paragraphs
- ✓ Understand the elements of a paper and what each element should contain
- ✓ Understand journal editorial processes and the peer-review system
- ✓ Know how to submit and publish papers
- ✓ Have an awareness of ethical issues associated with science publishing
- ✓ Have an insight into what it takes to get published in top-ranked journals

Handout material

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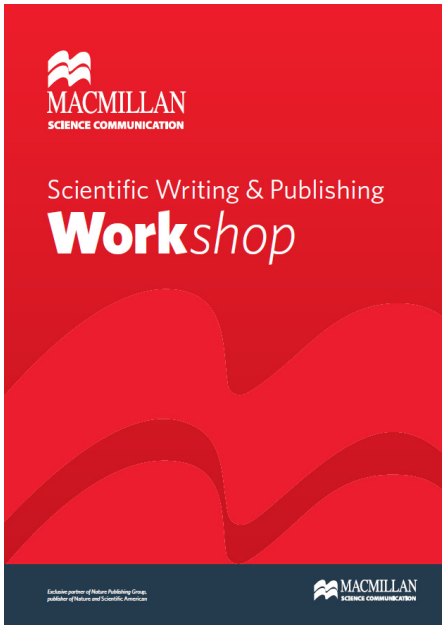
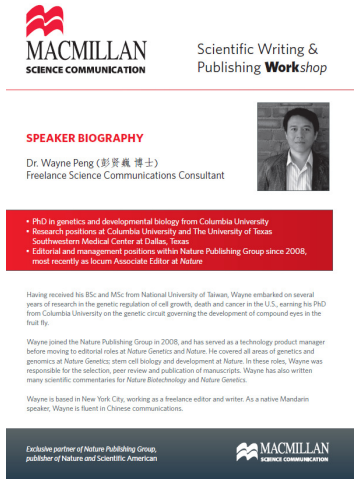
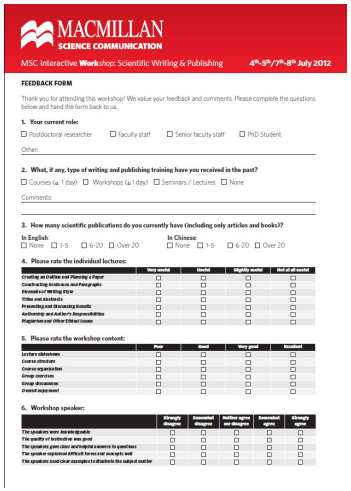


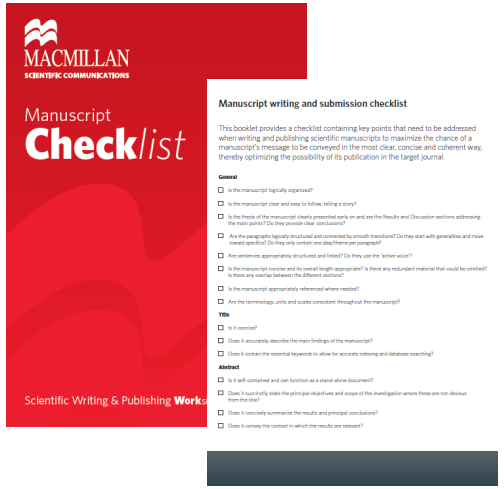
Folders



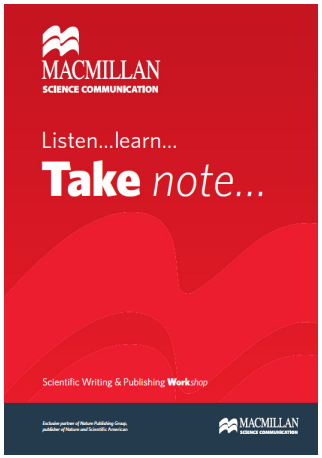
Editor biographies



Feedback forms



A recent copy of *Nature*



Notepads & USB pens

- Manuscript checklist
- How to get Published in *Nature*
- Further information flyer
- Certificate

Feedback

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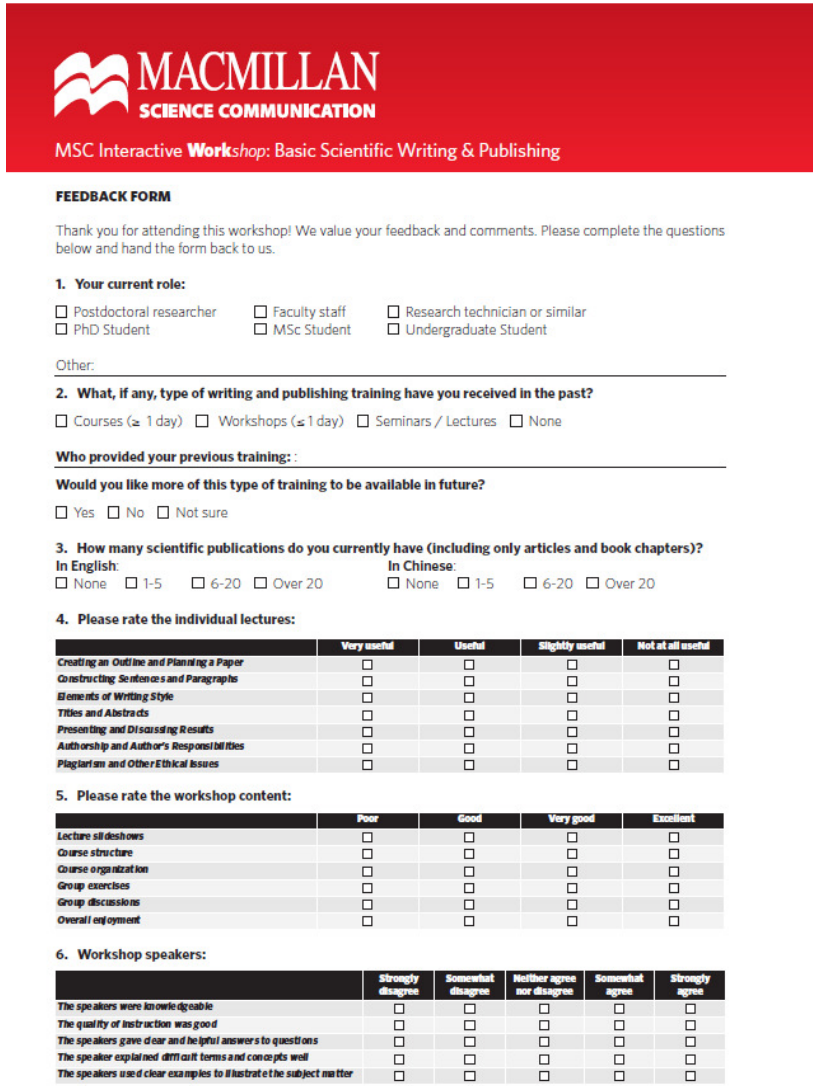
- Please take a few minutes to complete this feedback form at the end of the workshop
- Hand it back to the trainers



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MSC Interactive **Work***shop*: Basic Scientific Writing & Publishing

FEEDBACK FORM

Thank you for attending this workshop! We value your feedback and comments. Please complete the questions below and hand the form back to us.

1. Your current role:

☐ Postdoctoral researcher ☐ Faculty staff ☐ Research technician or similar
☐ PhD Student ☐ MSc Student ☐ Undergraduate Student

Other:

2. What, if any, type of writing and publishing training have you received in the past?

☐ Courses (≥ 1 day) ☐ Workshops (≤ 1 day) ☐ Seminars / Lectures ☐ None

Who provided your previous training: :

Would you like more of this type of training to be available in future?

☐ Yes ☐ No ☐ Not sure

3. How many scientific publications do you currently have (including only articles and book chapters)?

In English: ☐ None ☐ 1-5 ☐ 6-20 ☐ Over 20

In Chinese: ☐ None ☐ 1-5 ☐ 6-20 ☐ Over 20

4. Please rate the individual lectures:

	Very useful	Useful	Slightly useful	Not at all useful
Creating an Outline and Planning a Paper	☐	☐	☐	☐
Constructing Sentences and Paragraphs	☐	☐	☐	☐
Elements of Writing Style	☐	☐	☐	☐
Titles and Abstracts	☐	☐	☐	☐
Presenting and Discussing Results	☐	☐	☐	☐
Authorship and Author's Responsibilities	☐	☐	☐	☐
Plagiarism and Other Ethical Issues	☐	☐	☐	☐

5. Please rate the workshop content:

	Poor	Good	Very good	Excellent
Lecture slideshows	☐	☐	☐	☐
Course structure	☐	☐	☐	☐
Course organization	☐	☐	☐	☐
Group exercises	☐	☐	☐	☐
Group discussions	☐	☐	☐	☐
Overall enjoyment	☐	☐	☐	☐

6. Workshop speakers:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
The speakers were knowledgeable	☐	☐	☐	☐	☐
The quality of instruction was good	☐	☐	☐	☐	☐
The speakers gave clear and helpful answers to questions	☐	☐	☐	☐	☐
The speaker explained difficult terms and concepts well	☐	☐	☐	☐	☐
The speakers used clear examples to illustrate the subject matter	☐	☐	☐	☐	☐

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Taking Research from Bench to Paper

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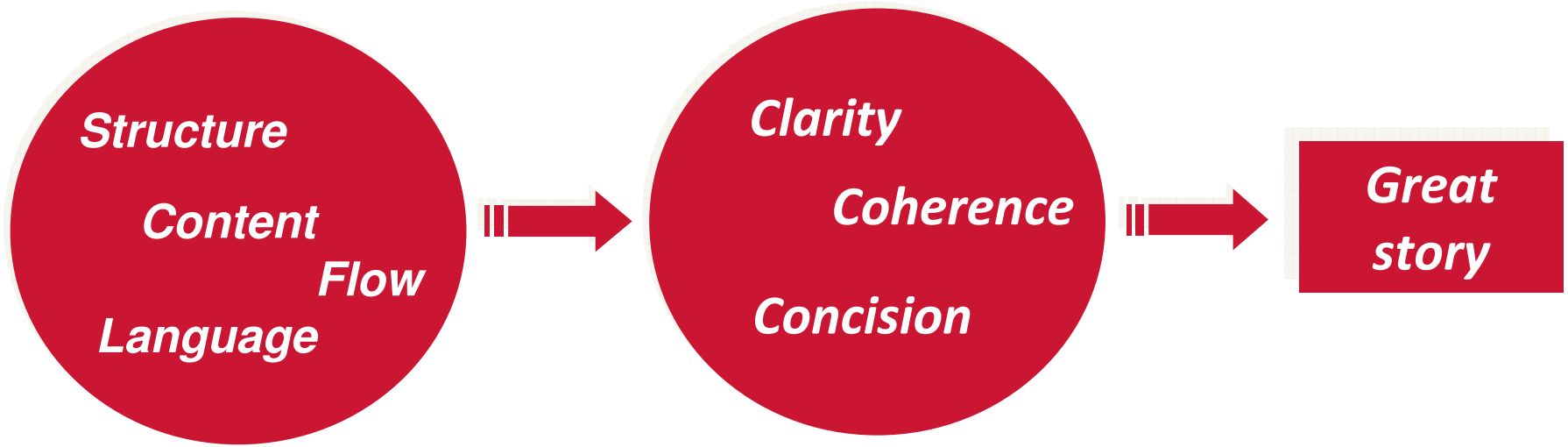
Question: What makes a great paper?

Answer: Great papers tell a story!



How to write scientific papers

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Start early

Steps to a great paper

- Thoughtful research
- Thorough preparation
- Logical presentation

"Nothing beats a comprehensive, thought-out experiment. Do that upfront and your writing will come much more easily."

Dr Mark Blumberg
Neuroscientist at University of Iowa and editor-in-chief of *Behavioural Neuroscience*

Writing and the research cycle

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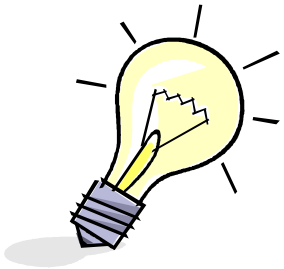
Idea



- Review and research previous work
- Identify the major questions
- Prepare a starting hypothesis
- Decide your approach: prove, disprove or provide supporting evidence

- Design your methodology
- Establish controls
- Collect and record your data

Analyse and interpret

Keep the paper in mind throughout

Writing and the research cycle

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- Make frequent notes — great raw material
- Keep a record of pertinent literature
- Write methods while still fresh
- Think of the project as a tentative paper title
- Read lots of papers and learn from them

Think ahead: Where to submit

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- The publishing cycle starts with the experimental results and their importance — think about possible journals to submit to
- For publication in high-impact journals, you need to be careful not to publish preliminary results too soon
- Resist the temptation to publish quickly
- Conference presentations and preprints are usually allowed prior to journal publication
- Conference proceedings in journals or popular media such as books can be a problem
- Check and consider the rules of the journal

Preparing to write

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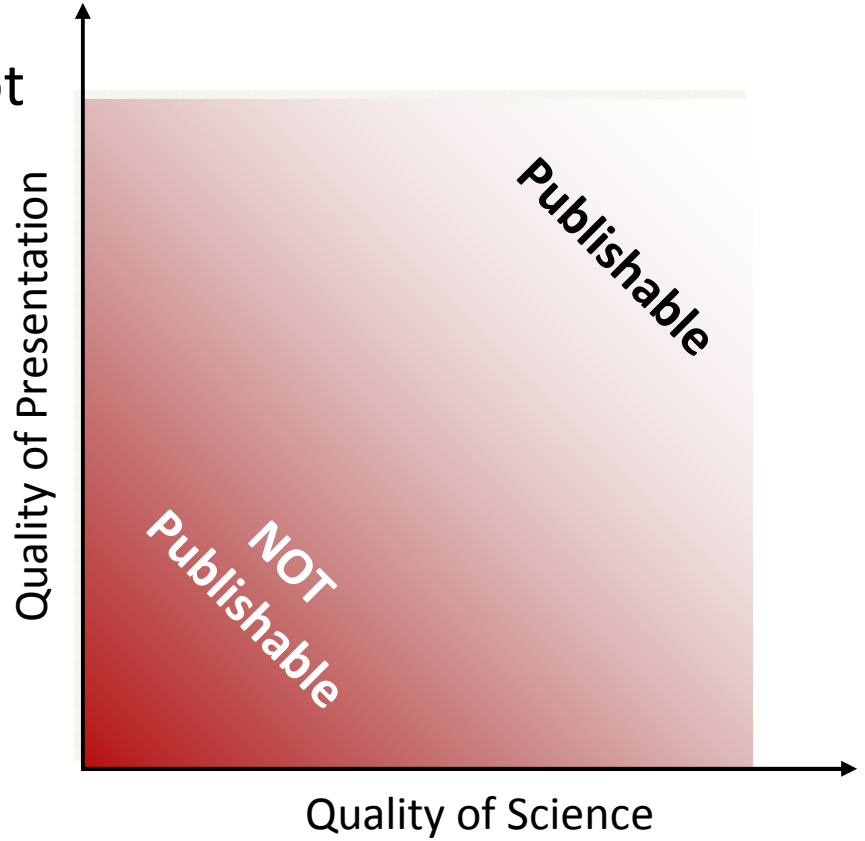
- Choose the focus of the manuscript
- Choose an audience
- What is the main message?
- Have you asked a good scientific question?
- Is the research novel/original?



Just before you write

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Analyse and interpret

- Re-evaluate all of the original data, not only the data for the publication figures
- Find out what was thought / known / done before this work? Re-check the literature
- Determine the impact of the new data. Do they change current thinking, or do they support existing ideas? Do they open new avenues of research?

Consultation and collaboration

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- Know who the key people are in your field: meet and talk with them (scientists are collegial — make use of this!)
- Develop collaborations with key people who you develop a good rapport with: start small and grow
- Identify areas of weakness that need to be addressed and consult on the best ways to address them

Novelty and conceptual advance

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- Anything that has not been published before is novel, but not all novel findings are considered interesting, or of sufficient conceptual advance, for a journal
- Different journals use different criteria to gauge the level of conceptual advance and readers' potential interest

Common types of conceptual advance

- Unexpected phenomenon
- Never before seen
- Mechanistic insight
- Technical breakthrough
- Resource value

Novelty and conceptual advance

- The **tomato genome** was sequenced for the first time and published in *Nature* (May 2012)
- This research paper stood out to the *Nature* Editor because of the additional in-depth analysis

1. It reported a new, high-quality sequence (not published before)
2. Tomatoes are a classic genetic model for fruit development and economically very important. This field is already interesting, and this study taught us more about fruit development
3. A comparative genetic analysis was carried out with a related species (the potato), shedding light on the evolutionary processes of *Solanum* and fruit development
4. With commercial applications: the creation of a phenotype resource for indexing particularly desirable tomato phenotypes has important implications in agronomy and commerce and for researchers in this field

Nature **485,** 635–641 (2012)

Novelty and conceptual advance

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In June 2012, *Nature Biotechnology* published an account of **optimised inhibitors for influenza virus using deep sequencing**. The research was comprehensive and topical, and stood out because:

1. Used cutting edge methodology: application of next-generation sequencing to generate large amounts of structure-function data, and mapped far more point mutants than had been done previously.
2. The authors applied the results to improve binding affinity of two de novo–designed protein inhibitors significantly.
3. The target of the inhibitors was H1N1 influenza hemagglutinin, an important drug target.
4. Showed that the effects of individual point mutations are not additive and that combinations of mutations can improve affinity beyond what would be predicted from the effects of individual mutations.
5. Solved an inhibitor-hemagglutinin crystal structure and showed that the designed interface agrees well with the experimentally determined one.

Summary

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- Start early
- Make sure you have thoughtful research and have done thorough preparation
- Review and research previous work
- Identify the major questions
- Prepare a starting hypothesis
- Decide your approach: prove, disprove or provide supporting evidence

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Creating an Outline and Preparing to Write

Break it down

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A scientific paper must contain enough information to enable peers (the scientific community) to:

- assess observations
- repeat experiments
- evaluate intellectual processes (i.e. are the authors conclusions and interpretations valid?)

Preparing to write

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- Avoid ‘salami-slicing’
- You need to give top-tier journals the whole sausage!
- Be honest — do not ignore data that do not fit your hypothesis
- Be selective — include the necessary data to support the main claims, but do not overcrowd the paper

“Some people don’t appreciate the fact that [having] a lot of weak data does not make up for having less, but more powerful data.”

Dr Eileen White, Associate Director of the Cancer Institute of New Jersey and a Senior Editor of *Cancer Prevention*

Key questions for *content*

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These questions will help to work out the **content** of your paper and how data will be presented.

- Why is the topic interesting?
- What is the broader context of your work?
- What big problems are there in the field?
- What has your work added to current knowledge?
- How did you do it?
- What is the wider impact of your work?

Key questions for *organization*

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These are some of the organizational questions, in terms of laying out the **structure** and also the way the paper is written, particularly if there is more than one person writing it.

- What questions are being addressed?
- What is the best way to present your findings?
- Which results are relevant?
- What is the appropriate length and format? Does this fit with your intended journal?
- Will this be a collaborative effort? Who will write what?

Developing an outline

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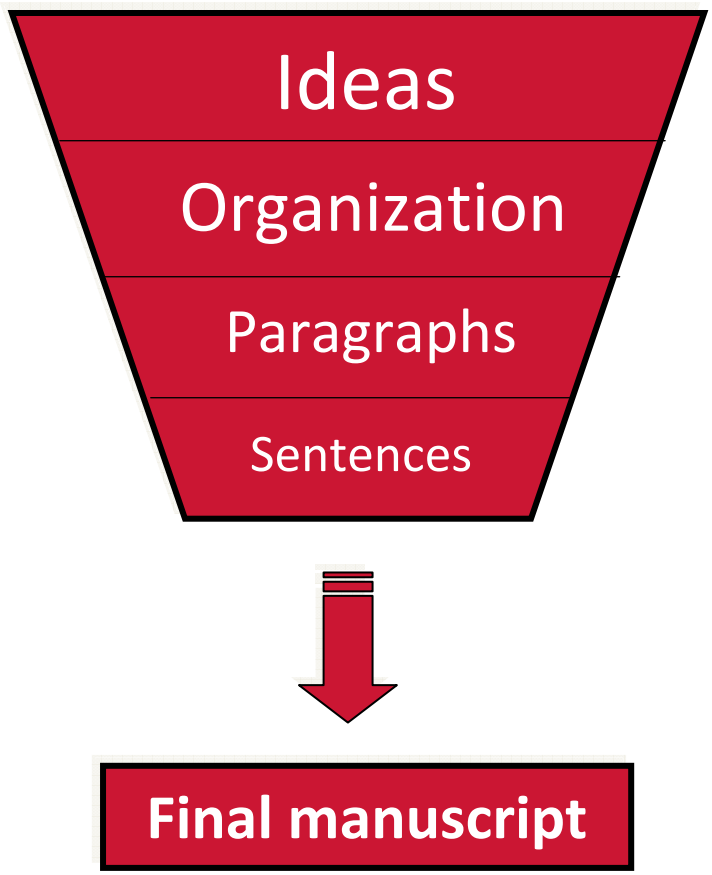
- Different scales/levels of detail
- Working from large to small scale:
  - increases efficiency
  - increases chance of presenting ideas clearly
- Good organization improves readability



Getting started

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Take these steps to help you plan

- Lay out all material for the paper
- Think about the best structure to present your data (graphs, tables, figures…)
- Develop an outline for the paper
- Select the data for figures and tables
- Design the figures and tables. They will help you in the narrative of the text
- Write rough subject headings — this will help add structure, particularly for long papers
- List all of the ideas you want to include

Plan your paper

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1. Outline
2. Main figures – the backbone of the paper
3. List of ideas you want to include
4. Subject headings

Do you have a coherent and compelling story, substantiated by the results and references?

YES

Start writing!

NO

- Revise outline
- Revise figures
- Revisit ideas
- More experiments?

Starting to write

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- Start with the results
- You don't need to finalize your paper title at the beginning — use a working title
- If you are not entirely clear about the flow of arguments, start with the introduction, and do the abstract at the end

Hints

1. Try to avoid the 'standard' headings. Write informative headings/subheadings to guide the reader
2. If the results are complex, results and discussion sections may be combined

Starting to write

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“ The secret of getting ahead is getting started. The secret of getting started is breaking your complex overwhelming tasks into small manageable tasks, and then starting on the first one. ”

Mark Twain

Collaborative writing

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- Often, parts of papers are written by different people:
  e.g. for theory/experiment
- Advantage: a wider range of expertise will increase the depth and quality of a paper
- Disadvantage: it can be challenging to achieve a common writing style, let alone join different parts for a coherent narrative

Collaborative writing: Tips

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- Establish a project leader and the procedure to resolve conflicts
- Write down procedures and responsibilities
- Establish a complete task list and assign who does what
- Determine which tasks depend on the completion of other tasks
- Create a realistic schedule
- Discuss an overall narrative and style to ensure a consistent format
- Individual sections need to be reviewed by all authors
- Double-check technical accuracy

Source: Mayfield, McGraw-Hill Companies Inc.

Summary

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- Create an outline by creating the main figures and a list of ideas you want to include
- Create a realistic schedule if working collaboratively
- Get started!

To finish on a quote

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"The formulation of a problem is often more essential than its solution…"

"To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science."

Albert Einstein and Leopold Infeld (1938)

Questions

Any questions?

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Graphs, Figures and Tables

Some background

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- Figures and tables were not commonly used in the past: they were too difficult to print, and people trusted the authors' description of their research results
- For example, Einstein’s paper on special relativity contained no figures at all…

Some background

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equipment, and to Dr. G. E. R. Deacon and the captain and officers of R.R.S. *Discovery II* for their part in making the observations.

[1] Young, F. B., Gerrard, H., and Jevons, W., *Phil. Mag.*, **40**, 149 (1920).
[2] Longuet-Higgins, M. S., *Mon. Not. Roy. Astro. Soc., Geophys. Supp.*, **5**, 285 (1949).
[3] Von Arx, W. S., Woods Hole Papers in Phys. Oceanog. Meteor., **11** (3) (1950).
[4] Ekman, V. W., *Arkiv. Mat. Astron. Fysik. (Stockholm)*, **2** (11) (1905).

MOLECULAR STRUCTURE OF NUCLEIC ACIDS

A Structure for Deoxyribose Nucleic Acid

WE wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.). This structure has novel features which are of considerable biological interest.

A structure for nucleic acid has already been proposed by Pauling and Corey[1]. They kindly made their manuscript available to us in advance of publication. Their model consists of three intertwined chains, with the phosphates near the fibre axis, and the bases on the outside. In our opinion, this structure is unsatisfactory for two reasons: (1) We believe that the material which gives the X-ray diagrams is the salt, not the free acid. Without the acidic hydrogen atoms it is not clear what forces would hold the structure together, especially as the negatively charged phosphates near the axis will repel each other. (2) Some of the van der Waals distances appear to be too small.

Another three-chain structure has also been suggested by Fraser (in the press). In his model the phosphates are on the outside and the bases on the inside, linked together by hydrogen bonds. This structure as described is rather ill-defined, and for this reason we shall not comment on it.

We wish to put forward a radically different structure for the salt of deoxyribose nucleic acid. This structure has two helical chains each coiled round the same axis (see diagram). We have made the usual chemical assumptions, namely, that each chain consists of phosphate diester groups joining β-D-deoxyribofuranose residues with 3′,5′ linkages. The two chains (but not their bases) are related by a dyad perpendicular to the fibre axis. Both chains follow right-handed helices, but owing to the dyad the sequences of the atoms in the two chains run in opposite directions. Each chain loosely resembles Furberg's[2] model No. 1; that is, the bases are on the inside of the helix and the phosphates on the outside. The configuration of the sugar and the atoms near it is close to Furberg's 'standard configuration', the sugar being roughly perpendicular to the attached base. There is a residue on each chain every 3·4 A. in the *z*-direction. We have assumed an angle of 36° between adjacent residues in the same chain, so that the structure repeats after 10 residues on each chain, that is, after 34 A. The distance of a phosphorus atom from the fibre axis is 10 A. As the phosphates are on the outside, cations have easy access to them.

This figure is purely diagrammatic. The two ribbons symbolize the two phosphate–sugar chains, and the joining rods the pairs of bases holding the chains together. The central line marks the fibre axis

The structure is an open one, and its water content is rather high. At lower water contents we would expect the bases to tilt so that the structure could become more compact.

The novel feature of the structure is the manner in which the two chains are held together by the purine and pyrimidine bases. The planes of the bases are perpendicular to the fibre axis. They are joined together in pairs, a single base from one chain being hydrogen-bonded to a single base from the other chain, so that the two lie side by side with identical *z*-co-ordinates. One of the pair must be a purine and the other a pyrimidine for bonding to occur. The hydrogen bonds are made as follows: purine position 1 to pyrimidine position 1; purine position 6 to pyrimidine position 6.

If it is assumed that the bases only occur in the structure in the most plausible tautomeric forms (that is, with the keto rather than the enol configurations) it is found that only specific pairs of bases can bond together. These pairs are: adenine (purine) with thymine (pyrimidine), and guanine (purine) with cytosine (pyrimidine).

In other words, if an adenine forms one member of a pair, on either chain, then on these assumptions the other member must be thymine; similarly for guanine and cytosine. The sequence of bases on a single chain does not appear to be restricted in any way. However, if only specific pairs of bases can be formed, it follows that if the sequence of bases on one chain is given, then the sequence on the other chain is automatically determined.

It has been found experimentally[3,4] that the ratio of the amounts of adenine to thymine, and the ratio of guanine to cytosine, are always very close to unity for deoxyribose nucleic acid.

It is probably impossible to build this structure with a ribose sugar in place of the deoxyribose, as the extra oxygen atom would make too close a van der Waals contact.

The previously published X-ray data[5,6] on deoxyribose nucleic acid are insufficient for a rigorous test of our structure. So far as we can tell, it is roughly compatible with the experimental data, but it must be regarded as unproved until it has been checked against more exact results. Some of these are given in the following communications. We were not aware of the details of the results presented there when we devised our structure, which rests mainly though not entirely on published experimental data and stereochemical arguments.

It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material.

Full details of the structure, including the conditions assumed in building it, together with a set of co-ordinates for the atoms, will be published elsewhere.

We are much indebted to Dr. Jerry Donohue for constant advice and criticism, especially on interatomic distances. We have also been stimulated by a knowledge of the general nature of the unpublished experimental results and ideas of Dr. M. H. F. Wilkins, Dr. R. E. Franklin and their co-workers at King's College, London. One of us (J. D. W.) has been aided by a fellowship from the National Foundation for Infantile Paralysis.

J. D. Watson
F. H. C. Crick

Medical Research Council Unit for the Study of the Molecular Structure of Biological Systems,
Cavendish Laboratory, Cambridge.
April 2.

[1] Pauling, L., and Corey, R. B., *Nature*, **171**, 346 (1953); *Proc. U.S. Nat. Acad. Sci.*, **39**, 84 (1953).
[2] Furberg, S., *Acta Chem. Scand.*, **6**, 634 (1952).
[3] Chargaff, E., for references see Zamenhof, S., Brawerman, G., and Chargaff, E., *Biochim. et Biophys. Acta*, **9**, 402 (1952).
[4] Wyatt, G. R., *J. Gen. Physiol.*, **36**, 201 (1952).
[5] Astbury, W. T., Symp. Soc. Exp. Biol. 1, Nucleic Acid, 66 (Camb. Univ. Press, 1947).
[6] Wilkins, M. H. F., and Randall, J. T., *Biochim. et Biophys. Acta*, **10**, 192 (1953).

- …and Watson and Crick's famous 1953 paper in *Nature* had only one simple diagram!
- Nowadays, modern technology makes printing figures easy (but we still have to trust the correctness of the data)

Figures should…

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- present data in an efficient way. It is imperative that your figures and graphs are interpreted correctly
- be clear and easily understandable
- have clearly labelled error bars where possible (include data on the error bars in the figure legend)
- appear in a logical order
- be minimally processed (e.g. addition of arrows to a blot) or, if unavoidable, processing should conform to community standards

Figures

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- Authors should retain the original, unprocessed data and metadata
- Editors and peer reviewers may ask for these, so make sure you have them to hand if not originally provided

http://www.nature.com/authors/policies/image.html

Examples of good and bad figures

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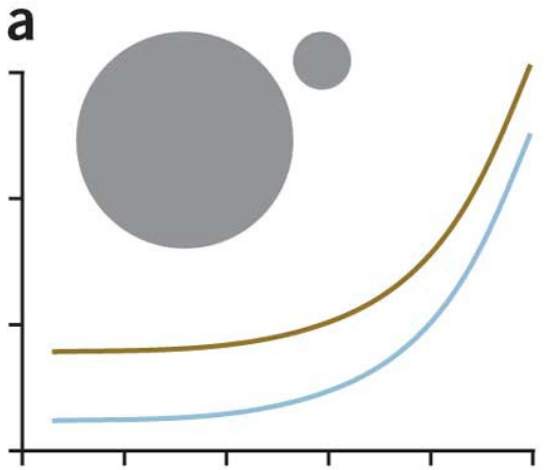
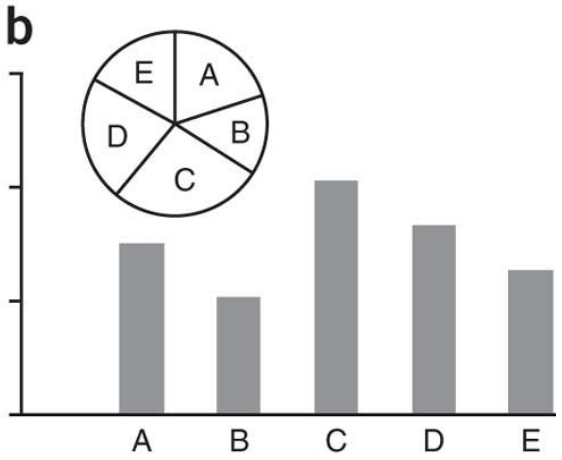
(a) It's difficult to distinguish the differences between the two curves on the right. It's also difficult to accurately judge the relative area differences between the two circles (one is 14-fold larger).



(b) On this pie chart, it's also difficult to judge how big each 'slice' is, but the bar chart is much more effective at communicating this



Nature Methods **7,** 665 (2010)

Figures should…

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- be self-contained with their legends. Some readers just look at the figures and not the text

A good example

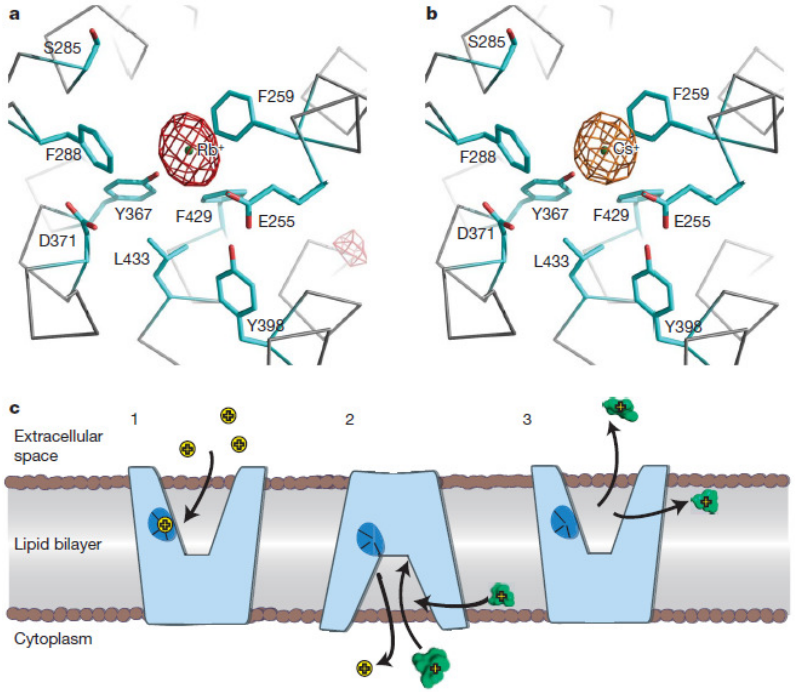


Figure 4 | The cation-binding site of NorM-VC and mechanism of transport. **a**, Cation-binding site superimposed with isomorphous difference Fourier map calculated between crystal 2 (containing Rb^+) and crystal 3 (native) (Supplementary Table 3), revealing a Rb^+ peak at 5.5σ (red mesh). **b**, A 5.0σ peak (orange mesh) revealing binding of Cs^+ in the same view as in **a**, calculated between crystal 4 (containing Cs^+) and crystal 3 (native). Stereo views are presented in Supplementary Fig. 12. **c**, Proposed transport mechanism. In the outward-facing conformation, a cation (yellow) binds at a conserved site (blue oval; step 1). Cation binding induces structural changes to the inward-facing conformation (step 2), which is competent to bind substrate (organic cation in green) from the inner membrane leaflet or cytoplasm. Substrate binding causes structural changes back to the outward-facing conformation (step 3), allowing export and cation binding.

Use legends and captions wisely

Nature **467,** 991 (2010)

Citing figures and tables

MACMILLAN SCIENCE COMMUNICATION

- Emphasize the finding when citing tables and figures in the main text

Instead of

Table 12 shows a reference gene set containing 21,001 genes for the panda.

Use

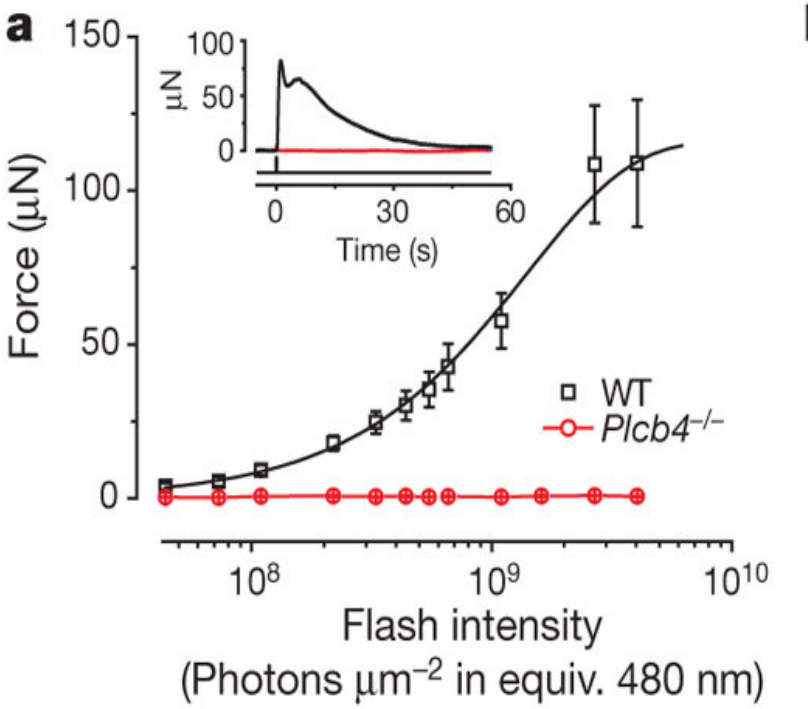
To facilitate further analysis, we […] created a reference gene set that contained 21,001 genes for the panda (Table 12).

- But be concise!

Figures: Don'ts

MACMILLAN SCIENCE COMMUNICATION

- Don’t clutter figures with too many panels
- Don’t include unnecessary figures and avoid parts (panels) in figures and tables: data presented in small tables or histograms, for instance, can generally be stated briefly in the text instead

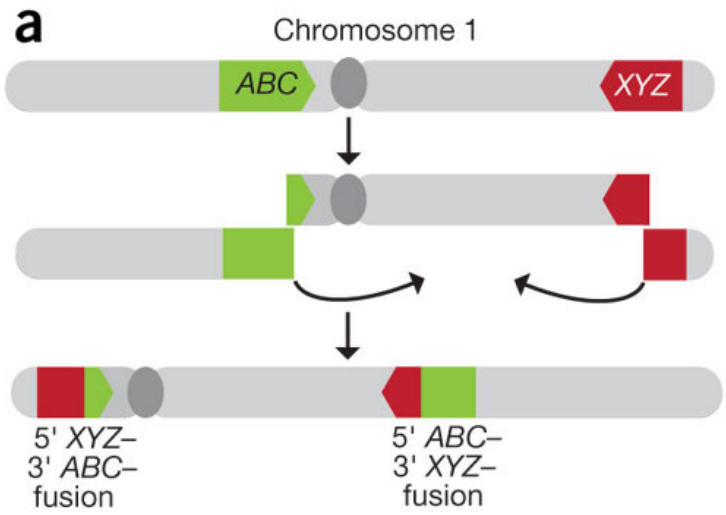


Nature **479,** 67–73 (2011)

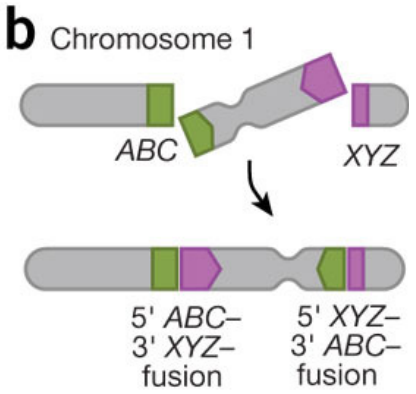
Figures

MACMILLAN SCIENCE COMMUNICATION

Keep your figures simple (but not simplistic)



An unnecessarily complicated diagram of an inversion event in two fusion genes



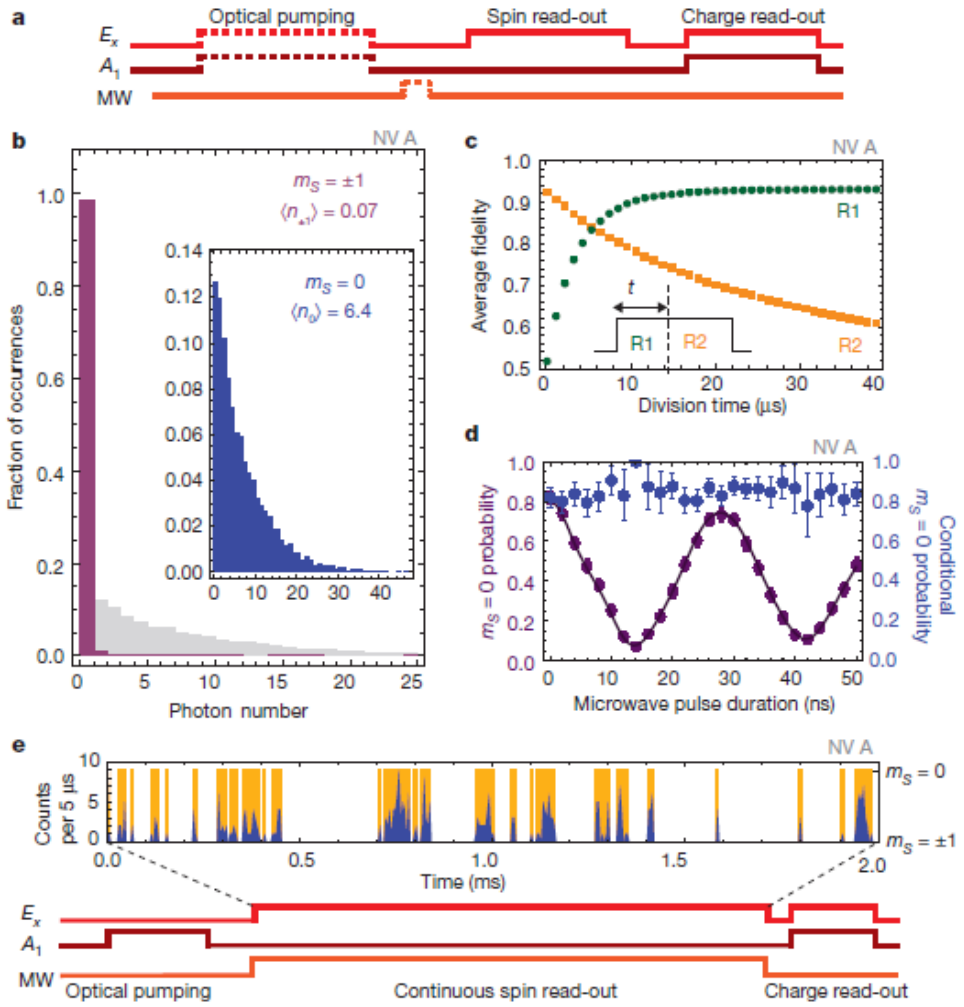
A simplified version of the same event combining steps 1 and 2 and using fewer arrows

Nature Methods **8,** 611 (2011)

Figures

MACMILLAN SCIENCE COMMUNICATION

This is probably the maximum complexity a figure should have

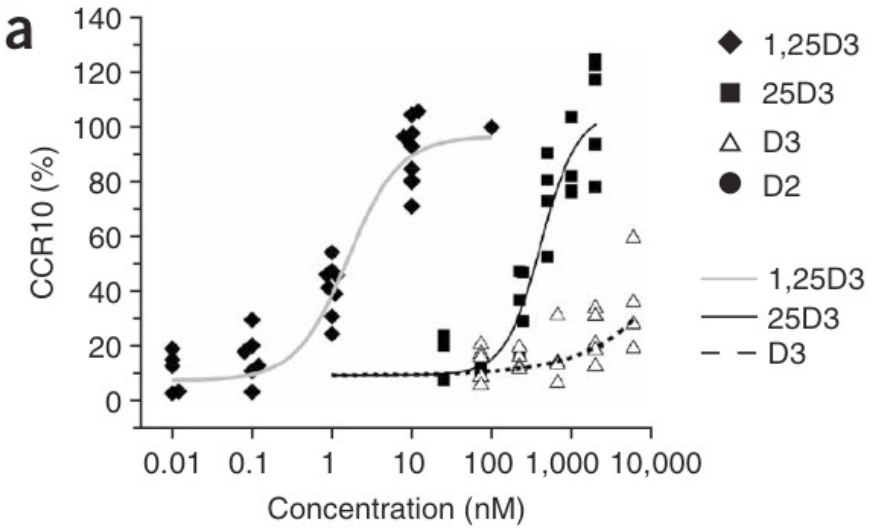


N*ature* doi:10.1038/nature10401

Figures: Statistics

MACMILLAN SCIENCE COMMUNICATION

- Show as much raw data as possible. If *n* experiments done for each data point, then show all points, rather than the average and SD
- Always define *n* and the statistical methods used



Figures: Housekeeping

MACMILLAN SCIENCE COMMUNICATION

- Prepare figures in vector graphics format (or high-definition graphics programs) for best presentation results
- Always indicate if figure used elsewhere before
- Feel free to use colour, but check that all parts of a figure can be understood even if printed black and white: use dashes to differentiate lines, not only colour

Electrophoretic gels and blots

MACMILLAN SCIENCE COMMUNICATION

Best practices

- Positive and negative controls and markers on every gel and blot
- You can conservatively crop gels for the paper: a reasonable guide, from *Nature Cell Biology*, is to retain about five bandwidths of background above and below and crop only when no essential information is removed
- Avoid splicing two gels together

http://www.nature.com/authors/policies/image.html

Summary

MACMILLAN SCIENCE COMMUNICATION

- Figures should be clear and understandable
- They should appear in a logical order
- They should be minimally processed
- Make sure they are not too cluttered
- Always define your statistical methods

Questions

Any questions?

MACMILLAN
SCIENCE COMMUNICATION

Constructing Sentences

Writing sentences

MACMILLAN SCIENCE COMMUNICATION

- This session will focus on sentences; the next session (Elements of Writing Style) shows how to string them together to create coherency and keep the reader interested
- Clarity is key in scientific writing, the aim is efficient communication of the facts
- Sentences consist of a SUBJECT, a VERB and, almost always, an OBJECT

  "The molecule bound tightly to the receptor."

- Each sentence should make a single point
- Maximum 20–25 words per sentence

General rules

MACMILLAN SCIENCE COMMUNICATION

- **The ABC of writing style**
  - Be Accurate
  - Be Brief
  - Be Clear
- **Clarity**
  - Write for your reader
  - Do not over-explain and avoid overstatement
- **Language and grammar**
  - Use simple words and avoid jargon
  - Avoid long sentences
  - Use verb tense consistently throughout the paper

Active versus passive voice

MACMILLAN SCIENCE COMMUNICATION

- Active voice

  The data show…

  - when the subject **performs** the action of the verb
  - adds action to the sentence
  - adds interest
  - makes sentences shorter

- Passive voice

  It can be seen from the data…

  - when the subject **undergoes** the action of the verb
  - use when the agent is not important
  - sometimes suitable for data and the methods section

Word order

MACMILLAN SCIENCE COMMUNICATION

Keep the subject and verb close together

Original

Extratropical cyclones with two or more warm-front-like baroclinic zones were examined.

9-word separation

Improved

We examined extratropical cyclones with two or more warm-front-like baroclinic zones.

No separation + active voice

Accuracy

MACMILLAN SCIENCE COMMUNICATION

- Avoid vague language
- Be precise

Original

Of the 16.9-fold genome coverage, the majority was from 454 sequencing by synthesis of paired and unpaired reads, with the remaining coverage from Sanger dye primer sequencing of paired reads.

Improved

Of the 16.9-fold genome coverage, 74% was from 454 sequencing by synthesis of paired and unpaired reads. Sanger dye primer sequencing of paired reads was used for the remaining 26% (Supplementary Table 1 and Supplementary Note).

Brevity

MACMILLAN SCIENCE COMMUNICATION

Use as few words as possible while retaining meaning — think economically

Original

We prepared our experiment thoroughly and the chromatography column was cooled down with great care to 4^{o}C before it was utilized.

Improved

The chromatography column was cooled to 4^{o}C before use.

Writing zeroes

MACMILLAN SCIENCE COMMUNICATION

Superfluous phrases often found in papers

- as a matter of fact
- I might add that
- it is noteworthy
- it is significant that
- it should be pointed out that
- the course of
- the fact that
- the presence of

Being concise

MACMILLAN SCIENCE COMMUNICATION

Redundancies

	Examples
(In order) to	~~In order~~ to remove the vacuum…
(already) existing	We used an ~~already~~ existing model.
(alternative) choices	We had many ~~alternative~~ choices.
at (the) present (time)	That is all that is planned at ~~the~~ present ~~time~~.
(completely) eliminate	All error sources were ~~completely~~ eliminated.
(continue to) remain	Questions ~~continue to~~ remain.
(currently) being	Experiments are ~~currently~~ being conducted.
(empty) space	We filled the ~~empty~~ space.
has been done (previously)	This has been done ~~previously~~.
(still) persists	Questions ~~still~~ persist.

Being concise

MACMILLAN SCIENCE COMMUNICATION

Reducing wordiness

at this point in time	→	**now**
at that point in time	→	**then**
has the ability to	→	**can**
has the potential to	→	**can**
in light of the fact that	→	**because**
in the event that	→	**if**
in the vicinity of	→	**near**
owing to the fact that	→	**because**
the question as to whether	→	**whether**

Being concise

MACMILLAN SCIENCE COMMUNICATION

~~At that point in time~~ **Then** we increased the temperature by 10 degrees.

Dragonflies ~~have the ability to~~ **can** fly in circles.

Silicon is attractive ~~in light of the fact that~~ **because** it is cheap and abundant.

~~In the event that~~ **If** temperatures increase, glaciers will melt.

Avoid complexity

MACMILLAN SCIENCE COMMUNICATION

- Break up sentences into segments
- Use punctuation: full stops rather than commas

Original

Whereas chimpanzees are widespread across equatorial Africa, bonobos, which have a relatively small and remote habitat, which also meant that they were the last ape species to be described, live only south of the Congo River (Fig. 1a) and are the rarest of all apes in captivity.

Improved

Whereas chimpanzees are widespread across equatorial Africa, bonobos live only south of the Congo River (Fig. 1a). As a result of their relatively small and remote habitat, bonobos were the last ape species to be described and are the rarest of all apes in captivity.

Avoid complexity

MACMILLAN SCIENCE COMMUNICATION

The object of the work was to confirm the nature of electrical breakdown of nitrogen in uniform fields at relatively high pressures and interelectrode gaps that approach those obtained in engineering practice, prior to the determination of the processes that set the criterion for breakdown in the above-mentioned gases and mixtures in uniform and non-uniform fields of engineering significance.

1 sentence, 59 words

The electrical breakdown of nitrogen was studied at high pressure (760 torr) and conventional electrode gap distances (1 mm), to determine its origin in uniform fields and the requirements for nitrogen's occurrence in uniform and non-uniform fields.

1 sentence, 37 words

We studied the electrical breakdown of nitrogen at 760 torr and a 1 mm electrode gap distance, to confirm its origin in uniform fields. Furthermore, we determined the requirements for its occurrence in uniform and non-uniform fields.

2 sentences, 24 + 13 words, active voice

Commas

MACMILLAN SCIENCE COMMUNICATION

Omitted or incorrectly used commas can confuse readers or even change the meaning

Example

Eats shoots and leaves

versus

Eats, shoots and leaves

Clarity

MACMILLAN SCIENCE COMMUNICATION

Where possible, use **verbs** instead of **noun forms**

Original

Perception of umami is through detection of the carboxylate anion of glutamic acid.

Improved

Humans perceive umami through detection of the carboxylate anion of glutamic acid.

Modifiers

MACMILLAN SCIENCE COMMUNICATION

- An optional element that *modifies* another word in the sentence
- Avoid placing a modifier between the verb and the direct object
- Modifiers of nouns should be placed directly after the noun
- Make sure modifiers don't create ambiguity

Ambiguous (embarrassing!)

He could not explain why he had got married to his father.

Better

He could not explain to his father why he had got married.

Subject–verb agreement

MACMILLAN SCIENCE COMMUNICATION

- The verb must agree with the subject in number and person
- Take care with plural subjects

Original

Multiple light-emitters **is** used.

Corrected

Multiple light emitters **are** used.

Original

A mixture of polymers **were** prepared.

Corrected

A mixture of polymers **was** prepared.

Parallelisms

MACMILLAN SCIENCE COMMUNICATION

- Parts of a sentence that are the same in function should be the same in structure, style and verb tense
- Most common parallelism mistake is made with bulleted lists

Not parallel list

The sedimentary and geological context of the new find indicates that the two hominids:

- died around the same time
- Debris flow carried them to their place of burial
- The fossils were found along with a wide range of other animals

Parallel list

The sedimentary and geological context of the new find indicates that the two hominids:

- died around the same time
- were carried by debris flow to their place of burial
- were found along with a wide range of other animals

Aluminium is light, ductile and has strength

(*adjectives **not** parallel)*

Aluminium is light, ductile, and strong

(*adjectives parallel)*

From: *Scientific English. A Guide for Scientists and Other Professionals*, Robert Day and Nancy Sakaduski

Incomplete comparisons

MACMILLAN SCIENCE COMMUNICATION

- All comparisons should specify *what* is compared with *what*: two components

Original	
The second group was much older.	*Incomplete*
Improved	
The second group was much older than the first.	*Complete*

Summary

MACMILLAN SCIENCE COMMUNICATION

- Remember the ABC of writing style
- Maximum 20–25 words per sentence
- Each sentence should make a single point
- Keep the subject and verb close together
- Use the active voice over the passive voice

To finish on a quote

MACMILLAN SCIENCE COMMUNICATION

"A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts.

This requires not that the writer make all sentences short, or avoid all detail and treat subjects only in outline, but that every word tell."

William Strunk Jr and E. B. White

Quiz

1. The total amount of fluorescent light coming from the hidden object through the scattering layer after subtracting the background was detected as a function of the angle of incidence, using a charge-coupled device.

2. The total amount of fluorescent light coming from the hidden object was detected through the scattering layer as a function of the angle of incidence, using a charge-coupled device after subtracting the background.

Quiz

MACMILLAN SCIENCE COMMUNICATION

1. The total amount of fluorescent light coming from the hidden object through the scattering layer after subtracting the background was detected as a function of the angle of incidence, using a charge-coupled device. ✗

Hint… identify the subject, verb and object

2. The total amount of fluorescent light coming from the hidden object was detected through the scattering layer as a function of the angle of incidence, using a charge-coupled device after subtracting the background. ✓

Quiz

In addition to the regulatory role of myostatin on skeletal muscle growth, it is also:

- a highly conserved member of the TGF-β family.
- inactivation of the myostatin gene (knockout) results in extensive skeletal muscle hypertrophy in humans.
- involved in the maintenance of metabolic homeostasis and in modulation of adipose tissue function and mass.

Quiz

MACMILLAN SCIENCE COMMUNICATION

Hint… do all bullet points on this list flow from the lead sentence?

In addition to the regulatory role of myostatin on skeletal muscle growth, it is also:

- a highly conserved member of the TGF-β family.
- inactivation of the myostatin gene (knockout) results in extensive skeletal muscle hypertrophy in humans.
- involved in the maintenance of metabolic homeostasis and in modulation of adipose tissue function and mass.

Quiz

In addition to the regulatory role of myostatin on skeletal muscle growth, it is also:

- a highly conserved member of the TGF-β family.
- a cause of extensive skeletal muscle hypertrophy in humans when the myostatin gene is knocked out.
- involved in the maintenance of metabolic homeostasis and in modulation of adipose tissue function and mass.

Questions

Any questions?

Coffee break until

11.15am

MACMILLAN
SCIENCE COMMUNICATION

Elements of Writing Style

Create a coherent flow in your writing

MACMILLAN SCIENCE COMMUNICATION

- Clarity and concision help your argument
- Create a compelling narrative throughout your text
- Don’t just ‘dump’ your material on the reader!

Topic and stress positions

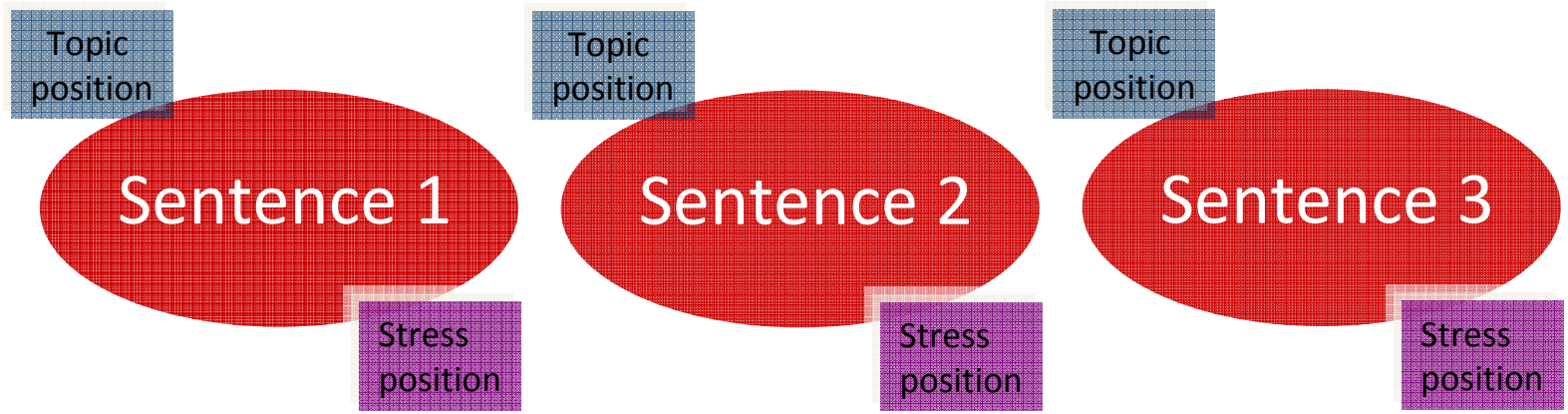
MACMILLAN SCIENCE COMMUNICATION

- Beginning of the sentence — **topic** position
  - Introduce the subject of the sentence first
  - Contains old information (context)
  - Links us backwards

Bees disperse pollen.	(is about bees)
Pollen is dispersed by bees.	(is about pollen)

- End of the sentence — **stress** position
  - Point of closure
  - Receives special emphasis
  - Adds new information

Links and transitions



Start a sentence with old information or a link (e.g. “however”, “as a result” or “thus”)

Transitions: Sentences and paragraphs

MACMILLAN SCIENCE COMMUNICATION

- **Sequence**
  again, and, besides, then, furthermore, in addition…
- **Comparison and contrast**
  despite, by contrast, conversely, unlike, but…
- **Examples**
  for example, to illustrate, in this way, specifically…
- **Time**
  while, at present, by, throughout, during, usually…
- **Cause and effect**
  therefore, thus, consequently, because, despite…

Creating sentence flow

MACMILLAN SCIENCE COMMUNICATION

Next-generation sequencing technologies have a very high throughput, as a hundred million DNA fragments can be sequenced in parallel on the chip.

Repetition

For example, the Illumina GA sequencing used in this study can provide up to 4–8 Gb high-quality data per week.

Therefore, the time needed to decipher a human genome (1–2 months using five next-generation sequencers), as well as the cost of sequencing (less than half a million US dollars), is substantially reduced.

Nature **456,** 60–65 (2008)

Paragraphs

MACMILLAN SCIENCE COMMUNICATION

- Fundamental organizational unit
- One idea / theme per paragraph
- Adequate ordering and relationship between sentences creates coherence
- Use transitions between paragraphs
- Material placed at beginning or end gets more attention

Paragraph coherence

MACMILLAN SCIENCE COMMUNICATION

To organize a paragraph coherently, you need to give it a beginning, a middle and an end

Example

In mammals, endosomal and extracellular Toll-like receptors recognize mainly pathogen-associated molecular patterns found in microbes. **Furthermore**, a multitude of cytosolic receptors recognize host-derived signals known as 'damage-associated molecular patterns'. **The cooperation between these** systems allows organisms to respond to a large number of infectious organisms and their effects on the host.

Topic sentences

MACMILLAN SCIENCE COMMUNICATION

- State the central idea of a paragraph in a topic sentence
- This sentence can be anywhere in the paragraph but is usually placed at the beginning

Example

PCR-based analyses of ancient human DNA are particularly susceptible to contamination by modern DNA. Only control assays of known differences between the ancient target sequence and modern human analog can reliably authenticate a novel sequence derived in this way.

General rules for paragraph construction

MACMILLAN SCIENCE COMMUNICATION

- When the topic sentence is placed at or near the beginning:
  - the succeeding sentences then explain or establish or develop the statement made in the topic sentence
  - the final sentence either emphasizes the thought of the topic sentence or states an important consequence
- Make sure you don’t digress in the final sentence

‘Top-down’ paragraphs

MACMILLAN SCIENCE COMMUNICATION

Topic sentence

Main message

In this study, we identified four patients with a deletion of 1q44 who manifest the typical features of microcephaly and seizures.

Substantiation

Clinical and genetic findings are summarized in Table 1 and Figure 5, respectively. All patients showed typical interstitial deletions of 1q44, in which *AKT3* and *ZNF238* are included. This study supports the findings reported by Smith et al., …

‘Bottom-up’ paragraphs

MACMILLAN SCIENCE COMMUNICATION

Intro

We performed quantitative RT-PCR (qRT-PCR) for *egl-1* transcript

Analysis

and observed that while *egl-1* is induced in wild-type worms upon ionizing radiation, its induction is undetectable in germlineless *glp-1* worms (Figure 2).

Conclusion

We conclude that *C. elegans* is unable to activate DNA damage response signalling in the adult soma despite the generation of DNA damage.

Topic sentence

Intra- and inter-paragraph flow

MACMILLAN SCIENCE COMMUNICATION

Nature, Feb 2011, doi:10.1038/nature09867 (edited)

To identify the mechanism, we tested the role of the Insulin-like receptor (InR) in neuroblasts (Supplementary Fig. 2). Unexpectedly, a dominant-negative InR inhibited neuroblast reactivation, whereas an activated form stimulated premature exit from quiescence (Fig. 1e). This indicates that at least one of the potential InR ligands, the seven ILPs, may be the neuroblast reactivating signal(s).

Repetition

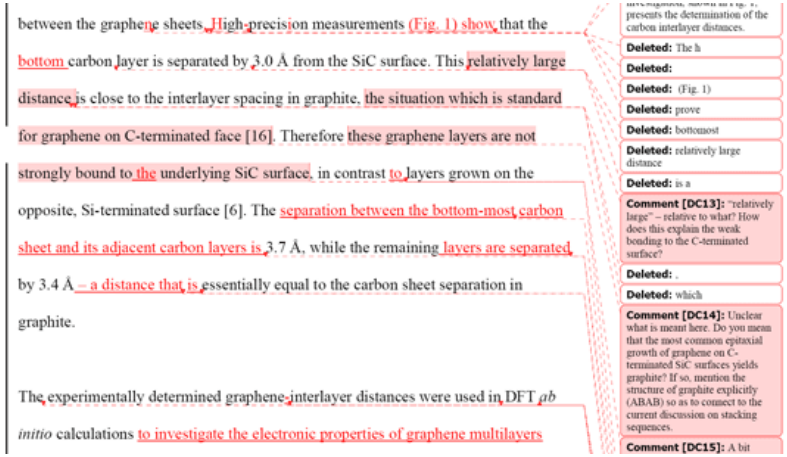
By testing various combinations of targeted *Ilp* null alleles and genomic *Ilp* deficiencies, we found that neuroblast reactivation was delayed in larvae deficient for both *Ilp2* and *Ilp3* (Fig. 2a).

Main message

Writing in English

MACMILLAN SCIENCE COMMUNICATION

- The most important aspects of a paper are the **content**, the **structure** and the **clarity** of expression
- A paper will not be rejected because of poor English grammar or spelling as long as the main idea is clear and compelling
- Many high-impact journals have professional copy editors who edit papers to improve the language usage


between the graphene sheets. High-precision measurements (Fig. 1) show that the bottom carbon layer is separated by 3.0 Å from the SiC surface. This relatively large distance is close to the interlayer spacing in graphite, the situation which is standard for graphene on C-terminated face [16]. Therefore these graphene layers are not strongly bound to the underlying SiC surface, in contrast to layers grown on the opposite, Si-terminated surface [6]. The separation between the bottom-most carbon sheet and its adjacent carbon layers is 3.7 Å, while the remaining layers are separated by 3.4 Å – a distance that is essentially equal to the carbon sheet separation in graphite.

The experimentally determined graphene-interlayer distances were used in DFT *ab initio* calculations to investigate the electronic properties of graphene multilayers

presents the determination of the carbon interlayer distances.

Deleted: The h

Deleted:

Deleted: (Fig. 1)

Deleted: prove

Deleted: bottomost

Deleted: relatively large distance

Deleted: is a

Comment [DC13]: "relatively large" – relative to what? How does this explain the weak bonding to the C-terminated surface?

Deleted: .

Deleted: which

Comment [DC14]: Unclear what is meant here. Do you mean that the most common epitaxial growth of graphene on C-terminated SiC surfaces yields graphite? If so, mention the structure of graphite explicitly (ABAB) so as to connect to the current discussion on stacking sequences.

Comment [DC15]: A bit

Common difficulties: Non-native speakers

MACMILLAN SCIENCE COMMUNICATION

- Using appropriate verb tenses
- Using technical language correctly
- Using suitable expressions: e.g. tentative versus declarative sentences in the discussion section
- Attitudes towards salami slicing and copying work from an admired paper

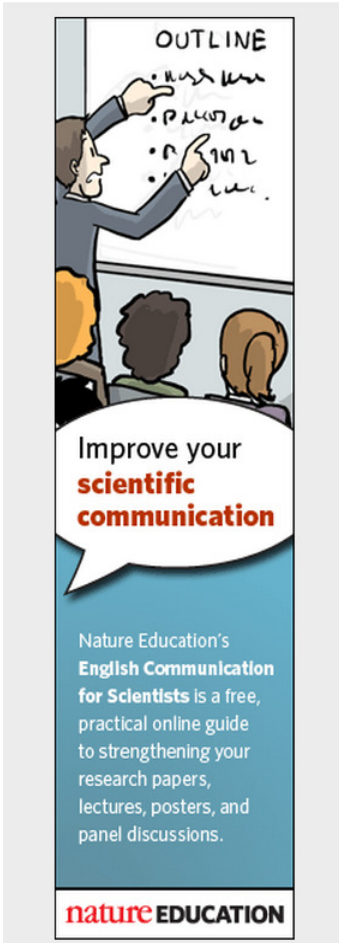
Strategies for improvement

MACMILLAN SCIENCE COMMUNICATION

- Keep to hand a list of commonly used words and phrases from your field and the context they are typically used in (called concordancing)
- Keep three or four articles from your field that are well written and use the structure and language from these articles as a guide for writing up your research (but don't copy chunks of text from them)
- Keep written records (e.g. lab books) in English

Writing in English: Resources

MACMILLAN SCIENCE COMMUNICATION



- Read as many papers as possible, especially from the journals you intend to submit to
- Ask a native English speaker to read your paper to check the language before submission
- Use online resources
- Nature Education (Scitable) is free
- Use an English language editing service
- Use an English language and developmental editing service

Summary

MACMILLAN SCIENCE COMMUNICATION

- Try to create a **compelling narrative** throughout your text, and don't just 'dump' your material on the reader
- Use topic and stress positions in sentences to hold your audience's interest
- Use **transitional devices** to link together sentences and paragraphs and create flow in your writing
- Paragraphs must have a **beginning**, a **middle** and an **end** and can be 'top-down' or 'bottom-up'
- A paper will not be rejected because of poor English grammar or spelling as long as the main idea is **clear and compelling**

Questions

Any questions?

MACMILLAN
SCIENCE COMMUNICATION

The Anatomy of an Abstract and Writing Engaging Titles

Title and Abstract

MACMILLAN SCIENCE COMMUNICATION

- The first (and, hopefully, not the last) thing the reader sees of the paper
- Crucial on the Web – make sure it is database friendly
- Short and self-contained
- The 'hook' to entice journal editors and readers

Most readers will only read the title and abstract!

Titles

MACMILLAN SCIENCE COMMUNICATION

- Informative
- Declarative
- Accurate
- Clear
- Concise
- Command attention

Tips on titles

MACMILLAN SCIENCE COMMUNICATION

- Words to avoid: “On the”, “Study”, “Investigation” etc.
- Avoid acronyms unfamiliar to your intended audience
- Be careful with overly assertive titles
  (e.g. “[X] *causes* [Y]”)
- Include keywords (to get more hits in electronic searches)

More tips on titles

MACMILLAN SCIENCE COMMUNICATION

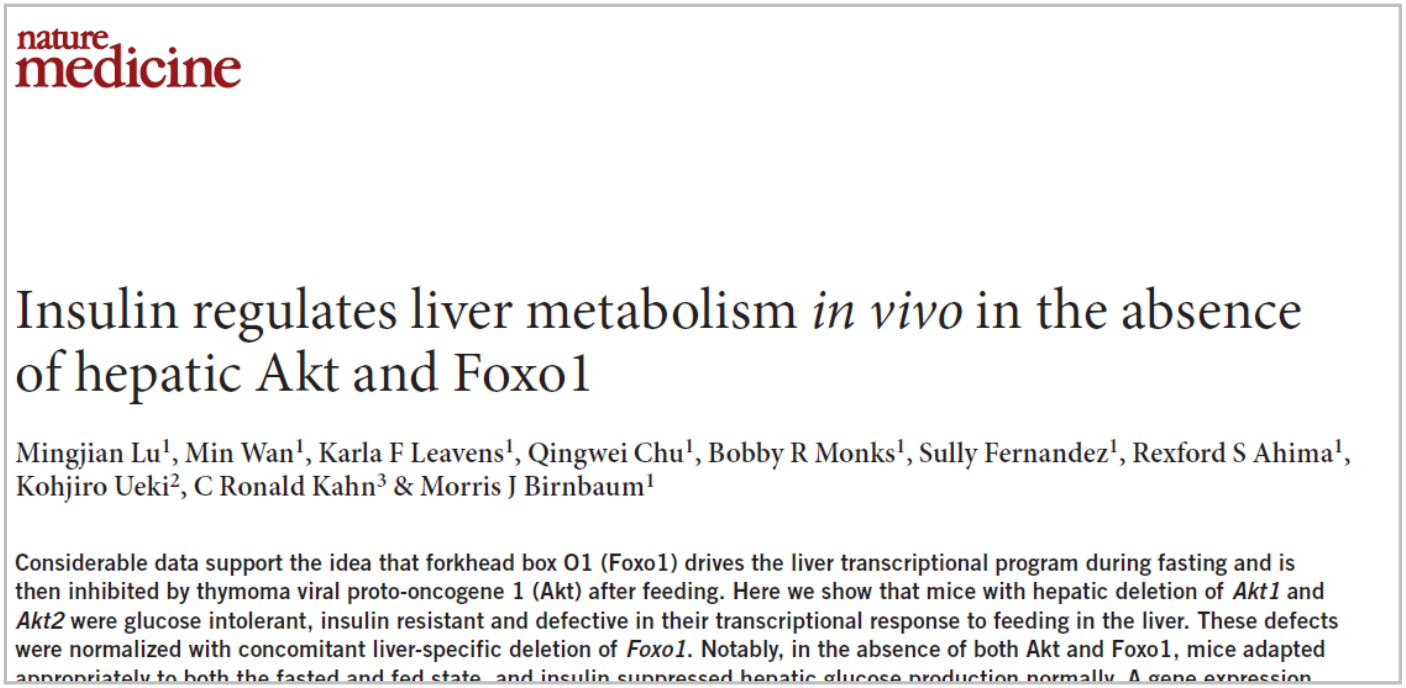
- Focus on the novelty in your work
- Include one key message only
- Be descriptive
- Make the title understandable on first reading
- Avoid creating complex compound nouns

Improving titles

MACMILLAN SCIENCE COMMUNICATION

Instead of

"The effect of insulin on liver cells in the absence of two key signalling components"



nature medicine

Insulin regulates liver metabolism *in vivo* in the absence of hepatic Akt and Foxo1

Mingjian Lu[1], Min Wan[1], Karla F Leavens[1], Qingwei Chu[1], Bobby R Monks[1], Sully Fernandez[1], Rexford S Ahima[1], Kohjiro Ueki[2], C Ronald Kahn[3] & Morris J Birnbaum[1]

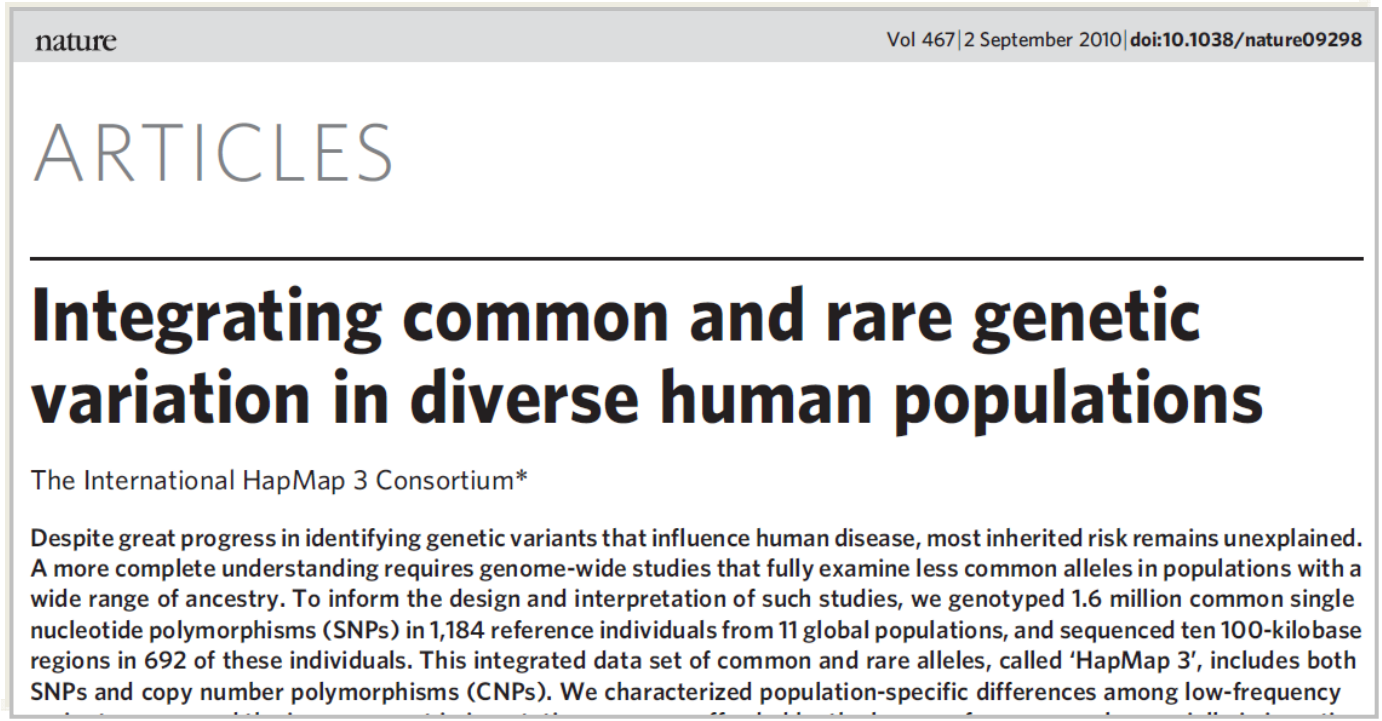
Considerable data support the idea that forkhead box O1 (Foxo1) drives the liver transcriptional program during fasting and is then inhibited by thymoma viral proto-oncogene 1 (Akt) after feeding. Here we show that mice with hepatic deletion of *Akt1* and *Akt2* were glucose intolerant, insulin resistant and defective in their transcriptional response to feeding in the liver. These defects were normalized with concomitant liver-specific deletion of *Foxo1*. Notably, in the absence of both Akt and Foxo1, mice adapted appropriately to both the fasted and fed state, and insulin suppressed hepatic glucose production normally. A gene expression

Improving titles

MACMILLAN SCIENCE COMMUNICATION

Instead of

"Expanding the public HapMap Phase I and II resource by performing genome-wide SNP genotyping and CNP detection, from an extended set from 11 populations"



nature Vol 467|2 September 2010|doi:10.1038/nature09298

ARTICLES

Integrating common and rare genetic variation in diverse human populations

The International HapMap 3 Consortium*

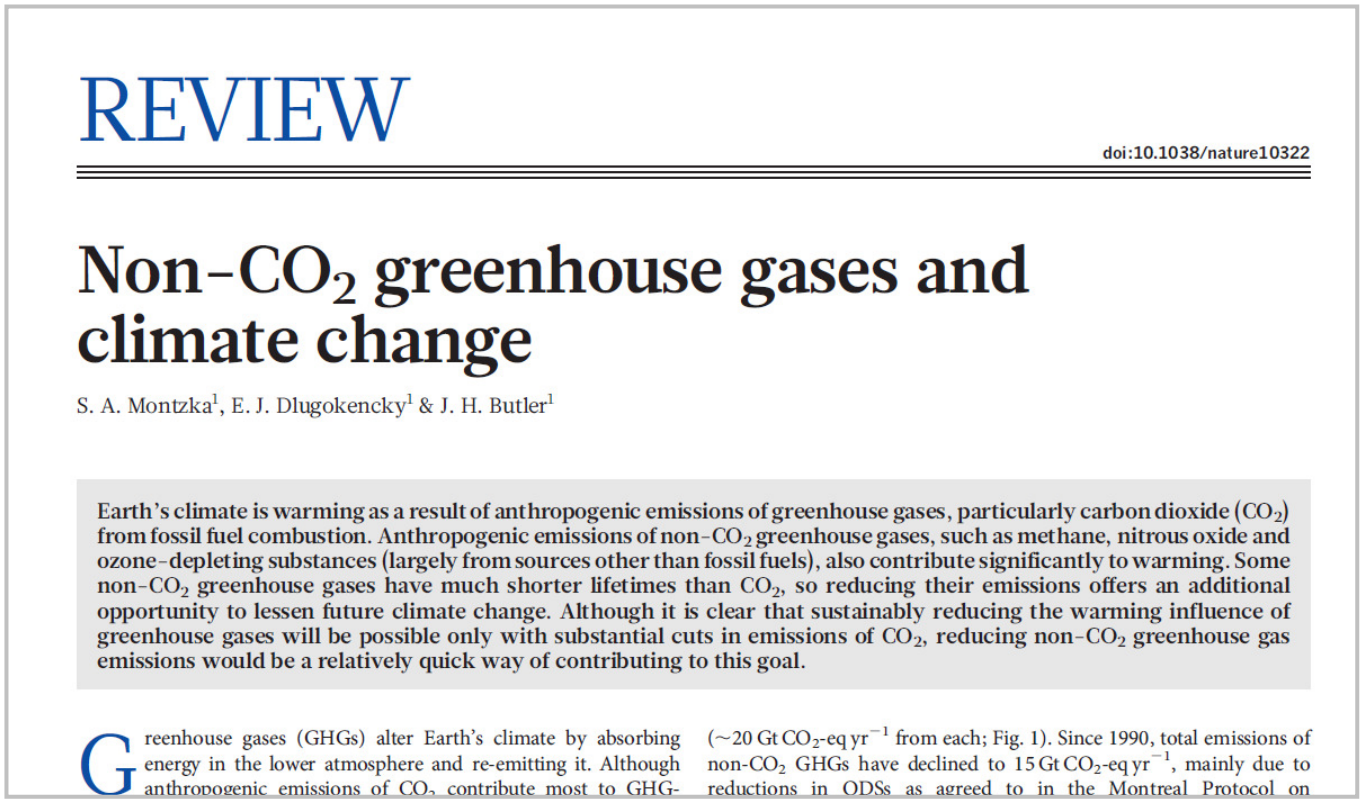
Despite great progress in identifying genetic variants that influence human disease, most inherited risk remains unexplained. A more complete understanding requires genome-wide studies that fully examine less common alleles in populations with a wide range of ancestry. To inform the design and interpretation of such studies, we genotyped 1.6 million common single nucleotide polymorphisms (SNPs) in 1,184 reference individuals from 11 global populations, and sequenced ten 100-kilobase regions in 692 of these individuals. This integrated data set of common and rare alleles, called 'HapMap 3', includes both SNPs and copy number polymorphisms (CNPs). We characterized population-specific differences among low-frequency

Improving titles

MACMILLAN SCIENCE COMMUNICATION

Instead of

"The potential for managing non-CO_2 greenhouse gas emissions to slow climate change"



REVIEW

doi:10.1038/nature10322

Non-CO_2 greenhouse gases and climate change

S. A. Montzka[1], E. J. Dlugokencky[1] & J. H. Butler[1]

Earth's climate is warming as a result of anthropogenic emissions of greenhouse gases, particularly carbon dioxide (CO_2) from fossil fuel combustion. Anthropogenic emissions of non-CO_2 greenhouse gases, such as methane, nitrous oxide and ozone-depleting substances (largely from sources other than fossil fuels), also contribute significantly to warming. Some non-CO_2 greenhouse gases have much shorter lifetimes than CO_2, so reducing their emissions offers an additional opportunity to lessen future climate change. Although it is clear that sustainably reducing the warming influence of greenhouse gases will be possible only with substantial cuts in emissions of CO_2, reducing non-CO_2 greenhouse gas emissions would be a relatively quick way of contributing to this goal.

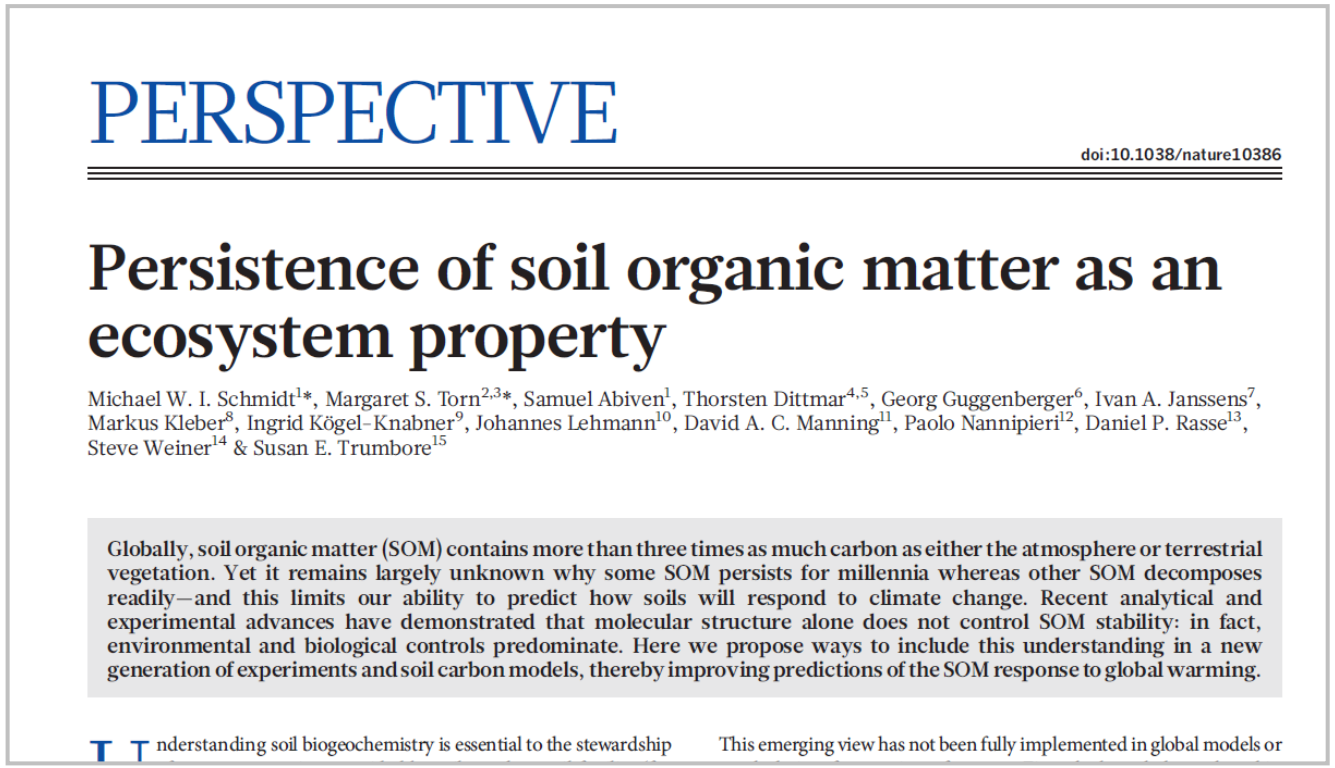
Greenhouse gases (GHGs) alter Earth's climate by absorbing energy in the lower atmosphere and re-emitting it. Although anthropogenic emissions of CO_2 contribute most to GHG- (~20 Gt CO_2-eq yr^{-1} from each; Fig. 1). Since 1990, total emissions of non-CO_2 GHGs have declined to 15 Gt CO_2-eq yr^{-1}, mainly due to reductions in ODSs as agreed to in the Montreal Protocol on

Improving titles

MACMILLAN SCIENCE COMMUNICATION

Instead of

"Why does organic carbon persist in soil?"



PERSPECTIVE

doi:10.1038/nature10386

Persistence of soil organic matter as an ecosystem property

Michael W. I. Schmidt[1]*, Margaret S. Torn[2,3]*, Samuel Abiven[1], Thorsten Dittmar[4,5], Georg Guggenberger[6], Ivan A. Janssens[7], Markus Kleber[8], Ingrid Kögel-Knabner[9], Johannes Lehmann[10], David A. C. Manning[11], Paolo Nannipieri[12], Daniel P. Rasse[13], Steve Weiner[14] & Susan E. Trumbore[15]

Globally, soil organic matter (SOM) contains more than three times as much carbon as either the atmosphere or terrestrial vegetation. Yet it remains largely unknown why some SOM persists for millennia whereas other SOM decomposes readily—and this limits our ability to predict how soils will respond to climate change. Recent analytical and experimental advances have demonstrated that molecular structure alone does not control SOM stability: in fact, environmental and biological controls predominate. Here we propose ways to include this understanding in a new generation of experiments and soil carbon models, thereby improving predictions of the SOM response to global warming.

Understanding soil biogeochemistry is essential to the stewardship ... This emerging view has not been fully implemented in global models or

Improving titles

MACMILLAN SCIENCE COMMUNICATION

Instead of

"A novel approach to radiation-absorbing systems using broadband super-singularity in the density of states of hyperbolic metamaterials"

Darker than black: radiation-absorbing metamaterial

E. E. Narimanov

Birck Nanotechnology Center, Purdue University, West Lafayette, IN 47907

H. Li, Yu. A. Barnakov, T. U. Tumkur, M. A. Noginov*

Center for Materials Research, Norfolk State University, Norfolk, VA 23504

* *mnoginov@nsu.edu*

Abstract:

We show that corrugated surfaces of hyperbolic metamaterials scatter light preferentially inside

Abstract: A mini version of the paper

MACMILLAN SCIENCE COMMUNICATION

The *Nature* 'formula'

- Write one or two general statements to set stage/context
- State the general problem
- Tell us what you did: summarize main results and conclusions
- Explain what the results add to previous knowledge
- Clearly and briefly state the implications of your findings

MACMILLAN SCIENCE COMMUNICATION

Basic introduction to the field, comprehensible to a scientist in any discipline

Detailed background, comprehensible to a scientist in a related discipline

One sentence stating the **general problem** studied in the paper

One sentence summarizing the **main result**

Two or three sentences explaining how the main results add to previous knowledge

One or two sentences to put the results into a more **general context**

(Optional) Two or three sentences to provide a broader perspective, readily comprehensible to a scientist in any discipline

During cell division, mitotic spindles are assembled by microtubule-based motor proteins[1,2]. The bipolar organization of spindles is essential for proper segregation of chromosomes, and requires plus-end-directed homotetrameric motor proteins of the widely conserved kinesin-5 (BimC) family[3]. Hypotheses for bipolar spindle formation include the 'push–pull mitotic muscle' model, in which kinesin-5 and opposing motor proteins act between overlapping microtubules[2,4,5]. However, the precise roles of kinesin-5 during this process are unknown. Here we show that the vertebrate kinesin-5 Eg5 drives the sliding of microtubules depending on their relative orientation. We found in controlled *in vitro* assays that Eg5 has the remarkable capability of simultaneously moving at ~20 nm s^{-1} towards the plus-ends of each of the two microtubules it crosslinks. For anti-parallel microtubules, this results in relative sliding at ~40 nm s^{-1}, comparable to spindle pole separation rates *in vivo*[6]. Furthermore, we found that Eg5 can tether microtubule plus-ends, suggesting an additional microtubule-binding mode for Eg5. Our results demonstrate how members of the kinesin-5 family are likely to function in mitosis, pushing apart interpolar microtubules as well as recruiting microtubules into bundles that are subsequently polarized by relative sliding. We anticipate our assay to be a starting point for more sophisticated *in vitro* models of mitotic spindles. For example, the individual and combined action of multiple mitotic motors could be tested, including minus-end-directed motors opposing Eg5 motility. Furthermore, Eg5 inhibition is a major target of anti-cancer drug development, and a well-defined and quantitative assay for motor function will be relevant for such developments.

Abstract: A mini version of the paper

MACMILLAN SCIENCE COMMUNICATION

In the abstract, don't:

- include too much detail about the methods (unless it's a methods paper)
- use obscure abbreviations, acronyms and references to literature and figures

Bad abstracts

MACMILLAN SCIENCE COMMUNICATION

This abstract is too specific

"To investigate the effects of anti-obesity drugs A and B, development was tracked for 20 days in adult BALB/c mice 18 weeks old, treated via introduction in the drinking water of Compound A at a concentration of 5 mg ml^{-1} for 7 days. Within 147 hours, they showed signs of appetite loss, with a 10.3% decrease in food ingestion, and their body mass decreased by 7.6%."

Abstract: A mini version of the paper

MACMILLAN SCIENCE COMMUNICATION

Setting the stage

Adipose phospholipase A2 (AdPLA or Group XVI PLA2) plays an important role in the onset of obesity by suppressing adipose tissue lipolysis. As a consequence, AdPLA-deficient mice are resistant to obesity induced by a high fat diet or leptin deficiency. It has been proposed that AdPLA mediates its antilipolytic effects by catalyzing the release of arachidonic acid. […] To better understand the enzymatic mechanism of AdPLA and LRAT-related proteins, we solved the crystal structure of AdPLA. Our model indicates that AdPLA bears structural similarity to proteins from the NlpC/P60 family of cysteine proteases, having its secondary structure elements configured in a circular permutation of the classic papain fold.

The main result

Using both structural and biochemical evidence, we demonstrate that the enzymatic activity of AdPLA is mediated by a distinctive Cys-His-His catalytic triad and that the C-terminal transmembrane domain of AdPLA is required for the interfacial catalysis. Analysis of the enzymatic activity of AdPLA toward synthetic and natural substrates indicates that AdPLA displays PLA1 in addition to PLA2 activity.

The analysis

Thus, our results provide insight into the enzymatic mechanism and biochemical properties of AdPLA and LRAT-related proteins and lead us to propose an alternate mechanism for AdPLA in promoting adipose tissue lipolysis that is not contingent on the release of arachidonic acid and that is compatible with its combined PLA1/A2 activity.

The implications

JBC October 12, 2012; 287 (42)

Choosing keywords

MACMILLAN SCIENCE COMMUNICATION

- Optimizing your paper for online search and indexing services raises the visibility of your article — and will ultimately help it get cited
- Some journals require a list of keywords

Where do you start?

- Carefully choose the title — this contains key words too
- The content (abstract) should contain your keywords
- Use words that are not too specific, not too general
- Search engines suggest including three to four mentions of your keyword per 200-word abstract, but be careful not to overuse each keyword

Summary

MACMILLAN SCIENCE COMMUNICATION

- Titles should be informative, declarative and clear
- Focus on the novelty in your work
- Avoid redundant words such as “An Observation of…” or “A Study into…”
- Structure your abstract
- Don’t include too much methodological detail

Questions

Any questions?

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Writing an Enticing Introduction

Elements of a paper: Introduction

MACMILLAN SCIENCE COMMUNICATION

The importance of the introduction cannot be overstated —

it is one of the more frequently read parts of a paper

Sets the stage for your work	Makes clear what you have studied and why	Provides a brief preview of the key findings (optional)

Paper elements: Introduction

MACMILLAN SCIENCE COMMUNICATION

- Give credit where credit is due
- Cite papers correctly
- Be selective, not exhaustive, with cited work
- Engage your reader:
  answer “What did you do?” and “Why should I care?”
- Move from general to specific
- Be brief and concise: it’s an introduction, not a thesis

Paper elements: Introduction

MACMILLAN SCIENCE COMMUNICATION

- Place the work into context
- Introduce the reader to the pertinent literature
- Establish the need for the current study
- State the task and objectives to be achieved
- Very briefly describe the methodology and the rationale for using it (optional)
- Very briefly describe the principal findings and conclusions (optional)

} Preview

Paper Elements: Introduction

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Context	Despite significant efforts over the past two decades, the development of 3D structured materials that possess the requisite low defect density for optoelectronic functionality has remained elusive. There are many pathways by which to impart a complex 3D structure into amorphous or polycrystalline materials[10–13], however
Need	such materials have poor electrical properties. In particular, for optoelectronic devices where long carrier lifetimes are required, it will almost certainly be necessary to form the 3D structure from a single-crystal, direct-bandgap semiconductor to minimize undesired recombination and other losses. Approaches based on the patterning of single-crystal starting materials, including anisotropic dry etching[14], wafer bonding[15] and layer-by-layer[16,17] assembly techniques, are intriguing. However, they are limited to specific 3D structures and materials, and often contain undesirable defects; thus, as far as we are aware, optoelectronic activity has not been demonstrated so far from any device formed using these approaches.
Principal findings and conclusions	Here we demonstrate the epitaxial growth of group III–V semiconductor 3D nanostructured materials, including those containing light-emitting heterostructures, by selective area epitaxy (SAE) through a 3D template. As traditionally performed, selective area epitaxy is a process during which a two-dimensional (2D), typically oxide, mask is patterned on a semiconductor wafer and material is subsequently grown by metal–organic chemical vapour deposition (MOCVD). Growth occurs only on the exposed regions of semiconductor, resulting in a patterned film. We show that a 3D

Adapted from *Nature Materials* **10**, 676

Verb tenses

MACMILLAN SCIENCE COMMUNICATION

- **Introduction** – use present simple to state facts and describe current thinking, past conditional, past perfect and past simple for describing others' research

"Skeletal muscle represents approximately 40% of the body weight in lean men and women and, therefore, constitutes the largest organ in nonobese humans."

Present simple used here to state facts

"In 2003, Pedersen *et al*. suggested that cytokines or other peptides that are produced, expressed and released by muscle fibres and exert endocrine effects should be classified as myokines[14]"

Past simple used to bring in what has been done before

Summary

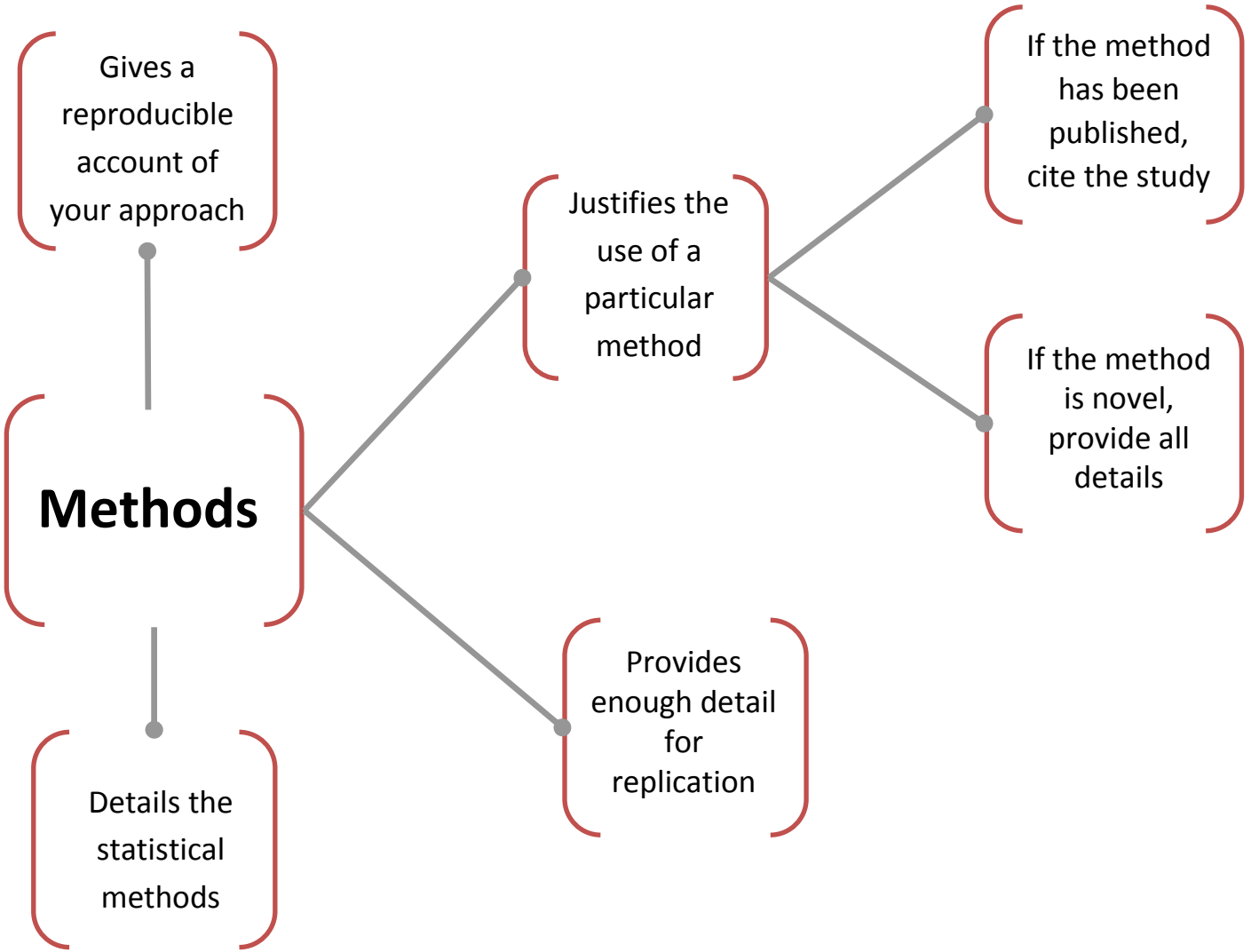
MACMILLAN SCIENCE COMMUNICATION

- The introduction allows you to place the research in context
- Move from general to specific

MACMILLAN
SCIENCE COMMUNICATION

Writing up Methods

Methods


Gives a reproducible account of your approach
Methods
Details the statistical methods
Justifies the use of a particular method
Provides enough detail for replication
If the method has been published, cite the study
If the method is novel, provide all details

Methods: Tips

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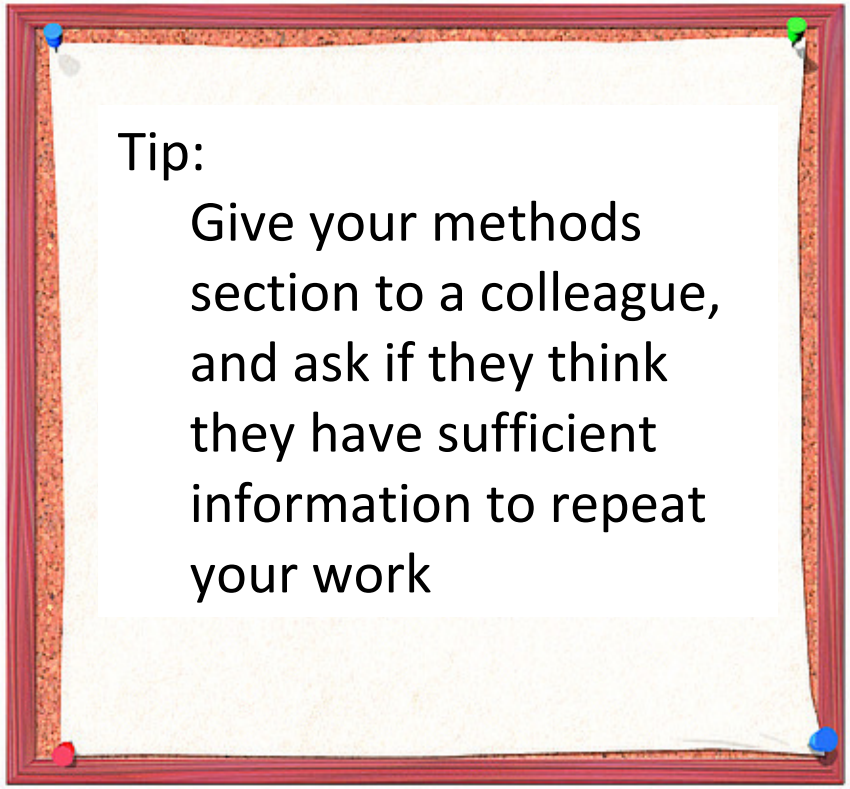
- Make sure the methods do not overwhelm the space between the Introduction and the Discussion. Readers could lose interest
- If the journal has a separate online methods section, supplementary information or appendix at the end of the paper, put as much information there as possible, and present pertinent information in the main text

Methods in *Nature*

MACMILLAN SCIENCE COMMUNICATION

- *Nature* has a printed methods summary (if < 200 words), an online only methods section (for specialists) and supplementary information
- The print and online sections contain all the relevant details for others to repeat experiments



LETTER

doi:10.1038/nature10445

Gravitational redshift of galaxies in clusters as predicted by general relativity

Radoslaw Wojtak[1], Steen H. Hansen[1] & Jens Hjorth[1]

The theoretical framework of cosmology is mainly defined by gravity, of which general relativity is the current model. Recent tests of general relativity within the Lambda Cold Dark Matter (ΛCDM) model have found a concordance between predictions and the observations of the growth rate and clustering of the cosmic web[1,2]. General relativity has not hitherto been tested on cosmological scales independently of the assumptions of the ΛCDM model. Here we report an observation of the gravitational redshift of light coming from galaxies in clusters at the 99 per cent confidence level, based on archival data[3]. Our measurement agrees with the predictions of general relativity and its modification created to explain cosmic acceleration without the need for dark energy (the *f*(*R*) theory[4]), but is inconsistent with alternative models designed to avoid the presence of dark matter[5,6].

According to the theory of general relativity[7], light emitted from galaxies moving in the gravitational potential well of galaxy clusters is expected to be redshifted proportionally to the difference in gravitational potential Φ between the clusters and an observer, that is, $z_{gr} = \Delta\Phi/c^2$, where c is the velocity of light in vacuum. For typical cluster masses of $\sim 10^{14} M_\odot$, where $M_\odot$ is the Sun's mass, the gravitational redshift is estimated to be[8–10] $cz_{gr} \simeq 10\,\mathrm{km\,s^{-1}}$, which is around two orders of magnitude smaller than the Doppler shift owing to the random motions of galaxies in clusters. The method of disentangling the kinematic Doppler effect from gravitational redshift relies on the fact that the former gives rise to a symmetric broadening of the observed velocity distribution, whereas the latter shifts its centroid. A critical factor in detecting such a velocity shift is the number of galaxies with spectroscopically measured velocities and the number of galaxy clusters. Both should be sufficiently high to reduce the error due to the Doppler width of the velocity distribution and to eliminate the sensitivity to irregularities in cluster structure, such as substructures and asphericity.

The data are compiled from the SDSS[3] Data Release 7 and the associated Gaussian Mixture Brightest Cluster Galaxy catalogue[11] containing the positions and redshifts of galaxy clusters identified in the survey. The cluster sample is richness-limited with a threshold corresponding to a cluster mass of $10^{14} M_\odot$. The mean, 5th percentile and 95th percentile values of the cluster richness[11] are 16, 8, and 86 and correspond to cluster masses of around $2 \times 10^{14} M_\odot$, $10^{14} M_\odot$ and $10^{15} M_\odot$, respectively. The typical number of spectroscopic redshifts per cluster (within a 6-megaparsec (Mpc) aperture and a velocity range of $\pm 4{,}000\,\mathrm{km\,s^{-1}}$ around the mean cluster velocities) varies from 10 for low-richness clusters to 140 for the richest ones.

Figure 1 shows the histograms of galaxy velocities calculated in four bins of the projected cluster-centric distance centred at 0.6, 1.6, 3.3 and 5.2 Mpc. The cluster centres and redshifts were approximated by the coordinates and redshifts of the brightest cluster galaxies. The observed velocity distributions consist of two clearly distinct parts: a quasi-flat distribution of galaxies not belonging to the clusters (observed due to projection effect) and a quasi-Gaussian component associated with galaxies gravitationally bound to the clusters[12]. The latter is expected to reveal the signature of gravitational redshift in terms of a systematic shift of its velocity centroid. Analysis of mock kinematic data generated from cosmological simulations shows that the number of redshifts and clusters is sufficient to reduce all expected sources of noise—such as substructures, cluster asphericity, and non-negligible offset between the brightest cluster galaxies and cluster centres[13] (both in the position on the sky and redshift space)—and to allow for detection of gravitational redshift at a confidence level of nearly 3σ (see Supplementary Information).

We search for gravitational redshift by measuring the mean velocity Δ of the quasi-Gaussian component of the observed velocity distribution. We carry out a Monte Carlo Markov Chain analysis of the data using a two-component model for the velocity distribution which includes contributions from both the cluster and non-cluster galaxies (Supplementary Information). Constraints on the mean velocity are obtained by marginalizing the likelihood function over the set of nuisance parameters defining the shape of both components of the velocity distribution. The best-fitting models of the velocity distributions are shown in Fig. 1 and the resulting measurements of the mean velocity as a function of the projected cluster-centric distance R are presented in Fig. 2. The obtained mean velocity is negative at all radii with a clear tendency to decline with increasing radius. The negative values arise from the fact that the rest frames of the clusters are defined by the observed velocities of the central galaxies. This choice of the reference frame implies that the gravitational redshift manifests itself

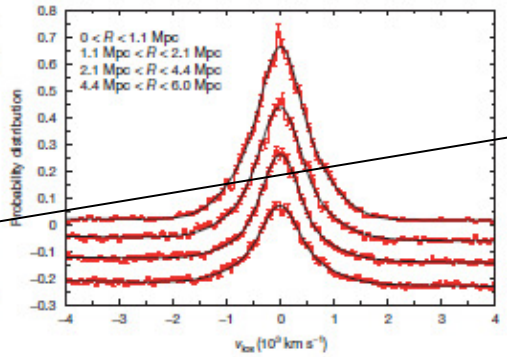


Figure 1 | Velocity distributions of galaxies combined from 7,800 SDSS galaxy clusters. The line-of-sight velocity (v_{los}) distributions are plotted in four bins of the projected cluster-centric distances R (indicated in the upper left corner for the distributions from top to bottom), and offset vertically by an arbitrary amount for presentation purposes. Red lines present the histograms of the observed galaxy velocities in the cluster rest frame and black solid lines show the best-fitting models. The model assumes a linear contribution from the galaxies that do not belong to the cluster and a quasi-Gaussian contribution from the cluster members (see Supplementary Information for more details). The cluster rest frames and centres are defined by the redshifts and the positions of the brightest cluster galaxies. The error bars represent Poisson noise.

[1]Dark Cosmology Centre, Niels Bohr Institute, University of Copenhagen, Juliane Maries Vej 30, DK-2100 Copenhagen Ø, Denmark.

The entire 'Methods' part in the main text of this experimental work

MACMILLAN
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LETTER

The bonobo genome co and human genomes

Kay Prüfer[1], Kasper Munch[2], Ines Hellmann[3], Keiko Ak
Chinnappa Kodira[7], Roger Winer[7], James R. Knight[7], Jan
Saneyuki Higashino[11], Asger Hobolth[2], Julien Dutheil[2], I
Mario Ventura[12,13], Tomas Marques-Bonet[12,14], Evan E. I
Jörg Junhold[15], Nick Patterson[16], Michael Siebauer[1], Jeff
David E. Symer[4], Thomas Mailund[2], Mikkel H. Schierup

**Two African apes are the closest living relatives of huma
chimpanzee (*Pan troglodytes*) and the bonobo (*Pan pa
Although they are similar in many respects, bonobos an
panzees differ strikingly in key social and sexual behaviours
for some of these traits they show more similarity with h
than with each other. Here we report the sequencing and as
of the bonobo genome to study its evolutionary relationsh
the chimpanzee and human genomes. We find that more tha
per cent of the human genome is more closely related to eit
bonobo or the chimpanzee genome than these are to each
These regions allow various aspects of the ancestry of the t
species to be reconstructed. In addition, many of the regio
overlap genes may eventually help us understand the genet
of phenotypes that humans share with one of the two ape
exclusion of the other.**

Whereas chimpanzees are widespread across equatorial
bonobos live only south of the Congo River in the Dem
Republic of Congo (Fig. 1a). As a result of their relatively sm
remote habitat, bonobos were the last ape species to be describ
are the rarest of all apes in captivity. As a consequence, they hav
recently, been little studied[2]. It is known that whereas DNA se
in humans diverged from those in bonobos and chimpanzee
seven million years ago, DNA sequences in bonobos diverge
those in chimpanzees around two million years ago. Bonobos a
closely related to chimpanzees. Moreover, comparison of
number of autosomal DNA sequences has shown that bonob
sequences often fall within the variation of chimpanzees[5].

Bonobos and chimpanzees are highly similar to each other i
respects. However, the behaviour of the two species differs in
ant ways[1]. For example, male chimpanzees use aggression to c
for dominance rank and obtain sex, and they cooperate to defe
home range and attack other groups[3]. By contrast, bonobo m
commonly subordinate to females and do not compete inten
dominance rank[1]. They do not form alliances with one anot
there is no evidence of lethal aggression between groups[3]. Co
with chimpanzees, bonobos are playful throughout their li
show intense sexual behaviour[3] that serves non-conceptive fu

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Columbus, Ohio 43210, USA. [4]J. Craig Venter Institute, Rockville, Maryland 20850, USA. [5]
[6]Genome Technology Branch, National Human Genome Research Institute, National In
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Bioscience and Biotechnology, Tokyo Institute of Technology, Kanagawa 226-8503, Japa
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Catalonia, Spain. [15]Lola Ya Bonobo Bonobo Sanctuary, "Petites Chutes de la Lukaya", [
Goodall Institute, Pointe-Noire, Republic of Congo. [17]Chimpanzee Sanctuary and Wildl
Genetics, Harvard Medical School, Boston, Massachusetts 02115, USA. [20]Division of Biol
and Ecology, 00100 Nairobi, Kenya. [21]Department of Biosciences, Aarhus University, DK
06800, Turkey.

difference in the variance of reproductive success between the sexes certainly contributes to this observation, as does the fact that whereas bonobo females often move to new groups upon maturation, males tend to stay within their natal group[20]. Because both current and ancestral X/A ratios are similar to each other and also to some human groups (Fig. 4), this suggests that they may also have been typical for the ancestor shared with humans.

Because factors that reduce the effective population size, in particular positive and negative selection, will decrease the extent of ILS, the distribution of ILS across the genome allows regions affected by selection in the *Pan* ancestor to be identified. In agreement with this, we find that exons show less ILS than introns (Fig. 3d and Supplementary Information, section 8). We also find that recombination rates are positively correlated with ILS (Fig. 3e), probably because recombination uncouples regions from neighbouring selective events. Unlike positive and negative selection, balancing selection is expected to increase ILS. In agreement with this, we find that ILS is most frequent in the major histocompatibility complex (MHC), which encodes cell-surface proteins that present antigens to immune cells (Supplementary Information, section 10) and is known to contain genes that evolve under balancing selection[21].

To identify regions affected by selective sweeps in the *Pan* ancestor, we isolated long genomic regions devoid of ILS. The largest such region is 6.1 Mb long and is located on human chromosome 3. This region contains a cluster of tumour suppressor genes[22], has an estimated recombination rate of 10% of the human genome average[23] and has been found to evolve under strong purifying selection in humans[24]. The diversity in the region, corrected for mutation rate, is lower than in neighbouring regions in chimpanzee but not in bonobos (Fig. 5a), and parts of the region show signatures of positive selection in humans[14,25,26]. Apparently this region evolves in unique ways that may involve both strong background selection and several independent events of positive selection among apes and humans.

The fact that the chimpanzee diversity encompasses bonobos fo
most regions of the genome can be exploited to identify regions that

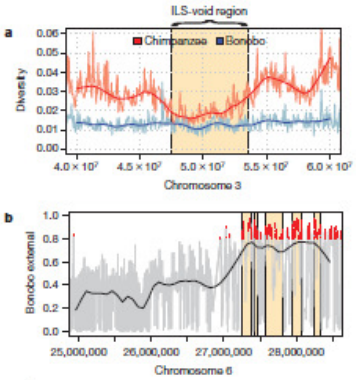

Figure 5 | Selection in the bonobo–chimpanzee common ancestor and chimpanzees. a, Diversity in chimpanzee and bonobo around the region on chromosome 3 devoid of ILS. b, Regions where bonobos fall outside the variation of chimpanzee upstream of the MHC. The MHC region is not plotted because the SNP density is sparse there as a result of duplications. Five regions among the 50 longest regions are shown in yellow. Red points show posterior probabilities >0.8.

have been positively selected in chimpanzees after their separation from bonobos, because in such regions bonobos will fall outside the chimpanzee variation. We implemented a search for such regions, which is similar to a test previously applied to humans to detect selective sweeps since their split from Neanderthals[40] (*Homo neanderthalensis*), in an HMM that uses coalescent simulations for parameter training, the chimpanzee resequencing data and the megabase-wide average of the human recombination rates (Supplementary Information, section 7). Because the size of a region affected by a selective sweep will be larger the faster fixation was reached, the intensity of selection will correlate positively with genetic length. We therefore ranked the regions according to genetic length and further corrected for the effect of background selection[24]. The highest-ranking region contains an miRNA, miR-4465, that has not yet been functionally characterized. Four of the ten highest-ranking regions contain no protein- or RNA-coding genes, and may thus contain structural or regulatory features that have been subject to selection. Notably, four of these ten regions are on chromosome 6, and two of these four are within 2 Mb of the MHC (Fig. 5b). This suggests that the MHC and surrounding genomic regions have been a major target of positive selection in chimpanzees, presumably as a result of infectious diseases. Indeed, chimpanzees have experienced a selective sweep that targeted MHC class-I genes and reduced allelic diversity across a wide region surrounding the MHC[27], perhaps caused by the HIV-1/SIV$_{CPZ}$ retrovirus[27,28].

The bonobo genome shows that more than 3% of the human genome is more closely related to either bonobos or chimpanzees than these are to each other. This can be used to illuminate the population history and selective events that affected the ancestor of bonobos and chimpanzees. In addition, about 25% of human genes contain parts that are more closely related to one of the two apes than the other. Such regions can now be identified and will hopefully contribute to the unravelling of the genetic background of phenotypic similarities among humans, bonobos and chimpanzees.

METHODS SUMMARY

We generated a total of 86 Gb of DNA sequence from Ulindi, a female bonobo who lives in Leipzig Zoo (Supplementary Information, section 1). All sequencing was done on the 454 sequencing platform and included 10 Gb of paired-end reads from clones of insert sizes of 3, 9 and 20 kb. The genome was assembled using the open-source Celera Assembler software[38] (Supplementary Information, section 2). In addition, we sequenced 19 bonobo and chimpanzee individuals on the Illumina GAIIx platform to about one-fold genomic coverage per individual (Supplementary Information, section 3). Supplementary Information provides a full description of our methods.

Received 8 December 2011; accepted 5 April 2012.
Published online 13 June 2012.

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10. Green, R. E. *et al.* A draft sequence of the Neandertal genome. *Science* **328,** 710–722 (2010).
11. Arnold, M. L. & Meyer, A. Natural hybridization in primates: one evolutionary mechanism. *Zoology* **109,** 261–276 (2006).

The same thing occurs here: the entire methods section in the main text of this experimental work with a link to Supplementary Information

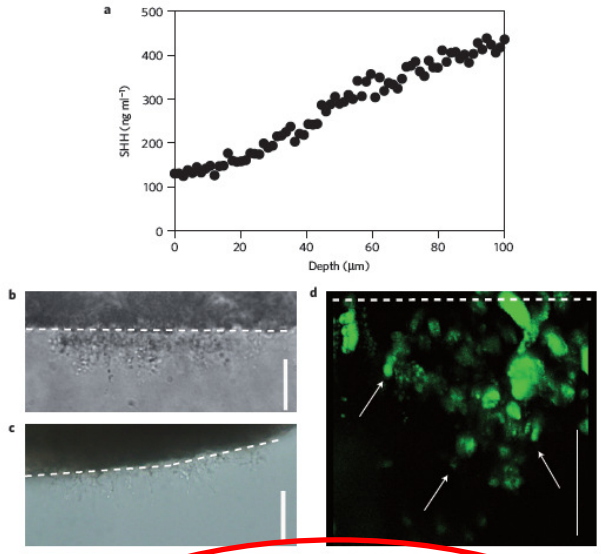

Figure 6 | NPCs migrate into a channel of SHH with RGD. a, Quantification of the concentration profile of SHH–488 as a function of depth within the hydrogel from the surface of the gel to a depth of 100 μm. **b**, Bright-field image of SHH–RGD channel showing that NPCs have migrated into the agarose gel after 14 d to a depth of 85 μm. **c**, Bright-field image of RGD-only channel showing that only minimal migration was observed within the hydrogel after 14 d to a depth of 20 μm. Mostly processes were observed within the gel. **d**, Confocal micrograph of SHH–RGD channel emphasizing migration of NPCs expressing yellow fluorescent protein into the agarose gel. All scale bars represent 50 μm. For all cell images the white dashed line represents the surface of the gel.

Methods

Photopatterning and imaging. All patterns were created and imaged on a Leica TCS-SP2 confocal microscope equipped with an argon laser (50 mW; 458, 476, 488, 514 nm), a red HeNe laser (10 mW; 633 nm), a multiphoton Mai Tai laser using a ×20 objective (NA = 0.4) and an electronic stage. For patterning experiments, the multiphoton laser was set to 740 nm with an offset of 75% and gain of 0% for visualization and an offset of 75% and gain of 43% for patterning. One scan of a 100 μm × 100 μm square takes 1.28 s. A typical patterned hydrogel of ten squares (Figs 2 and 3) took between 2 and 6 min. The maximum length scale that can be achieved (maximum depth of patterning) is limited by the working distance of the lens (15 mm). Leica software version 2.5.1227a was used for the visualization and fluorescence quantification. Z-stacks and 3D images were constructed using Image J.

Patterning SHH–barstar. 25 μl of 1 wt% coumarin sulphide agarose gels with 0.15 mg ml^{-1} of maleimide–barnase was patterned and reacted for 2 h at room temperature (RT) in a humidity chamber. The series of boxes was created by selecting a 100 μm by 100 μm squares, with a height of ~20–40 μm, 400 μm below the surface of the hydrogel. Using a macro, the first box was scanned ten times followed by a further four scans for each subsequent box. The gels were then washed in 200 ml of PBS for 1 d. 20 μl of 0.3 mg ml^{-1} SHH–barstar–488 was placed on top of the gel and left overnight at RT. The gels were washed in PBS at pH 7.4 for 2 d, changing the PBS daily. For the quantification, a z-stack was imaged spanning 180 μm with 2 μm steps and six scans per slice. The 458, 476, 488 nm excitation wavelengths were set to 100% and the gain of the photomultiplier tube was 602 with wavelengths from 500 to 590 nm collected.

Patterning biotin–CNTF. 25 μl of 1 wt% coumarin sulphide agarose gels with 1 mg ml^{-1} of maleimide–streptavidin was patterned and reacted for 2 h at RT in a humidity chamber. A series of boxes was created by selecting a 100 μm by 100 μm square, with a height of ~40–80 μm, 400 μm below the surface of the hydrogel. Using a macro, the first box was scanned once followed by a further two scans for each subsequent box. The gels were then washed in 200 ml of PBS at pH 7.4 for 1 d. 20 μl of 0.54 mg ml^{-1} biotin–CNTF–633 was placed on top of the gel and left for 16 h at RT. The gels were washed again in PBS at pH 7.4 for 2 d, changing the PBS once. For the quantification, a z-stack was imaged spanning 163. 2 μm with 2 μm steps and six scans per slice. The 633 nm excitation wavelength was set to 100% and the gain for the photomultiplier tube at 591 with wavelengths from 640 to 750 nm collected.

Dual patterning. A 25 μl gel of 1 wt% coumarin sulphide agarose with 0.15 mg ml^{-1} of maleimide–barnase was patterned. The truncated circle was selected, after which the region was scanned 40 times. This was repeated three more times with each 100 μm below the previous pattern to construct the layered pattern. After 2 h in a humidity chamber, the gel was washed in PBS at pH 6.8 for 2 h. A solution of 20 μl of 2 mg ml^{-1} of maleimidopropionic acid in PBS at pH 6.8 was added on top of the gel. After 16 h the gel was washed for 1 d in PBS at pH 6.8. 20 μl of 2 mg ml^{-1} maleimide–streptavidin in PBS at pH 6.8 was added on top of the gel at 4 °C. After 16 h, the gel was patterned again by selecting an oval region fitting into the truncated circle and scanned 15 times. This was repeated for each layer of the barnase pattern. The gel was then washed in 200 ml of PBS at pH 7.4 for 1 d. A 20 μl solution of 0.3 mg ml^{-1} of both barstar–SHH–488 and biotin–CNTF–633 was added on top of the gel. After 1 d, the gel was washed for 2 d in PBS at pH 7.4, changing the buffer once. A 327.6 μm stack was constructed with 2.1 μm spacing between slices using the following settings: lasers 458, 476, 488 and 633 nm set to 100%; six scans per slice; collected wavelengths of 500–590 nm and 640–800 nm; photomultiplier tubes of 683 and 589 for green and red channels, respectively.

Migration of NPCs into SHH–RGD channel. NPCs were placed on top of hydrogels with patterns consisting of an SHH gradient with GRGDS or GRGDS alone. After 14 d, hydrogels were imaged and cell migration into the hydrogel was compared between conditions (greater detail is provided in Supplementary Information).

Received 17 September 2010; accepted 18 July 2011; published online 28 August 2011

References

1. DeForest, C. A., Polizzotti, B. D. & Anseth, K. S. Sequential click reactions for synthesizing and patterning three-dimensional cell microenvironments. *Nature Mater.* **8**, 659–664 (2009).

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The actual 'Methods' section at the end can be quite long (and even more can often be found online)

Methods in *Nature:* Supplementary Information

MACMILLAN SCIENCE COMMUNICATION

Methods

Abstract • Introduction • Data generation, alignment and variant discovery • Power to detect variants • Genotype accuracy • Putative functional variants • Application to association studies • Mutation, recombination and natural selection • Discussion • Methods • Change history • References • Acknowledgements • Author information • Supplementary information • Comments

The Supplementary Information provides full details of samples, data generation protocols, read mapping, SNP calling, short insertion and deletion
methods used in the analyses relating t
population genetics and extrapolation to

Supplementary information

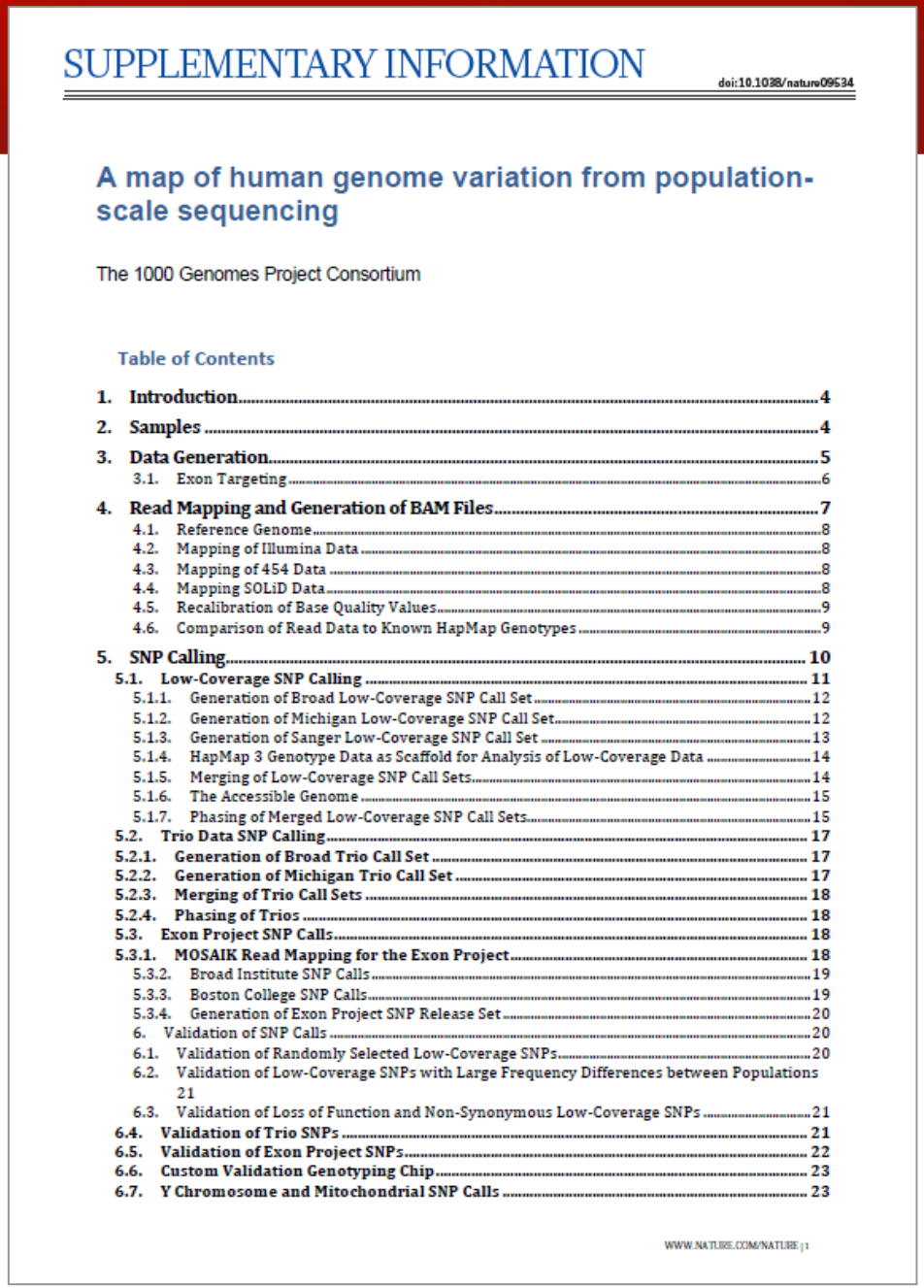
Abstract • Introduction • Data generation, alignment and variant discovery • Power to detect variants • Genotype accuracy • Putative functional variants • Application to association studies • Mutation, recombination and natural selection • Discussion • Methods • Change history • References • Acknowledgements • Author information • Supplementary information • Comments

PDF files

1. Supplementary Information (4.7M)
   This file contains Supplementary Text 1-16 (see contents list for details), additional references and Supplementary Figures 1-16 with legends and references. *Supplementary Information section 7.7 was corrected on 05 May 2011.*

Excel files

1. Supplementary Tables (413K)
   This file contains Supplementary Tables 1-13



SUPPLEMENTARY INFORMATION

doi:10.1038/nature09534

A map of human genome variation from population-scale sequencing

The 1000 Genomes Project Consortium

Table of Contents

MACMILLAN SCIENCE COMMUNICATION

A place for all the exhaustive details

Nature **467, 1061–1073**

Verb tenses

MACMILLAN SCIENCE COMMUNICATION

- **Methods** – use past simple to describe what you did, present simple to describe background information

"Samples for air gas analysis were collected using the method described by Brown (1999), which uses a pneumatic air sampling pump"

Past simple used to show your own work, present simple describes a standard procedure.

Methods in other journals

MACMILLAN SCIENCE COMMUNICATION

Science

Online only methods, supplementary information

Proceedings of the National Academy of Sciences, PNAS

Materials and methods section at end of print and online article, supplementary information

Cell

Experimental procedures section at end of print article, online-only methods, supplementary information

Summary

MACMILLAN SCIENCE COMMUNICATION

- The aim of the methods section is to give a reproducible account of your approach
- Provide enough detail for replication
- If the journal has a separate methods section at the end of the paper, put as much information there as possible and present pertinent information in the main text

Group discussion – hands up!

- What section of the paper do you start writing first?

Abstract / Introduction / Methods / Results / Discussion

- Do you find structuring a paper easy or difficult?

Yes / No

Lunch break until

1.30pm

- What part of the writing process do you find most difficult?

Language / Structure / Knowing what to include / All of it

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Presenting and Discussing the Results and Concluding the Paper

Results

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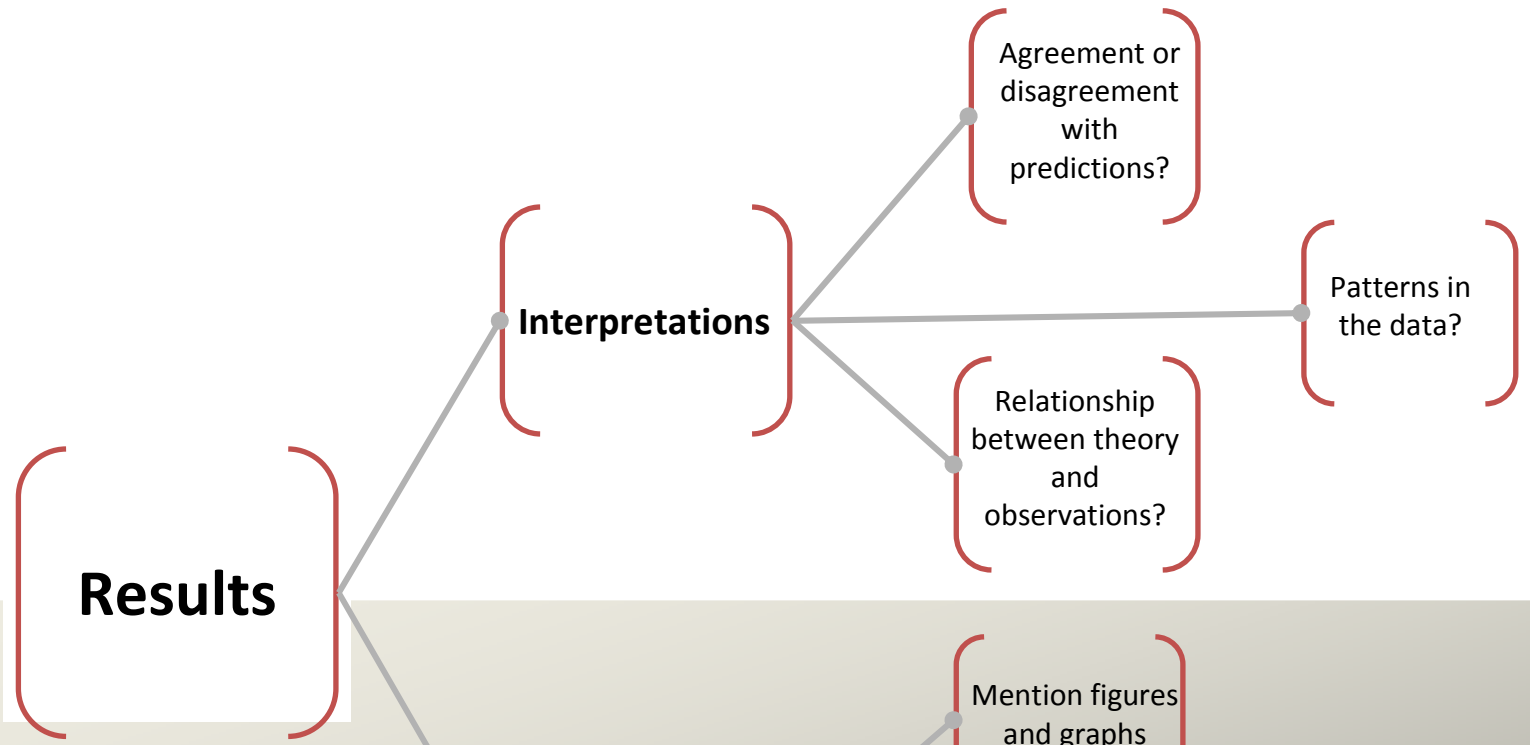

Results

MACMILLAN SCIENCE COMMUNICATION

- The results section is where you present the core of the work
- The purpose of this section is to describe your results and briefly explain their meaning to others
- Deeper evaluation and implications of the results should be saved for the discussion and conclusion sections
- You should not just dump your data onto the reader
- Depending on the discipline and journal, the results section can be combined with the discussion or can be called Data or Data Analysis

Presenting your results

MACMILLAN SCIENCE COMMUNICATION

- Think about the ‘story line’ — create a narrative
- The results should be presented in a pedagogical way, not in the order in which experiments were conducted
- The discussion of results should present results as they are — don’t say something has been proven unless it really has
- Structure paragraphs in a **top-down** manner — main message in the first sentence
- Number figures in the order cited in the text

Presenting your results: An example

MACMILLAN SCIENCE COMMUNICATION

Overview of the result	The crystal structures showed that the GBR2 ectodomain differs from known mGluR structures in three aspects (Fig. 2).
The result	First, the structure of GBR2VFT features three disulfide bonds. None of these are conserved in mGluRs. Second, mGluRs have a cysteine-rich region between the VFT and transmembrane domains that is replaced by a 15- to 17-residue peptide linker in GBR2. Third, the structure of GBR2VFT has several insertions and deletions when compared with mGluR structures; many of these variations have no known biological implication.
The significance of the result	The most notable difference is the omission of a loop between helix B and strand c of GBR2VFT that, in mGluRs, is responsible for the formation of an intermolecular disulfide bond involved in dimerization. Consistent with this observation and previous work[18], GABAB receptor is a noncovalently linked dimer, unlike mGluRs.

Common vocabulary and phrases

MACMILLAN SCIENCE COMMUNICATION

Result overview

It is apparent that in all / most / the majority of cases…

It is evident from these results that…

In this section, we evaluate / compare / present…

When referring to data

As detailed in / from Fig. 1...

X can be identified / is evident from Table 2.

In Fig. 9, we compare / present…

We observe / conclude / deduce from Fig. 8a that…

Data in Fig. 10 indicate / illustrate / reveal / show…

…small volume changes are reported in Fig. 6d

Reference: *Science Research Writing*, by Hilary Glasman-Deal, Imperial College Press

Verb tenses

MACMILLAN SCIENCE COMMUNICATION

- **Results** – as a general explanation, use present simple or past simple

  "We found that X occurs, which indicates that x causes y"

  Present simple used to express permanent truths and facts

  "We found that X occurred, which indicated that x caused y"

  Use past simple if you are less confident

Supplementary information

MACMILLAN SCIENCE COMMUNICATION

- The results section should present only the data crucial for your arguments
- Results of peripheral importance might be better placed in the supplementary information
- Supplementary material can be in several formats: documents, images, movies, audio files, databases

Examples of supplementary information

MACMILLAN SCIENCE COMMUNICATION

- Experiments that further support your conclusions but are not key to the argument
- Expanded experimental methods
- Extended deductions of mathematical formulae
- Crystallographic and other raw data
- 3D rendering of molecules
- Anything unsuitable for printing

SUPPLEMENTARY INFORMATION

doi:10.1038/nature10538

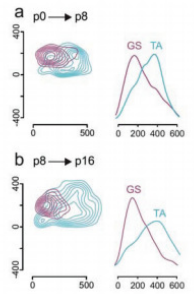

Figure S1. Variation in injection timing does not affect medio-lateral distributions

Transverse section density analysis (left) and medio-lateral density analysis (right) of dorsal GS and TA premotor interneuron distributions (scale in μm). Injections were carried out at p0 (a) or p8 (b) and experiments were analyzed 8 days later.

Nature **479,** 61–66 (2011)

Many possibilities

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DOWNLOAD PLUGINS FOR YOUR BROWSER

Movie files
- QuickTime Player (PC or Mac)
- Realplayer (PC or Mac)
- Windows Media player (PC only)

PDF documents
- Adobe Acrobat Reader (PC or Mac)

Text documents
- Textpad (PC only)
- SimpleText (Mac only)

PostScript documents
- GhostView (Mac and PC)

Flash movies
- Macromedia Flash Player

Audio files
- Apple iTunes (PC or Mac)
- QuickTime Player (PC or Mac)
- Realplayer (PC or Mac)
- Windows Media player (PC only)

Chemical structures
- MDL Chime

Microarray
- Treeview

Compressed Stuff files
- StuffIt Expander

Compressed Zip files
- WinZip (PC only)

Systems Biology Markup Language files (SBML)
- More information about SMBL

Chemical Markup language files (CML)
- More information about CML

Statistics checklist

MACMILLAN SCIENCE COMMUNICATION

- Include clearly labelled error bars on all graphs
- Define sample size, *n*, at the start of the study and for each analysis thereafter
- Give a sample size calculation/justification
- State the unit of analysis for all comparisons
- Give the alpha level and actual *P* values for primary analyses
- Clearly state all statistical methods applied, a justification and details (e.g. one- or two-tailed tests)
- Describe a clearly labelled measure of centre (e.g. median or mean)
- Include in your submission/resubmission letter to the editor that you have done all this

Statistics checklist

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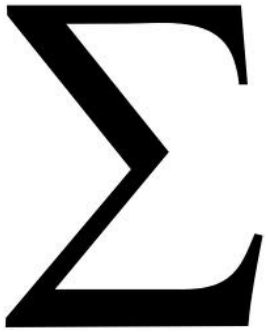

More information on checking your statistics

www.nature.com/nature/authors/gta/#a5.6

Discussion

MACMILLAN SCIENCE COMMUNICATION

- Evaluate the data and discuss their implications
- Focus on the key findings
- Justify any assumptions you make (not already discussed in full in the methods/results sections)
- The narrative should refer back to the introduction
- Consider and discuss alternative explanations
- Mention any limitations to the work

Discussing the implications

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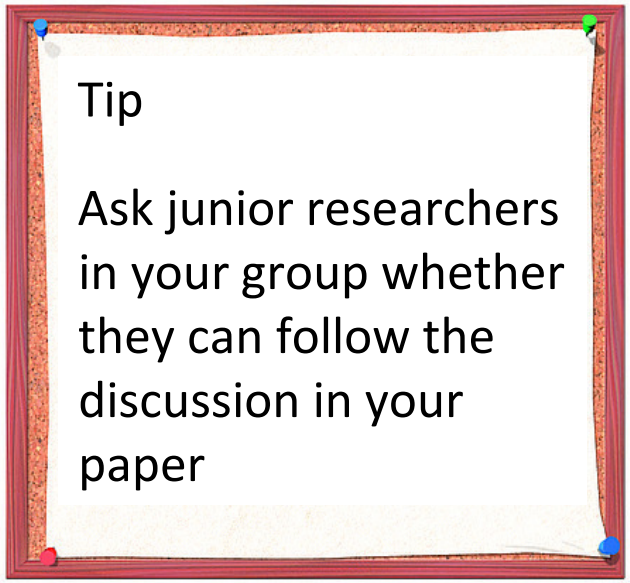
How does your work fit in with previous work?

- Agreement with other studies
- Contradictions/surprises — why?
- What do contradictions / surprises tell us?
- What does your paper add?



Modal verbs in the discussion

MACMILLAN SCIENCE COMMUNICATION

- Modal verbs are important in the discussion section
- The most commonly used modal verbs in science writing are *may*, *might*, *could*, *can*, *should*, *ought to*, *need to*, *have to*, *must*

Example

The drop in volume was due to a loss of fluid.

No modal verb here: this is a **declarative** statement — states the definite reason

The drop in volume may have been due to a loss of fluid.

Modal verb: this is a **tentative** statement — suggests a possible reason

Reference: *Science Research Writing*, by Hilary Glasman-Deal, Imperial College Press

Common pitfalls in the discussion

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- Referring to a large number of studies for the first time
- Bringing in a lot of new data not mentioned in the results
- Simply restating the results
- Not placing the results in the context of existing knowledge

An example

MACMILLAN SCIENCE COMMUNICATION

nature immunology

Greater context	The selective transcription of functionally related subsets of genes in response to inflammatory stimuli is important for achieving appropriate immune responses[11]. Here we have shown that the
Summarizing key result	Notch–RBP-J pathway selectively regulated a subset of TLR4 inducible, classic M1 macrophage–associated genes, […]. Our findings have provided a functional connection between Notch–RBP-J signalling and the IRF family of transcription factors and have identified a mechanism
Detailing key result and suggesting the exact signalling mechanism	by which RBP-J and TLR4 signalling are integrated to induce the translation of a key transcription factor […] Although IRAK2 is an integral component of the TLR signalling cascade […], little is known
Remaining gap in current knowledge (from introduction)/future work	about how the synthesis or degradation of IRAK2 protein is regulated. The exact mechanisms […] remain to be determined.
Limitations	Our results indicate that IRF8 represents such a factor, however, we were unable to rule out the possibility that RBP-J regulated the expression of TLR-inducible genes by additional mechanisms. […]
Summary	Overall, our findings have highlighted the selective regulation of TLR-inducible gene expression by Notch signalling that modulates inflammatory macrophage phenotype.

Nature Immunology **13,** 642–650 (2012)

Importance of conclusions

MACMILLAN SCIENCE COMMUNICATION

- Many readers read only the abstract and the conclusion
- This is your **last chance** to convince the reader of the importance of your work
- The art of the conclusion is to be concise yet compelling
- The conclusion does not need its own section

Tips for summarizing

MACMILLAN SCIENCE COMMUNICATION

- Consider including your own perspective
- Do not be afraid to write a **short** conclusion — less is more
- Assume readers have either read the paper or know from the title/abstract what it's about
- only if necessary, add a brief summary of the **key finding**. Not more than one or two sentences.
- Without hype or undue speculation, discuss the impact of your results and what this adds to the body of knowledge
- What could these results lead to?

Common pitfalls in the conclusions

MACMILLAN SCIENCE COMMUNICATION

- Writing redundant information, often from only one or two paragraphs above
- Not telling the reader anything about the “why bother?”
- Leaving readers guessing why these results are important

Good conclusions: Examples

MACMILLAN SCIENCE COMMUNICATION

nature

ARTICLE

doi:10.1038/nature10423

Deep sequencing reveals 50 novel genes for recessive cognitive disorders

Direct impact

We expect that these findings will have direct implications for the diagnosis and prevention of intellectual disability, and perhaps also for autism, schizophrenia and epilepsy, which often co-exist in intellectual disability patients and are frequently associated with mutations in the same genes (for example, see ref. 38; reviewed in ref. 1).

Long-term impact

Further investigation of the novel genes and networks presented here should significantly deepen our insight into the pathogenesis of intellectual disability and related disorders. Moreover, this study illustrates the power of large-scale next-generation sequencing in families as a general strategy to shed light on the aetiology of complex disorders and on the function of the underlying genes.

Nature **478,** 57–63 (2011)

Good conclusions: Examples

MACMILLAN SCIENCE COMMUNICATION

nature materials

LETTERS

PUBLISHED ONLINE: 25 SEPTEMBER 2011 | DOI: 10.1038/NMAT3119

A micromechanical model to predict the flow of soft particle glasses

Wider scope

Long-term impact

The theory and the experimental data we have presented are not very sensitive to the exact form of the interacting potential, so the generic properties reported here will be found in many other systems[23]. Our results open new strategies to estimate particle properties from macroscopic rheology and conversely provide rational tools for manufacturing and processing soft materials in industrial applications.

Good Conclusions: Examples

MACMILLAN SCIENCE COMMUNICATION

nature genetics

Identification of common variants associated with human hippocampal and intracranial volumes

Context

It has previously been hypothesized that brain imaging endophenotypes would have large effect sizes; however, this has proven not to be the case for the specific volumetric traits measured here, which had comparable effect sizes to those observed in other genome-wide association studies of complex traits[40]. Notably, the discovery sample had 99.92% power to detect variants with effect sizes of 1% of the variance for MAF ≥ 0.05. It remains to be determined whether specific genetic variations linked to volumetric brain differences are also associated with other neuropsychiatric disorders, brain function and other cognitive traits. If this is the case, neuroimaging genetics may also discover new treatment targets related to the neurobiology of these disorders, in addition to improving phenomenologically based diagnostic criteria.

How this study fits in

Significance of study

Wider perspective

Nature Genetics **44,** 552–561 (2012)

Examples that could be improved

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In conclusion, this report characterizes a novel comprehensive mouse model of autoantibody-associated cystitis, which provides various insights about establishment of the bladder autoimmunity.

Scientific Reports **2**, Article number: 317

It is concluded from the results obtained in this study that the juice of *C. paradisi* fruit (grapefruit) possesses protective and even rejuvinative effects on the liver of Wistar rats at a lower dose, but it is deleterious to the liver at higher doses.

AJPP, 15 April, 2012; 6(14), pp. 1056 - 1063

Summary

MACMILLAN SCIENCE COMMUNICATION

- In the discussion, you should evaluate the data and discuss the implication
- Structure paragraphs **top-down** — main message in the first sentence
- Use the supplementary information section freely
- Focus on the key findings and refer back to the introduction
- Don’t bring in a lot of new information
- When concluding, make sure you discuss the impact of your work

Questions

Any questions?

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Authorship

A question of responsibility

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As an author you bear responsibility, at least in part, for the content of a paper. This is not to be taken lightly. Serious debates about authorship often arise if something goes wrong (e.g. fraud) or really well (e.g. awards)

Who should be an author?

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Nature has no policy on authorship, but many institutions and academic societies such as the American Physical Society have recommendations:

"Authorship should be limited to those who have made a significant scientific contribution to the concept, design, execution, or interpretation of the research study."

APS Council, November 2002

Equally, it is important that all authors read the paper before submission.

Determining authorship: ICMJE criteria

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Authors should meet conditions 1, 2 and 3 to be credited

1. Substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data
2. Drafting the article or revising it critically for important content
3. Final approval of the version to be published

"Acquisition of funding, collection of data, or general supervision of the research group, alone, does not constitute authorship." - ICMJE

International Committee of Medical Journal Editors (ICMJE) criteria

Honorary authors

MACMILLAN SCIENCE COMMUNICATION

- This practice is strongly discouraged
- Authors who did not actually contribute to a study
- Often institute directors, deans or well-known scientists from a different institution (to ‘enhance’ an author list)
- Distorts the contributions of individual authors, reduces the credit to other authors

Changes to author lists

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Note: *Nature*'s policy

"Any changes to the author list after submission, such as a change in the order of the authors, or the deletion or addition of authors, needs to be approved by a letter signed by every author."

Deciding on order

MACMILLAN SCIENCE COMMUNICATION

- The order of authors is entirely up to the authors
- Some groups do it alphabetically
- Most often, the first authors are the ones who did most of the work, with principal investigators at the end of the list
- Some journals allow annotations identifying one or two authors who did the majority of the work (this can be important for PhD thesis defences or for job applications)

Deciding on order

MACMILLAN SCIENCE COMMUNICATION

University, Lexington, Virginia 24450, USA.

*First authorship determined by coin toss.
†Last authorship determined by coin toss.
‡To whom correspondence should be addressed. E-mail: mark.springer@ucr.edu (M.S.S.); wmurphy@cvm.tamu.edu (W.J.M.)

Impacts of the Cretaceous Terrestrial Revolution and KPg Extinction on Mammal Diversification

Robert W. Meredith,[1*] Jan E. Janečka,[2*] John Gatesy,[1] Oliver A. Ryder,[3] Colleen A. Fisher,[2] Emma C. Teeling,[4] Alisha Goodbla,[4] Eduardo Eizirik,[5] Taiy[illegible] [illegible] Stadler,[6] Daniel L. Rabosky,[7] Rodney L. Honeycutt,[8] [illegible]gram,[9] Cynthia Steiner,[3] Tiffani L. Williams,[11] [illegible] Burk-Herrick,[1,13] Michael Westerman,[14] [illegible]ringer,[1†‡] William J. Murphy[2†‡]

[illegible]ivergence times, and diversification patterns among extant [illegible]on supertree methods and local molecular clocks. We constructed [illegible]mmalian families and analyzed these data with likelihood-based [illegible]clocks. Phylogenetic analyses resulted in a robust phylogeny with [illegible]es from supertree methods. Relaxed clock analyses support the [illegible]n and highlight the importance of including multiple fossil [illegible]ss the tree. Molecular time trees and diversification analyses [illegible]retaceous Terrestrial Revolution and Cretaceous-Paleogene (KPg) [illegible]ospace that promoted interordinal and intraordinal diversification, [illegible]tation analyses provide no support for the hypothesis concerning [illegible]mammals during the Eocene Period.

[illegible] of living mam- [illegible]verse ecological [illegible], fossorial, vo- [illegible] some of which exhibit 100 million–fold differences in body mass (*1*, *2*). Mammals exhibit striking examples of ecomorphological convergence that has led to contentious debates in modern systematics (*3*–*5*). The diversity of living and extinct mammalian species is documented by the fossil record of ~220 million years and has evolved against the backdrop of radical alterations in terrestrial floras during the Cretaceous Terrestrial Revolution (KTR), the Cretaceous-Paleogene (KPg) mass extinction, continental rearrangements, and changes in key environmental parameters, such as average global temperature. However, the impact of these drivers on taxonomic diversification, particularly near the KPg boundary, remains controversial (*6*–*8*).

Previous molecular studies have elucidated mammalian interordinal relations (*9*–*11*). One study (*8*) that examined relations and divergence times among all living mammalian families used matrix representation with parsimony (MRP) supertrees and was compromised by including numerous source phylogenies with overlapping data (*12*, *13*). The supertree study (*8*) proposed that there was a dramatic upturn in diversification rates in the Eocene ~55 to 50 million years ago (Ma), but this hypothesis was inferred from a topology that contained numerous polytomies and was dated with a combination of local molecular clocks and pure birth interpolation for internal nodes. Even with these limitations, this time tree (*8*) underpins numerous studies in comparative biology (*14*–*17*). Here, we report an analysis of relations, divergence times, and diversification patterns among 97 to 99% of mammalian families (*1*, *2*) on the basis of a molecular supermatrix that includes 164 mammals, five outgroups, and 26 gene fragments (tables S1 and S2). The resulting DNA and protein alignments comprise 35,603 base pairs (bp) and 11,010 amino acids, respectively. Divergence time estimates from molecular data used a large assemblage of fossil calibrations (table S3).

Phylogenetic relations from maximum likelihood (ML) and Bayesian methods are well resolved across the mammalian tree. More than 90% of the nodes have bootstrap (BS) support of ≥90% and Bayesian posterior probabilities (BPP) of ≥0.95 (Fig. 1, figs. S1 to S4, and table S4). Amino acid and DNA ML trees are in agreement for 163 out of 168 internal nodes (figs. S1 to S4). The MRP supertree (*8*) failed to recover ~30% of our well-supported nodes (Fig. 1). These disagreements occur in some of the most speciose mammalian clades, including bats, rodents, and carnivorans, and may potentially affect the conclusions of numerous studies that have relied on the MRP topology. Our phylogeny improves upon previous resolution (*8*) and provides a character matrix–based framework for reevaluating early mammalian divergence times.

Results derived from coalescence methods (*18*, *19*) were broadly similar to ML and Bayesian supermatrix methods but, in some cases, failed to recover well-substantiated clades such as Amniota, Haplorhini, and Odontoceti (*13*) (figs. S5 to S8). Coalescence methods assume that discrepancies between individual gene trees and the species tree are solely the result of incomplete lineage sorting, but our results suggest otherwise and highlight difficulties of applying coalescence methods to deep-level phylogenetic problems where differences between individual gene trees often result from problems such as long branch attraction (*13*).

Rates of molecular evolution range over an order of magnitude for mammalian lineages (*20*, *21*) and present an exceptional challenge for estimating divergence times. Mammals also have a fossil record that provides numerous constraints for calibrating relaxed clocks (*22*). Accordingly, we selected minimum and maximum constraints for 82 different nodes (table S3). Unlike previous studies (*8*–*11*), outgroup representation in our analyses provided well-constrained fossil calibrations that precede mammalian diversification and allowed us to bracket controversial interordinal divergences with both older and younger calibrated nodes. Further, we used relaxed clock molecular dating methods that utilized eight different combinations of molecule type (DNA versus amino acids), evolutionary rate (autocorrelated versus independent rates), and hard- versus soft-bounded constraints.

Molecular time-tree analyses that used subsets of constraints that were either temporally restricted (deep versus shallow nodes) or topologically confined to groups with fast (rodents) or slow (cetaceans) rates of molecular evolution resulted in poor estimates of divergence times that are in direct conflict with the fossil record (*13*) (table S5). For example, the fossil record provides robust support for the origin of crown-group mysticetes (baleen whales) no later than 20.4 Ma (*23*), but soft-bounded analyses with only rodent constraints suggested an age as young as 4 million years for Mysticeti. These results demonstrate that lineage-specific rate variation can have severe effects on resulting divergence dates when fossil calibrations are sparse and/or unevenly distributed throughout the tree and further suggest that appropriate caution should accompany molecular time-tree analyses for taxonomic groups

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Science **334,** 521 (2011)

The corresponding author

MACMILLAN SCIENCE COMMUNICATION

- Is solely responsible for communicating with the journal and managing communication between co-authors
- Coordinates communication between senior team members on multi-group collaborations
- Ensures that all authors are included in the author list, that its order has been agreed by all authors, and that all authors are aware that the paper was submitted
- Is the point of contact for queries from the journal about the published paper
- Is responsible for informing all co-authors of matters arising and ensuring such matters are dealt with promptly

Author contribution statements

MACMILLAN SCIENCE COMMUNICATION

- Statement of responsibility in the manuscript that specifies the contribution of every author
- Mandatory at *Nature* since 2009
- Important to identify personal contributions to a study
- Addresses issue of author responsibility

Examples

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S.H.C. designed and performed experiments, analysed data and wrote the paper; N.C., M.T. and J.M.G. designed and performed experiments; D.R. and M.B.G. developed analytical tools; and C.I.B. designed experiments, analysed data and wrote the paper.

T.J. and U.H.v.A. designed the study; T.J., E.A.M., M.I., S.M. and P.A.L. performed experiments; T.J., E.A.M., M.I. and S.M. collected and analysed data; M.B., K.F., N.C.D.P., D.M.S., N.v.R. and S.P.W. provided reagents and mice; T.J., E.A.M., M.I. and U.H.v.A. wrote the manuscript; S.M., K.F., S.E.H., T.M. and S.P.W. gave technical support and conceptual advice.

All authors contributed extensively to the work presented in this paper.

Acknowledgements

MACMILLAN SCIENCE COMMUNICATION

- The Acknowledgements section can be used to acknowledge scientific contributions from someone who does not qualify for authorship
- This could be outside reviewers of the manuscript draft or sources of funding
- Usual style requirements are more relaxed, but keep these simple and brief

Summary

MACMILLAN SCIENCE COMMUNICATION

- Authorship is reserved for those who have made an active scientific contribution to the manuscript
- The International Committee of Medical Journal Editors (ICMJE) has criteria for authorship that can be used as a guide

Quiz

Professor Smith, the head of the lab, is publishing a paper on the structure of chitin.

Professor Smith's lab collaborated with a high profile lab group in Sweden that had already engineered and published the correct gene construct to express chitin *in vitro*, and who sent some of their materials to help Professor Smith's team.

Professor Smith's post-doc, Mary, did the majority of the lab work, staying late and working long hours to get the necessary data. A final year PhD student, Jiang, and a technician, Oliver, both helped Mary do some of the technical work.

Professor Smith did not write any of the paper, but reviewed and edited Mary's drafts that she sent to him. He is writing the cover letter and submitting the paper to *Nature*. Mary wrote the bulk of the paper but for the Introduction she used paragraphs of text directly from Jiang's unsubmitted, draft thesis.

Who should be listed as an autho

The high profile lab group in Sweden?

Questions

Any questions?

MACMILLAN
SCIENCE COMMUNICATION

Editing, Revising and Finalizing

Editing your own work is essential

MACMILLAN SCIENCE COMMUNICATION

"As a reviewer, I see a lot of papers that are sent in with the idea that they [the authors] will do the final editing after the reviews (or perhaps that the reviewers will provide what they [the authors] need to edit to final form).

My personal view is that when you submit a paper it should be in final form and that you should be comfortable with the paper going directly to press as is.

It is a waste of time for all of us to review anything less."

Jim Steenburgh, University of Utah

Eloquent Science, David M. Schultz, AMS 2009, p167

Editing your own work is essential

MACMILLAN SCIENCE COMMUNICATION

- Writing good text is not easy
- First drafts are useful to get down a rough idea
- Editing helps to refine and enhance your text
- The purpose of editing is not only to refine language but also to review the entire draft, from the presentation to the content and structure

➢ You will be surprised how bad first drafts can be…

Detailed checklist: Overall structure

MACMILLAN SCIENCE COMMUNICATION

- ✓ Is the overall structure appropriate? Double-check the order of sections and subsections
- ✓ Rethink the headings: are they missing or superfluous?
- ✓ Is the text coherent? How about the transitions between different sections?
- ✓ Is the order of the figures and tables correct?
- ✓ Does the text flow smoothly between paragraphs?

Detailed checklist: Paper content

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Once you are satisfied with the structure of a paper, do a thorough review of the content

- ✓ Is the paper written clearly and understandably?
- ✓ Have you pitched it to the right audience?
- ✓ Does it get all the relevant points across?
- ✓ Is the text in the right section?
- ✓ Could you simplify the text without losing the meaning?
- ✓ Is all information accurate and complete?

Detailed checklist: Paper content

MACMILLAN SCIENCE COMMUNICATION

- ✓ Is all figure content correct and not misleading?
- ✓ Are all concepts explained to a level of detail appropriate for the intended audience? Check for jargon
- ✓ Are all methods adequately explained?
- ✓ Are all acronyms explained when first used and all technical terms clarified?
- ✓ Are all sources cited? Have quotes been marked up with quotation marks?

Some practical tips

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- Ask others for comments
- Leave some time between writing and editing. Sleep on it, and take a fresh look the next day. You will be surprised!
- If English is not your first language, ask a native English speaker to read your paper
- Be brutal and uncompromising when editing yourself
- It is normal to rewrite entire sections from scratch
- Carry out this process more than once

Knowing when to stop

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- When neither you nor your colleagues have further major improvements
- Even if you are not entirely happy, at some stage it is better to let go. Nothing is ever perfect
- Don’t forget that peer reviewers may have further good advice, **BUT** peer reviewers are not your personal copy editors. Prepare a thorough, good draft to the best of your abilities
- Some journals have professional copy editors in-house

Summary

MACMILLAN SCIENCE COMMUNICATION

- The manuscript you submit should be in its final form
- Go through the manuscript checklist (in your handout folders)
- Ask others for comments

Questions

Any questions?

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Choosing and Submitting to a Suitable Journal

Where should I publish my work?

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Factors to take into account

1. Audience
2. Scope
3. Publication frequency
4. Quality of other papers published
5. Publication form (print/online)
6. Open access/subscription based
7. Technical-peer-review-only journals

1. Audience

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- The audience is probably the most important aspect when deciding where to submit
- A paper will find recognition only if it reaches the right audience
- Some studies are better for a highly specific audience; others are more suited to a broad readership
- Does the intended journal typically cover your field of research?

2. Scope

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- Some journals are dedicated to specific issues only
- Others publish specialized studies but across a larger range of research fields
- Some journals are broad in scope yet selective

3. Publication frequency

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- For urgent results, choose a journal that publishes frequently and has a fast turnaround time
- Many journals publish papers online ahead of a full issue, typically on a weekly basis
- Look at average times between submission and acceptance dates of a journal's published papers to get an indication of average turnaround times

4. Quality of other papers published

MACMILLAN SCIENCE COMMUNICATION

- Beyond the scope and the selection criteria of a journal, it is impossible to assign an objective number to a journal's impact
- The ‘impact factor’ is an attempt at a rough estimate of quality
- Impact factors are gathered and sold by Thomson Reuters (formerly The Institute for Scientific Information, ISI)
- Impact factors are a very short-term metric
- There are other citation metrics available

4. Quality of other papers published

MACMILLAN SCIENCE COMMUNICATION

Impact factors are a very short-term metric

A = the number of times articles published in 2009 and 2010 were cited during 2011

B = the total number of 'citable items' published by that journal in 2009 and 2010

2011 impact factor = *A* / *B*

4. Impact factors 2011

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Rank	Journal Title	Total Cites	Impact Factor	Articles
1	CA: A CANCER JOURNAL FOR CLINICIANS	10976	101.78	19
2	NEW ENGLAND JOURNAL OF MEDICINE	232068	53.298	349
3	ANNUAL REVIEW OF IMMUNOLOGY	15990	52.761	23
4	REVIEWS OF MODERN PHYSICS	31368	43.933	38
5	CHEMICAL REVIEWS	103702	40.197	196
6	NATURE REVIEWS MOLECULAR CELL BIOLOGY	29222	39.123	66
7	THE LANCET	158906	38.278	276
8	NATURE REVIEWS GENETICS	20384	38.075	71
9	NATURE REVIEWS CANCER	28602	37.545	68
10	ADVANCES IN PHYSICS	4400	37	9
11	NATURE	526505	36.28	841
12	NATURE GENETICS	76456	35.532	196
13	ANNUAL REVIEW OF BIOCHEMISTRY	18684	34.317	41
14	NATURE REVIEWS IMMUNOLOGY	22613	33.287	69
15	NATURE MATERIALS	39242	32.841	134

4. Note of caution on impact factors

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- Depend heavily on the size of the field
- Do not reflect individual articles
- Include self-citations (journal and author)
- Review articles skew impact factors
- Linked to publication time of journal (two-year time frame)
- Publishing in high-impact journal does not guarantee high citations
- Citations to retracted articles are still counted in the impact-factor calculation

5. Publication form: Print/online

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- Print-only was the norm until recently
- Vast majority of reputable international journals now publish online as well
- Increasing number of online-only journals: conversions from print, as well as ‘born digital’
- NPG publishes an increasing number of online-only journals, including *Nature Communications*
- Bottom line: for authors print-only probably not ideal; no substantive difference for authors between print + online and online-only. However, do carefully consider the quality of the online presentation of your paper at potential journals

6. Open-access/subscription model

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Open access

- Open-access journals: author (or funder) pays fee to make article available to be read free online
- Hundreds of open-access journals today and rapidly increasing
- *Nature Communications*, NPG's first open-access journal (hybrid) http://www.nature.com/ncomms/index.html
- The 'green' route to open access: online repositories of published papers or of preprints http://www.pubmedcentral.nih.gov and http://arxiv.org/

7. Technical-peer-review-only journals

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- New range of journals that publish everything that is technically correct, without regard for impact
- Open access, online only
- Large number of papers
- Will these replace expensive, highly specialized journals?

PLoS one
www.plosone.org

SCIENTIFIC REPORTS

Other considerations

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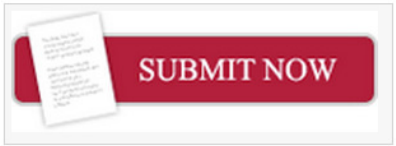
- Who owns the journal? (e.g. an academic society you feel strongly about)
- Copy-editing, other production services
- Services offered beyond print
  - Online search tools
  - Online commenting
  - Digital meta-information: e.g. linking chemical formulae or crystal structures with databases
- Your likelihood of acceptance!

Submission procedure



- Most journals have online submission procedures
- Include a cover letter indicating that it is a new publication and results are not being considered elsewhere
- **No manuscript should be submitted simultaneously to more than one journal**

Things you may be asked to include

MACMILLAN SCIENCE COMMUNICATION

- Referee suggestions (inclusions but especially also exclusions)
- Biographies of all authors
- Statement of contributions by all authors
- Evidence of ethical approval/statements that the experiments carried out comply with animal care and human subject laws
- Statement on conflict of interest
- Statement that manuscript is not simultaneously being considered at another journal

The right digital format

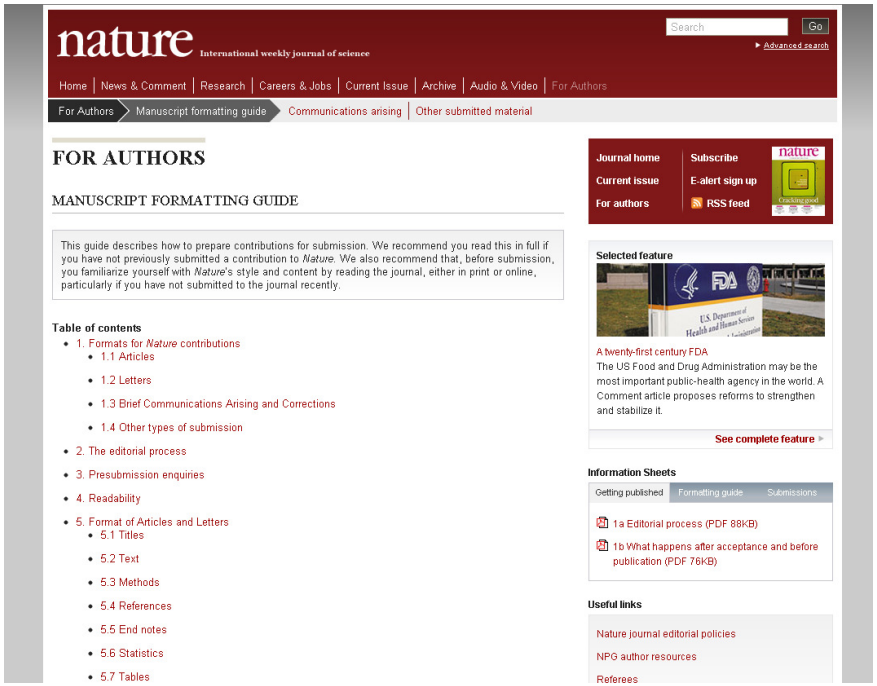
MACMILLAN SCIENCE COMMUNICATION

- Paper in original format: common word-processing software
- Check whether a journal requires certain templates (e.g. *Science*)
- Figures in TIFF (.tif), high-resolution PDF (.pdf), encapsulated PostScript (.eps) or vector graphics format
- Supplementary material such as videos in a format accepted by the journal
- If possible, make sure all files are correctly uploaded

Formatting

MACMILLAN SCIENCE COMMUNICATION

- Follow the journal's guidelines
- Manuscripts should be double-spaced and have page and line numbers
- Start each section on a new page
- Put each table on a separate page



Pre-submission enquiries at *Nature*

MACMILLAN SCIENCE COMMUNICATION

- At *Nature*, submit an abstract with covering paragraph; we will tell you within 2 - 3 days whether you should submit the whole paper
- We receive approximately 120 per month
- About one-third of the time, we ask for the whole paper

Cover letter: things to include

MACMILLAN SCIENCE COMMUNICATION

Dear Editor,

Please find enclosed our manuscript, [manuscript title] by [first author's name] et al., which we would like to submit for publication as a [publication type] in [name of the journal].

To our knowledge, this is the first report showing...

We believe our findings would appeal to the readership of [journal name]...

Possible referees we would suggest...

Please address all correspondence to:
We look forward to hearing from you at your earliest convenience...

The basics:

- Letter format
- Title of the research paper
- Intended submission type (article, report, letter, review etc.)

The background:

- Very brief background on the research field (what are the open questions, and why are they important?)
- A brief about the paper's objectives and findings
- Why is the study relevant?

The contact details:

- Referee suggestions and exclusions
- Details about the authors and their affiliations
- Contact information for the corresponding author

http://www.springer.com/authors/journal+authors/journal+authors+academy

Example cover letter: Physics

MACMILLAN SCIENCE COMMUNICATION

Dr Nghi Q. Lam
Editor
Applied Physics Letters

November 3, 2010

Dear Dr Lam,

Submission details

Please find enclosed our manuscript entitled "Tailoring hole spin splitting and polarization in nanowires" by Dan Csontos et al., which we would like to submit for publication in *Applied Physics Letters*.

Background/context

The continuing drive to miniaturize device features on integrated circuits is fast approaching a realm where the microscopic quantum-mechanical properties of charge carriers determine electric transport. Spintronics (short for spin electronics) aims to capitalize on quantum effects by using the intrinsic spin of electrons, instead of their charge, as the principal carrier of information. To realize that aim, efficient means to encode, transport, store and manipulate electron spins need to be devised.

Objectives/findings

In this paper we demonstrate that the spin of holes – the positive mobile charge carriers in p-type semiconductors – can be sensitively manipulated when confining them to move in just one spatial dimension, as in a nanowire. Our analytical and numerical quantum mechanical calculations reveal surprising qualitative differences in the hole spin properties (such as spin splitting and polarization) of nanowires depending on the spin-orbit (SO) coupling strength as well as the degree of spatial confinement (the lateral dimensions of the wire).

Relevance

The theoretical results suggest the possibility of engineering of hole spins for spintronic applications, using as building blocks, for example, nanowires which can be readily grown by self-assembly.

Example cover letter - Physics

MACMILLAN SCIENCE COMMUNICATION

We believe our findings would appeal to the audience of *Applied Physics Letter*. As a wide-reaching journal publishing original research on all aspects of spintronics, we believe *Applied Physics* represents the perfect platform for us to share our results with the international research community.

Referees

As possible referees we would like to suggest

1. Prof. Roland Winkler – expert in theory of SO-coupling effects in nanostructures
   Northern Illinois University
   Phone: +1 815 753 6475
   rwinkler@niu.edu

2. Prof. Michael Flatté – expert in spintronics (theory)
   University of Iowa
   Phone: +1 319 335 0201
   michael-flatte@uiowa.edu

Statements

We confirm that this manuscript has not been published elsewhere and is not under consideration by another journal. All authors have approved the manuscript and agree with submission to *Applied Physics Letters*. The authors have no conflicts of interest to declare.

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Please address all correspondence to:
Dr. Dan Csontos
Division of Solid State Physics, Lund University
P.O. Box 231, Lund, SE-22100
Sweden
Phone: +46 46 123 4567
E-mail: d.csontos@ftf.lth.se

We shall look forward to hearing from you at your earliest convenience.

Yours sincerely,
Dan Csontos, on behalf of all authors

Cover letter: A bad example

MACMILLAN SCIENCE COMMUNICATION

November 26, 2002

Editor
Nature Genetics
345 Park Avenue South, 10th Floor
New York, NY 10010-1707
USA

Dear Editor,

It is not clear why a cover letter is required except to fulfill the silly British preoccupation with letterhead and other emblems of status.

Please accept my correspondence.

Sincerely,

_____

Cover letter: things to include

MACMILLAN SCIENCE COMMUNICATION

All cover letters should contain these statements:

- “We confirm that this manuscript has not been published elsewhere and is not under consideration by another journal”.
- “All authors have approved the manuscript and agree with its submission to [name of journal].”
- “The authors have no conflict of interest to declare” or “The authors have a conflict of interest to declare”…

Conflicts of interest

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http://www.nature.com/authors/policies/competing.html

- **Funding:** research support (including salaries, equipment, supplies, reimbursement for attending symposia and other expenses) by organizations that may gain or lose financially through the publication

- **Employment:** recent (while engaged in the research project), present or anticipated employment by any organization that may gain or lose financially through the publication

- **Personal financial interests:** stocks or shares in companies that may gain or lose financially through publication; consultation fees or other forms of remuneration from organizations that may gain or lose financially; patents or patent applications whose value may be affected by publication.

Declaring conflicts of interest

MACMILLAN SCIENCE COMMUNICATION

In print

Additional information

The authors declare competing financial interests: details accompany the paper at www.nature.com/naturematerials. Supplementary information accompanies this paper on www.nature.com/naturematerials. Reprints and permissions information is available online at http://npg.nature.com/reprintsandpermissions. Correspondence and requests for materials should be addressed to R.W.

Online

Declaration of competing financial interests

From the following article
Complementary resistive switches for passive nanocrossbar memories
Eike Linn, Roland Rosezin, Carsten Kügeler & Rainer Waser
Nature Materials **9**, 403 - 406 (2010) Published online: 18 April 2010
doi:10.1038/nmat2748

back to article

Declaration: A patent application has been submitted by RWTH Aachen and Forschungszentrum Jülich based on these results.

Data deposition

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"Thou shalt share your data"

Nature Methods **5,** 209 (2008)

- Reviewers need to see the raw data
- Nature recommends depositing supporting data such as genome sequences, microarray data or protein structures into a **community-endorsed public repository**, and then citing the accession number in the manuscript
- The sheer volume of data can often exceed the supplementary information section limit
- The *Nature Methods* blog has good links to various recommended databases for depositing all types of data

  http://blogs.nature.com/nmeth/methagora/

Summary

MACMILLAN SCIENCE COMMUNICATION

- Ensure you have a great final draft
- Follow the journal's instructions to authors
- Don't skimp on the cover letter

Summary

MACMILLAN SCIENCE COMMUNICATION

- Ensure you have a great final draft
- Don’t skimp on the cover letter
- When deciding which journal to submit to, the **audience** may be the most important factor to take into account
- It is also valuable to look at the scope, the publication frequency, the quality of other papers published and the publication form (print/online) of the journal you have in mind
- Also keep in mind your likelihood of acceptance at that journal
- Use impact factors with caution

Group discussion

Coffee break until 4pm

MACMILLAN
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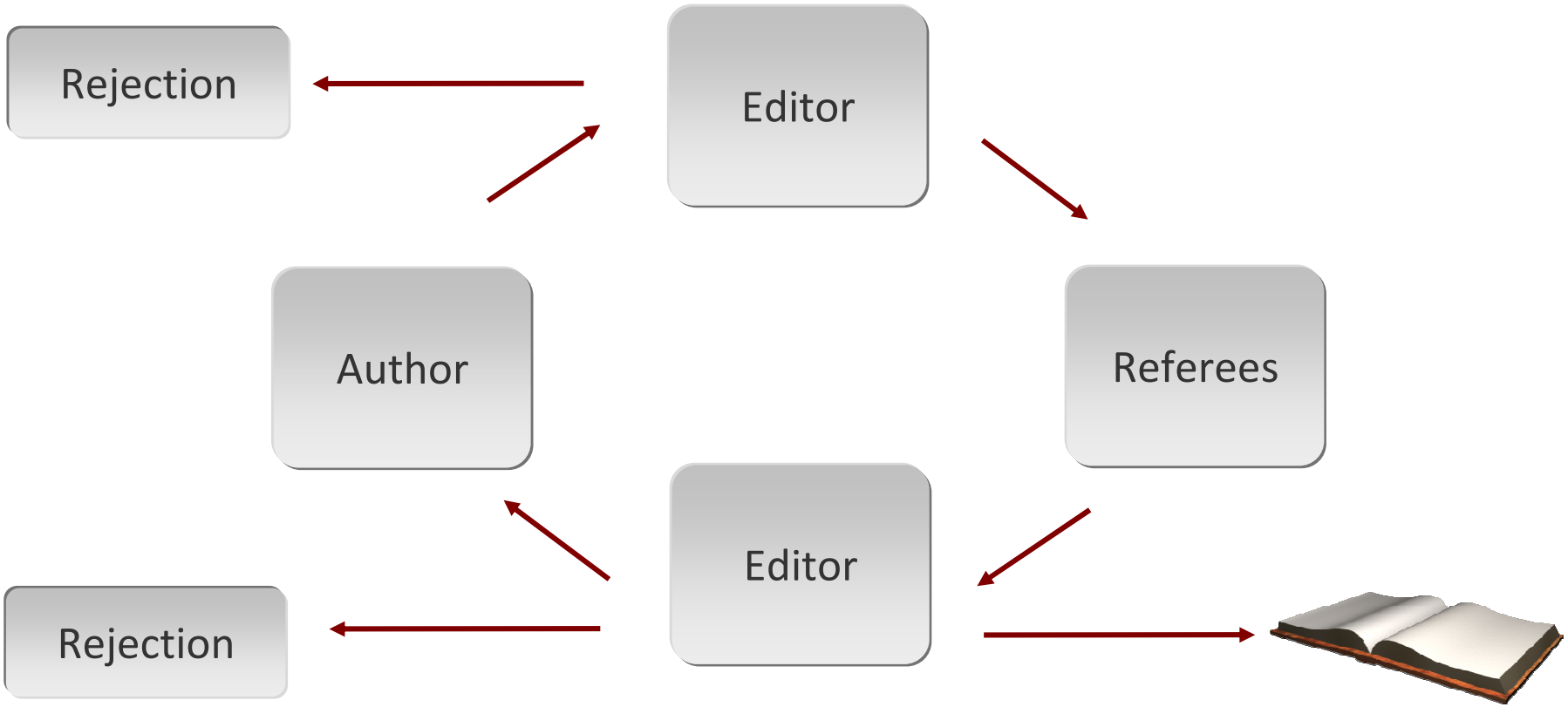
The Editorial Process and Peer Review: How it Works

The process



Different philosophies

MACMILLAN SCIENCE COMMUNICATION

- Professional versus academic editors
- Independent editors versus academic board
- Strong or weak initial editorial screening

The editorial process

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Initial editorial questions at top-tier journals

- Where does the paper fit into the field?
- Is it original?
- Does it represent a significant leap forward?
- What are the broader implications of this work?
- Is it of interest to the journal audience?

Note: for high-impact journals, it is impact and not impact factor that counts

Typical checks at *Nature* journals

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- We read the whole paper!
- Novelty of arguments made
- Supporting data in favour of claims
- Cited references: completeness, important omissions
- Prior related studies by the authors and others

Online Manuscript Tracking System

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- Papers allocated to all editorial offices as they arrive
- All files online — efficient decision making
- Speeds up every step of the process

Home Page for Ritu R Dhand

Author Tasks

- Author Instructions
- Submit Manuscript

Editor Tasks

- Send Invitation
- Find Manuscript
- Search Commissioning Database
- Find Person
- Manage Accounts
- Advanced Manuscript Tasks
- **Chase All**
- Reports
- Previous Manuscripts Report

Invited and Agreed 5 All 0 PE

Editor Assignment 37 All

Manuscript Assessment Before Review 226 All 9 PE 0 SE

Contact Potential Referees 91 All 0 PE 0 SE

Under Review 0 PE 0 SE

Draft Editor Recommendations 36 All 0 PE 0 SE

Review Circulated Recommendations 29 All 0 PE 0 SE

Manuscript Decision 59 All 0 PE 0 SE

Decisions Ready for Author 2 All 0 PE 0 SE

All Pending Manuscripts 1633 All 11 PE 2 SE

Queued E-mail 10 All 1 PE 0 SE

Post Decision All

Accepted - Waiting for Production 4650 All 5 PE 18 SE

Accepted - Sent to Production 12 All

Waiting for Revised Manuscript 961 All 2 PE

Declined 50039 All

Transferred 3770 All

Staff Tasks

Nature: Some numbers

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- 1 week: typical time for the initial editorial assessment
- 5 - 10%: proportion of papers accepted by leading journals
- 2 - 4: typical number of peer reviewers per paper
- 4 - 5 weeks: average turnaround time during review process

A strong contender for review at *Nature*

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- A clear presentation of an interesting question
- An introduction that creates interest — why should the reader care?
- Strong, well-controlled data
- Rules out some alternative explanations
- Speculation that doesn't 'stretch' the data
- A discussion that puts the paper in perspective

Fundamentals of peer review

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- Peer review is expert advice
- Typically ‘blind’ peer review: the reviewers know the authors’ names, but the authors do not know the identity of the reviewers
- Reviewers should be independent and not have any positive or negative bias towards authors (they need to declare any such interests to the editor)

Why peer review?

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- An editor cannot know all the details — this is the reason why peer review has been almost universally used since the mid-20th century
- More opinion lessens the danger of bias from the editor/referees
- A first check for technical correctness
- It helps to screen papers for possible relevance

Peer review is a modern tool

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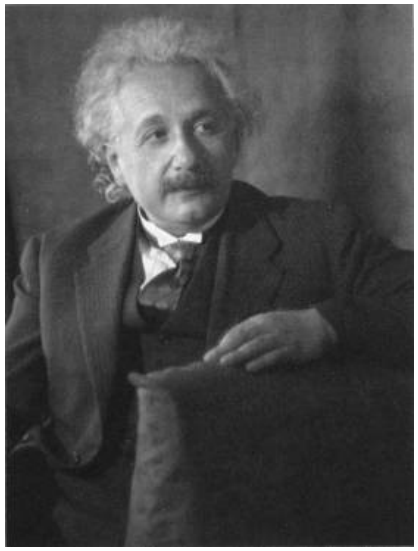

Dear Sir,

We (Mr. Rosen and I) had sent you our manuscript for publication and had not authorized you to show it to specialists before it is printed. I see no reason to address the — in any case erroneous — comments of your anonymous expert. On the basis of this incident I prefer to publish the paper elsewhere.

Respectfully,

Albert Einstein

Exceptions at *Nature*:

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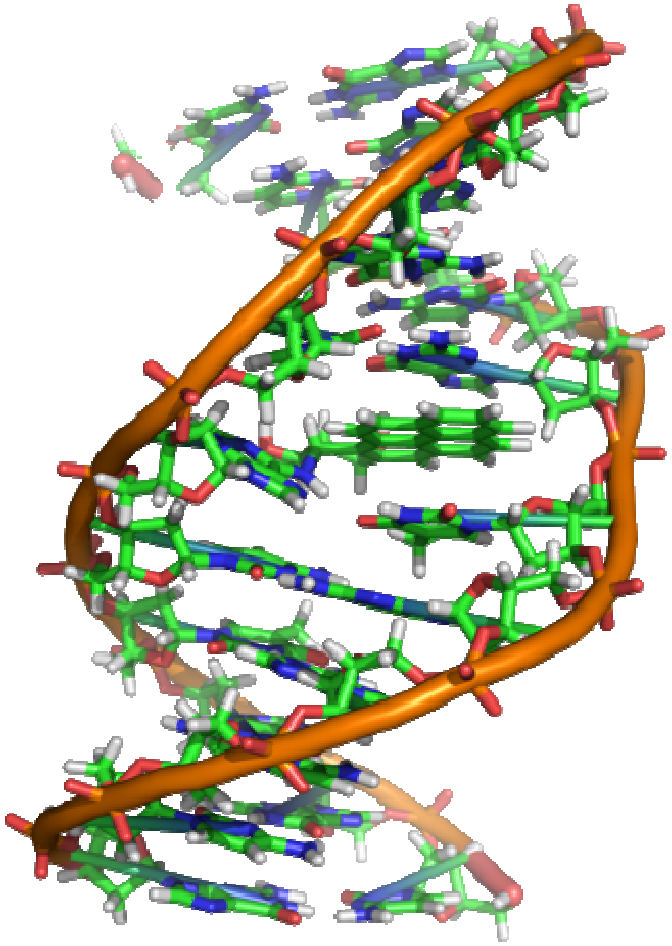
Watson and Crick's 1953 *Nature* paper on the structure of DNA apparently was not sent for peer review

John Maddox, *Nature*'s former editor:

“The Watson and Crick paper was not peer-reviewed by *Nature*...the paper could not have been refereed: its correctness is self-evident. No referee working in the field...could have kept his mouth shut once he saw the structure."



The choice of referees at *Nature*

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- Experience in the field
- Broad overview of current trends and important issues
- Efficient (we ask for a 1- or 2-week turnaround)
- History of thorough and to-the-point reports that are fair-minded and constructive
- No conflict of interest

Drawbacks of peer review

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- We are all prone to mistakes
- Inaccurate — small set of opinions
- Never 100% objective
- Can be slow
- Implicit trust in authors — cannot catch fraud
- Not a perfect metric — can be inconsistent

Common misconceptions

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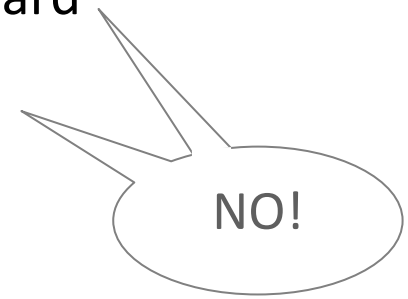
- Peer review guarantees an equal level of standard
- Peer review guarantees technical correctness



BUT: Peer review does add value

74% of scientists agreed that their paper had been improved by the process

20% felt neutral

Only 6% disagreed

Source: ***Nature*'s trial of open peer review.** Sarah Greaves, Joanna Scott, Maxine Clarke, Linda Miller, Timo Hannay, Annette Thomas, Philip Campbell. doi:10.1038/nature05535

Referee reports

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- Example of a referee report from *Nature*
- What the author sees…

[redacted]'s Comments (Referee #4) - 2nd August 12

Note	Comment
Remarks to the Author	Review of [redacted] et al In this MS, the authors investigate the role of the [redacted] in regeneration of the chick retina. They use verystraightforward experimental strategies to investigate, and provide data insupport of the conclusion that [redacted], though a signaling pathway that involves [redacted], is capable of stimulating regeneration of the retina. Comments 1. In essence this is a very interesting and topical manuscript. We are only just starting to uncover the activities of complement components outside their traditional roles and this MS makes a very valuable contribution to this area. Though it has been previously recognized that [redacted] plays a role in regeneration of the liver, this is the first time that a nervous tissue has been shown to respond in a similar way. From this point of view,this is a very worthy analysis. 2. The nature of the experimental system - where the regeneration of retina is monitored after retinectomy - has required that most analysis is performed using modulatory agents that can be directly delivered to the chick eye. This has limited somewhat the kind of experiments can be performed. The advantage is that the story is very straightforward, the disadvantage is that some of the analysis is not that sophisticated and it is not easy, for example, to establish convincingly the relationships between different components of the signaling pathway. Despite this limitation, thebasic observation of [redacted] involvement in regenerative activity is convincing. 3. In several places in the MS, data is shown that compares the regenerative response to [redacted] and [redacted] What is missing is a comparison with the normal developmental process in the retina. For example, the number of amacrine cells that arise in response to [redacted] or [redacted] has been quantified, but it is not clear which of these is closer to the number normally found. Obviously, it might be necessary to choose a developmental stage from the normal chick that is a fair comparison, but nonetheless this information would be very valuable. 4. For the experiments assessing the activity of [redacted], it would be necessary to show that the agent can block [redacted]-dependent regeneration before this negative result can be interpreted. With the analysis presented, it remains possible that [redacted] activity is a necessary component of the [redacted]-dependent regenerative response. 5. More generally, it would be a valuable enhancement ofthis analysis if the relationship between [redacted] and [redacted] signaling was betterunderstood. Even if, with further analysis, [redacted] signaling is shown not to be a component of [redacted]-dependent regeneration, it remains possible that [redacted] is required downstream of [redacted]-dependent regeneration. The use of inhibitors coupled to protein and RNA expression analysis could settle this question. This might also help explain the distinct features (like amacrine cell numbers) apparent in [redacted] versus [redacted]-dependent regeneration.

Referee reports

- Another example of a referee report from *Nature*
- What the editor sees…

Remarks to the Editor	The current text does a poor job of convincing a reader of the findings, and does little to make the important findings digestible. A friendly reader or the authors' mothers might be the only people that would think the present treatment does enough to present the points…

Summary

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- Different types of editorial boards and editorial screening at different journals
- At top-tier journals, the editors are generally looking for:
  - novelty of arguments
  - solid supporting data
  - cited references
  - originality
  - interest to the scientific community
- Peer review is a first check for technical correctness
- It also helps to screen papers for possible relevance

Questions

Any questions?

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Journal Decisions: Acceptance, Rejection or Revision

Decisions after refereeing

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- **Three basic categories of decision: REVISE, REJECT and ACCEPT**
- Referees provide advice to editors on perceived impact and importance of a paper, as well as on technical correctness
- Editors make decisions based on arguments and don't count votes
- Most papers experience two rounds before publication
- Most journals can be patient and wait for additional experiments to be completed

REVISE: Dealing with referee reports

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- If invited to resubmit, only do so when you are able to comprehensively address all comments
- If further experiments are requested, don't try to argue your way around this (there are exceptions)
- Stay professional. Insults, arrogance and bullying are counterproductive
- Referees are only human and can make mistakes. Don't forget that these are colleagues in your field, and you will have to deal with them again
- The editor is who you need to pay attention to

REVISE: Example rebuttal after peer review

MACMILLAN SCIENCE COMMUNICATION

29th July 2012

Dear Editor.

Submission details and background

We thank you for your consideration of our manuscript entitled 'The role of Exo34 in the bovine pathological responses to bacterial invasion' in Nature. We are truly grateful for the constructive feedback provided, particularly from reviewer 4.

We agree with the criticisms put forward and indeed anticipated some of these after submission. We were particularly amenable to the idea of additional gene expression experiments using Exo35 and comparative analysis of this with the expression profile of Exo34.

What has been changed

As a result of the reviewers comments, we have carried out additional work and we are confident that our revised article will now meet the expectations of the reviewers as it includes the additional experiments and analysis suggested which support the arguments in the main text. We have also revised the text as suggested by the review team.

We have addressed the five main comments from the reviewers, which are listed below with our responses. After reviewing the comments below, we would like to request that you consider a revised draft of our paper.

Objectives/findings

1) Referee 1, 2, 3, Major Comment: No overexpression data of Exo35
Our response: this work now completed…

2) Referee 1, 2, 3, Major Comment: No comparative data with related gene Exo35
Our response: This data will be replaced by Exo35

…

REJECT: Reasons for rejection

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- Severe technical problems
- Over-interpretation: data don't support conclusions
- Lacking mechanistic insight, or a catalogue of data without new insight
- Raises many interesting possibilities, but doesn't distinguish between them
- Lacking significant novelty
- Novel, but not a large enough step in the field
- Only of interest to specialists in a subfield
- No broad conclusions

REJECT: Dealing with rejection

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Never give up!

- You can appeal
- Take comfort from past rejection of great scientists.
- There are other journals
- You are bound to resent negative referees — editors try to ensure that criticism is constructive

REJECT: Appeals

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- Consider your case realistically
- At many journals the paper is seen again by the handling editor
- Other journals have an escalation process in which more-senior editors handle appeals
- In most cases, appeals are not given the highest priority

REJECT: How to appeal

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- Determine the reason for initial rejection
- Present new data to strengthen your claims or to expand the scope of the paper
- Point out possible factual errors in the decision process and argue scientifically
- Detail the specific contribution of the work to the field as well as its possible immediate impact
- Address all major criticisms in the appeal and not just those you think are critical

REJECT: How not to appeal

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- Statements about your reputation and the number of papers published
- ‘Celebrity’ endorsements
- Unfair and unspecific attacks on referees and editors
- General statements irrelevant to the reasons behind the rejection
- Overselling your results
- Cosmetic rewriting of the paper

ACCEPT: Embargo policy

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- Why do journals have strict embargo policies?
  - By enabling many news organizations to break your story at the same time, it will make a bigger splash
  - Science stories do (and should) take longer to write than conventional news
  - No respected news organization wants to run a story that their competitor broke a week ago
- Any journalists you talk to about your work before publication must agree to honour the embargo
- This does not preclude you from discussing your work with other scientists, giving conference presentations or using preprint servers such as arXiv

ACCEPT: Aiming for the cover

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- Being on the cover of a journal brings additional visibility
- Often, ‘getting a cover’ is seen as a confirmation of the quality of a study. This, however, may not always be the case! Often, it is a consideration based on overall balance and art design
- Tips to get on the cover

- Take a look at the cover style of the journal
- Submit several design options based on that style
- Submit early, upon acceptance

Dealing with criticism after publication

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- When a paper receives criticism, this will most likely be passed to the corresponding author for a response
- Take this criticism seriously and respond comprehensively
- Don’t repeat obvious arguments from the paper, but respond with specific replies and, possibly, further experimental data
- Stay professional in your response
- Be open and forthcoming — as is the case when confronted directly, e.g. at conferences. Science is an ongoing debate, and criticism is part of the process
- Be constructive

Summary

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- Three basic categories of decision: REVISE, REJECT and ACCEPT
- If advised to revise and invited to resubmit, only do so when you are able to comprehensively address all comments
- If rejected, determine the reason for the initial rejection, and don’t lose heart
- You can appeal a rejection if you think it is unfair

Questions

Any questions?

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Plagiarism and Other Ethical Issues

Plagiarism

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"**Plagiarism** is the use of others' published and unpublished ideas or words (or other intellectual property) without attribution or permission, and presenting them as new and original rather than derived from an existing source.

The intent and effect of plagiarism is to **mislead the reader** as to the contributions of the plagiarizer. This applies whether the ideas or words are taken from abstracts, research grant applications, Institutional Review Board applications, unpublished or published manuscripts in any publication format (print or electronic)."

Publication Ethics Policies for Medical Journals, World Association of Medical Editors

Examples of plagiarism

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- Copying text, but providing new data
- Duplicate figures in two separate publications
- Republication of papers already published (in non-English journals); the original publication must always be cited

Remember

- Give credit where credit is due — citations must acknowledge the intellectual contribution of earlier work
- If in doubt, err on the side of too many rather than too few citations

Self-plagiarism

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"Duplicate publication, sometimes called self-plagiarism, occurs when an author reuses substantial parts of his or her own published work without providing the appropriate references. This can range from getting an identical paper published in multiple journals, to 'salami-slicing', where authors add small amounts of new data to a previous paper."

From *Nature* journal editorial policies

Plagiarism

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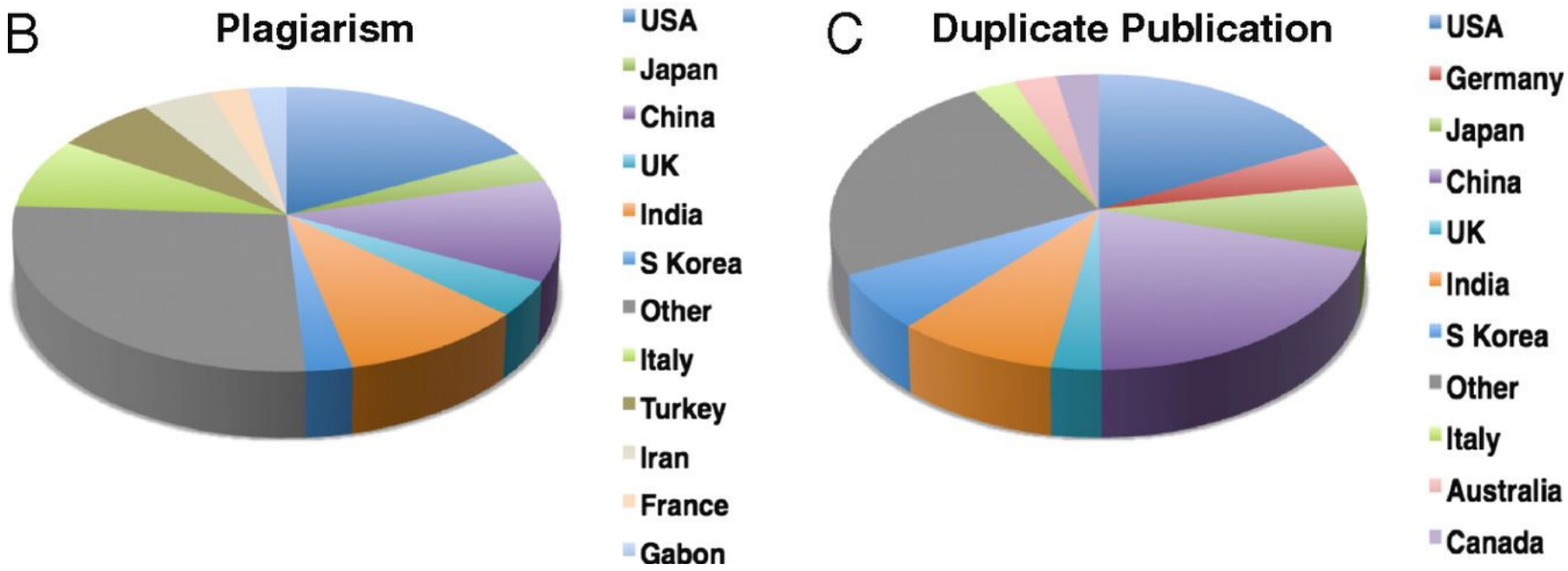
"Plagiarists are either fools or desperate people"

John Maddox, *Nature* **286,** 831–832 (1980)

Statistics on plagiarism and duplicate publication

MACMILLAN SCIENCE COMMUNICATION

Country of origin of publications retracted for plagiarism (B) or duplicate publication (C):



Fang F C et al. PNAS 2012;109:17028-17033

Tools for detecting plagiarism

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Copied text can readily be detected...

- CrossCheck, powered by iThenticate
- DOC Cop (doccop.com)
- eTBLAST (biomedical literature only)

…and editors will immediately reject papers in which plagiarism is found

Other ethical issues in science publishing

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- Inappropriate citations
- Fabrication and falsification (fraud)
- Image or data manipulation (fraud)
- Authorship issues
- Confidentiality
- Conflicts of interest

Inappropriate citations

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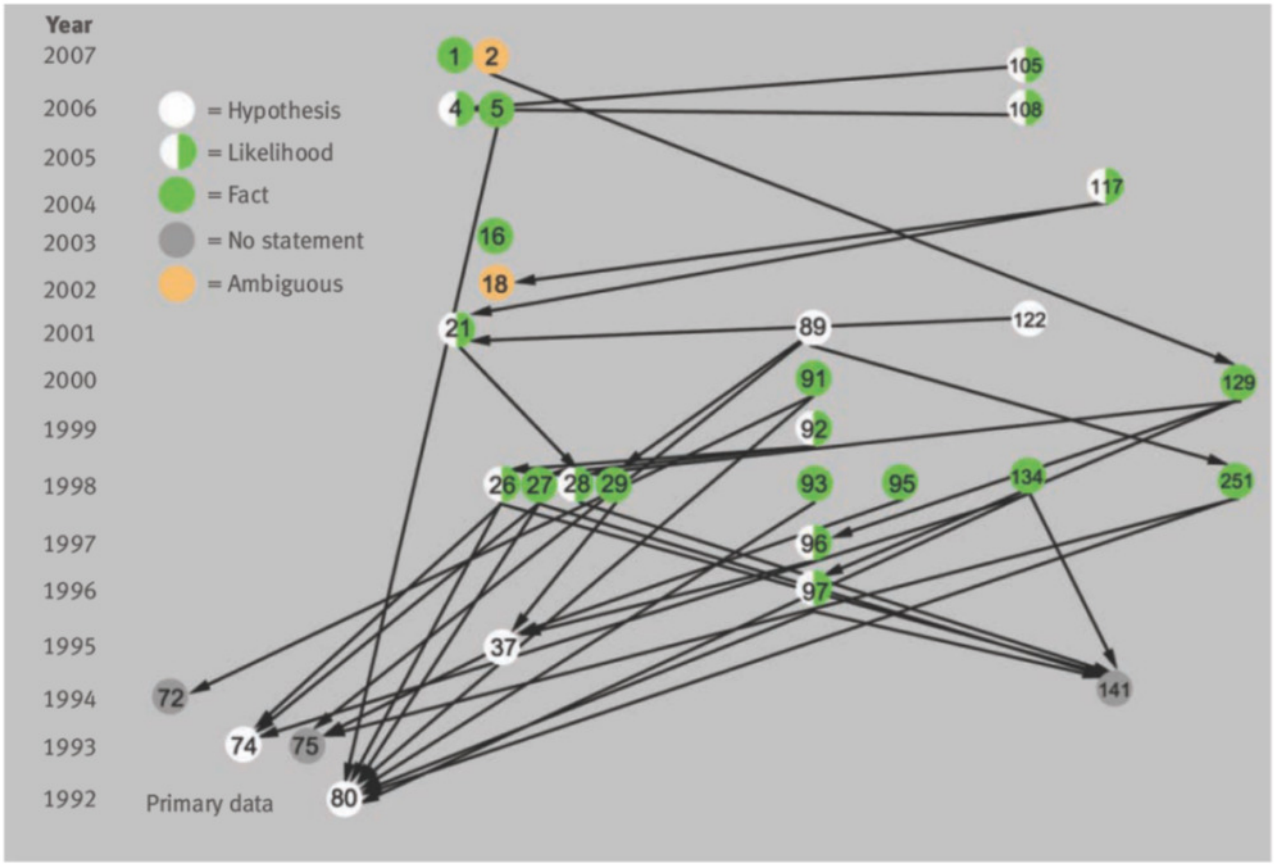
- Omission: overlooking citations
- Citation bias: not citing papers contradicting your claims
- Amplification or misrepresentation: citing a paper wrongfully, to support a claim it doesn't
- Cut and paste: copying references from other papers without reading them which creates citation misprints

Editorial: *Accurately reporting research,* Nature Cell Biology ***11****, 1045 (2009).*

Citation misrepresentation

MACMILLAN SCIENCE COMMUNICATION

Conversion of hypothesis to fact through citation alone



BMJ **339,** 2680 (2009)

Image and data manipulation

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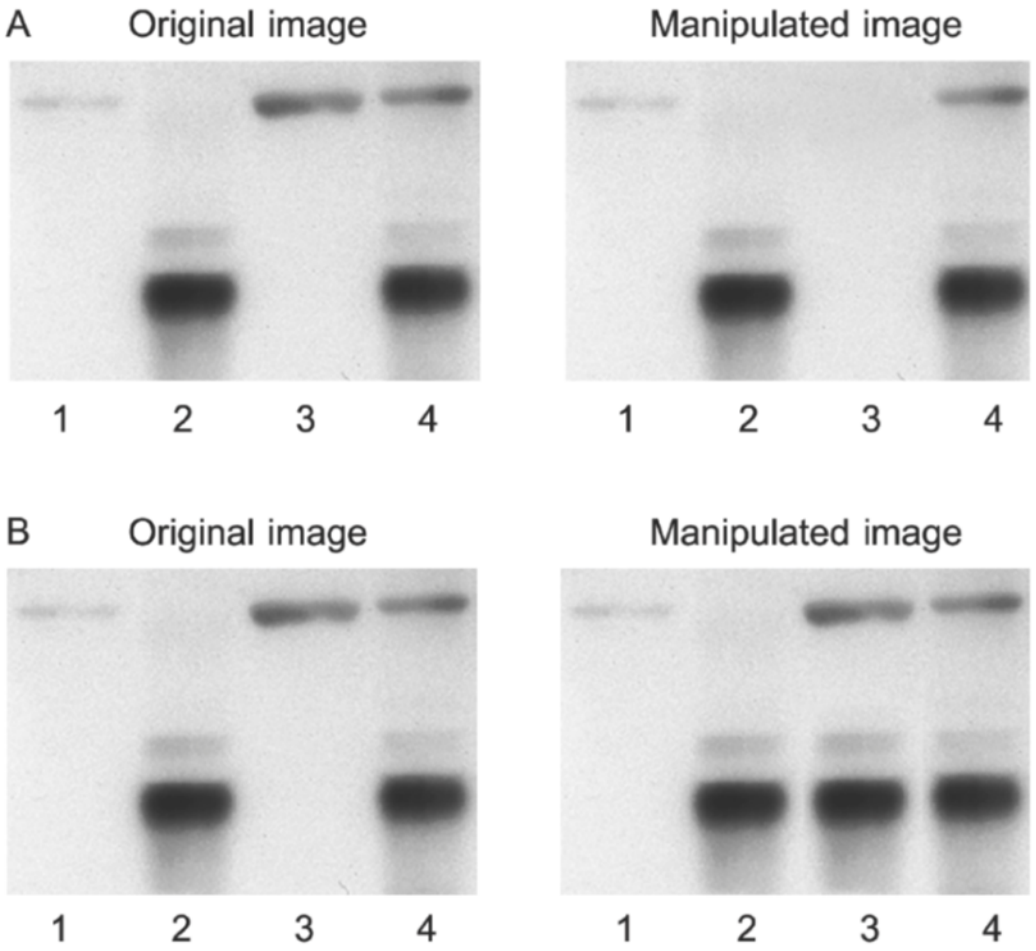
Adding and removing features to fit expected behaviour

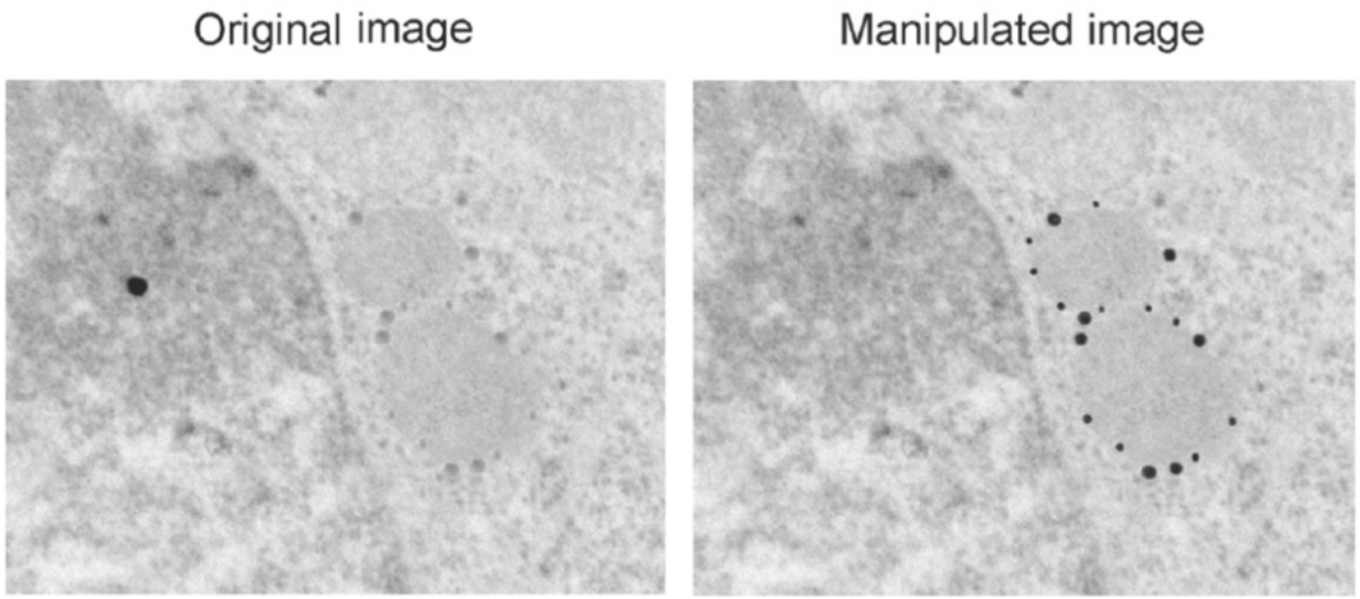


What's in a picture? The temptation of image manipulation. *J. Cell Biol.* **166,** 11 (2004)

Image and data manipulation

MACMILLAN SCIENCE COMMUNICATION

Artificially highlighting elements of interest



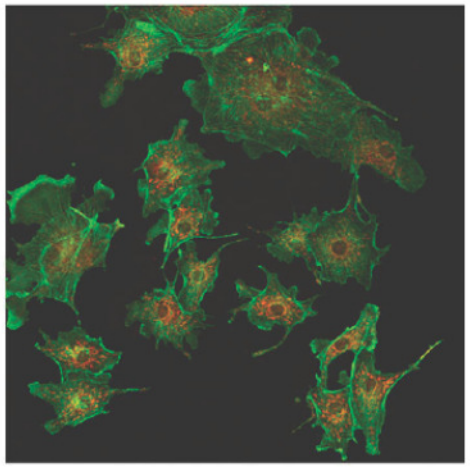
What's in a picture? The temptation of image manipulation.
J. Cell Biol. **166,** 11 (2004)

Image and data manipulation

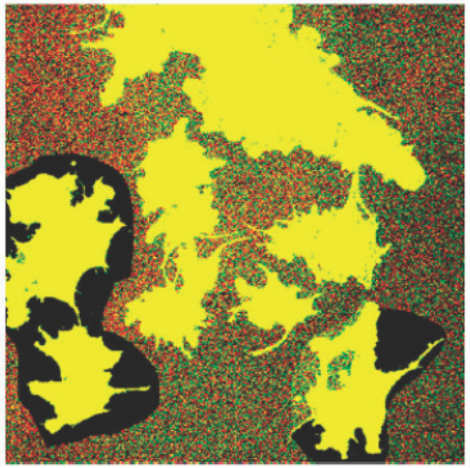
MACMILLAN SCIENCE COMMUNICATION

Misrepresenting image data by combining images taken at different time or of different samples

Manipulated image



Manipulation revealed by contrast adjustment



What's in a picture? The temptation of image manipulation. *J. Cell Biol.* **166,** 11 (2004)

General guidelines

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- Report image acquisition tools and image-processing software used
- Clearly demarcate borders if combining several images
- Processing (such as changing contrast and brightness) is appropriate only if it is applied equally across the entire image and if data are not obscured
- Do not create or eliminate data within an image
- Always retain unprocessed data and metadata files

Many top-ranked journals now check integrity of images in accepted papers

Fabrication and falsification

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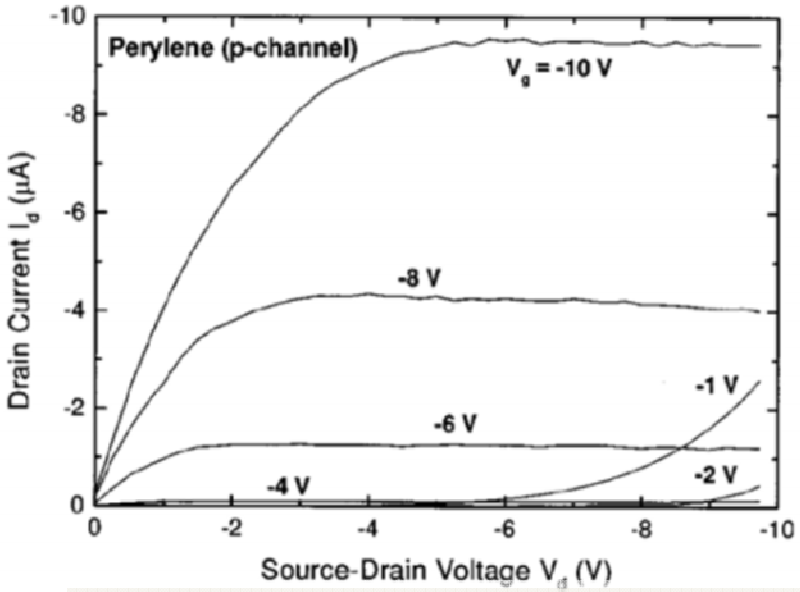
The Schön affair

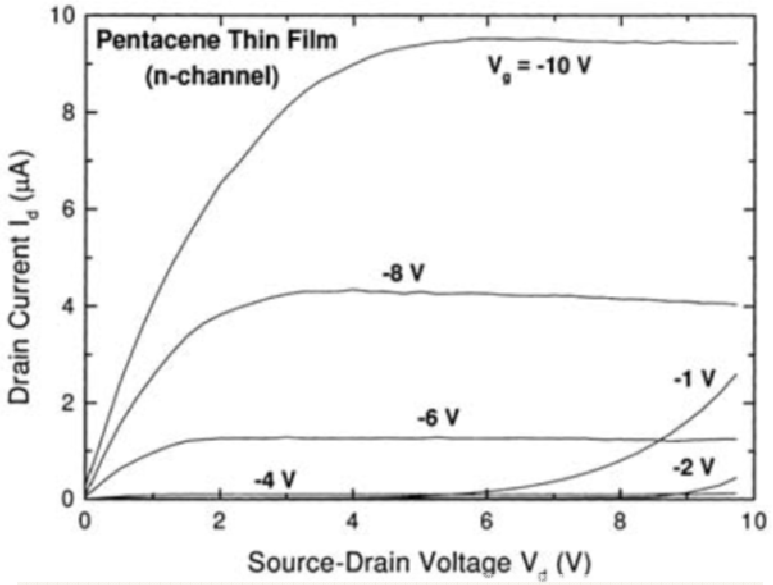
- 24 allegations of scientific misconduct
- a) substitution of data, b) unrealistic precision of data, c) results that contradict known physics
- 16 proven to be true, 2 unrelated to specific publications,
  6 "…were troubling but did not provide compelling evidence of scientific misconduct"
- 1 November 2002, 8 papers retracted from *Science*
- 6 March 2003, 7 papers retracted from *Nature*

Report of the investigation committee on the possibility of scientific misconduct in the work of Henrik Schön and coauthors, M. Beasley, H. Kroemer, H. Kogelnik, D. Monroe & S. Datta - external report commissioned by Bell Lab's management (2002).

Fabrication and falsification



"Perylene: A promising organic field-effect transistor material," J. H. Schön et al. Appl. Phys. Lett. **77,** 3776 (2000).

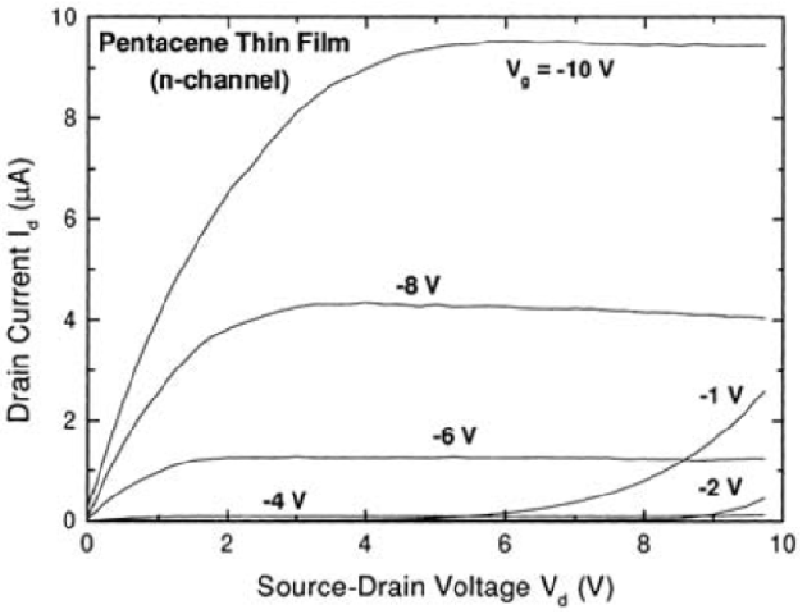


"Ambipolar organic devices for complementary logic," J. H. Schön et al. Synthetic Metals **122,** 195 (2001).

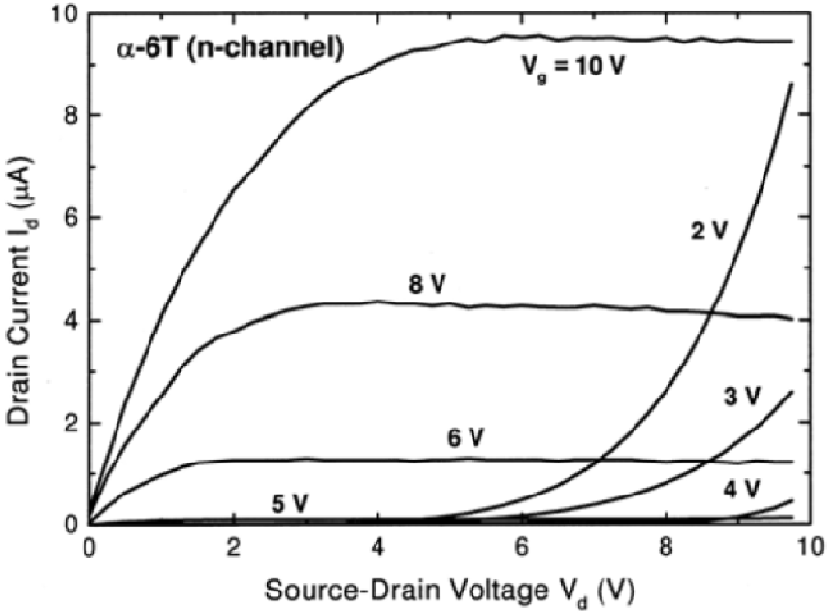
Report of the investigation committee on the possibility of scientific misconduct in the work of Henrik Schön and coauthors, M. Beasley, H. Kroemer, H. Kogelnik, D. Monroe & S. Datta - external report commissioned by Bell Lab's management (2002).

Fabrication and falsification

MACMILLAN SCIENCE COMMUNICATION



"Ambipolar organic devices for complementary logic," J. H. Schön et al. Synthetic Metals **122,** 195 (2001).



"A Light-Emitting Field-Effect Transistor," J. H. Schön et al. Science **290,** 963 (2000).

Report of the investigation committee on the possibility of scientific misconduct in the work of Henrik Schön and coauthors, M. Beasley, H. Kroemer, H. Kogelnik, D. Monroe & S. Datta - external report commissioned by Bell Lab's management (2002).

Even ‘small’ cases can be serious

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- Knowingly omitting a reference to earlier work and thus misrepresenting your own contribution
- Combining data from different samples without declaring this
- Minor image manipulations such as removing outliers

→ **Is it worth your reputation and scientific career?**

Statistics on misconduct

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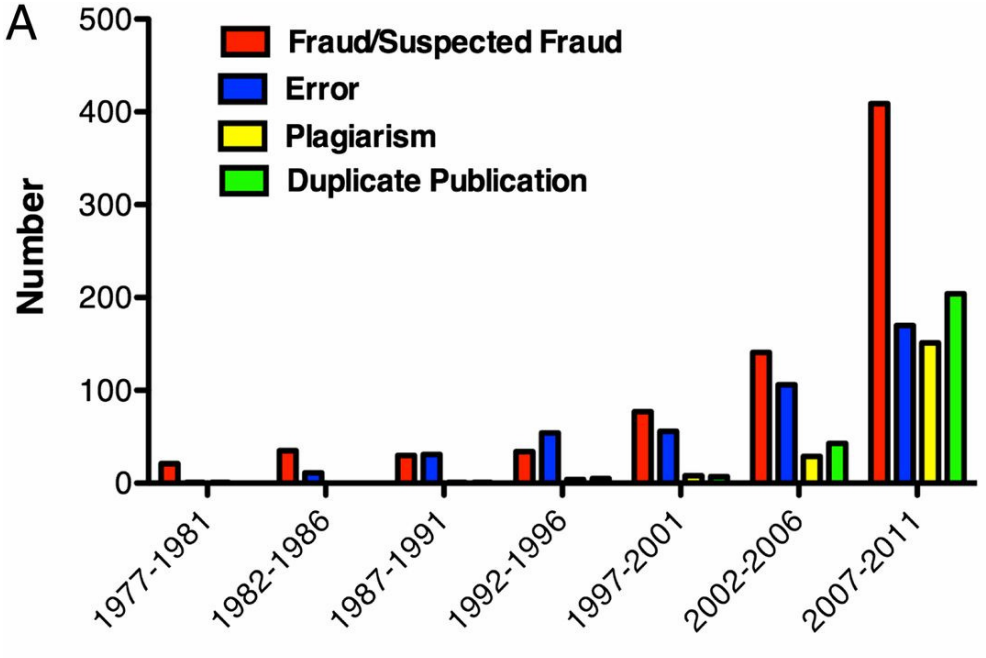
- A review carried out of 2047 retracted articles in PubMed
- 21.3% attributed to error
- 67.4% attributed to misconduct of which the majority were:
  - Fraud or suspected fraud (43.4%)
  - Duplicate publication (14.2%)
  - Plagiarism (9.8%)



Fang F C et al. PNAS 2012;109:17028-17033

Statistics on misconduct

MACMILLAN SCIENCE COMMUNICATION

Country of origin of publications retracted for fraud or suspected fraud (fraud defined as data falsification or fabrication):

Fang F C et al. PNAS 2012;109:17028-17033

Data on misconduct from *Nature* journals

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Variety of issues

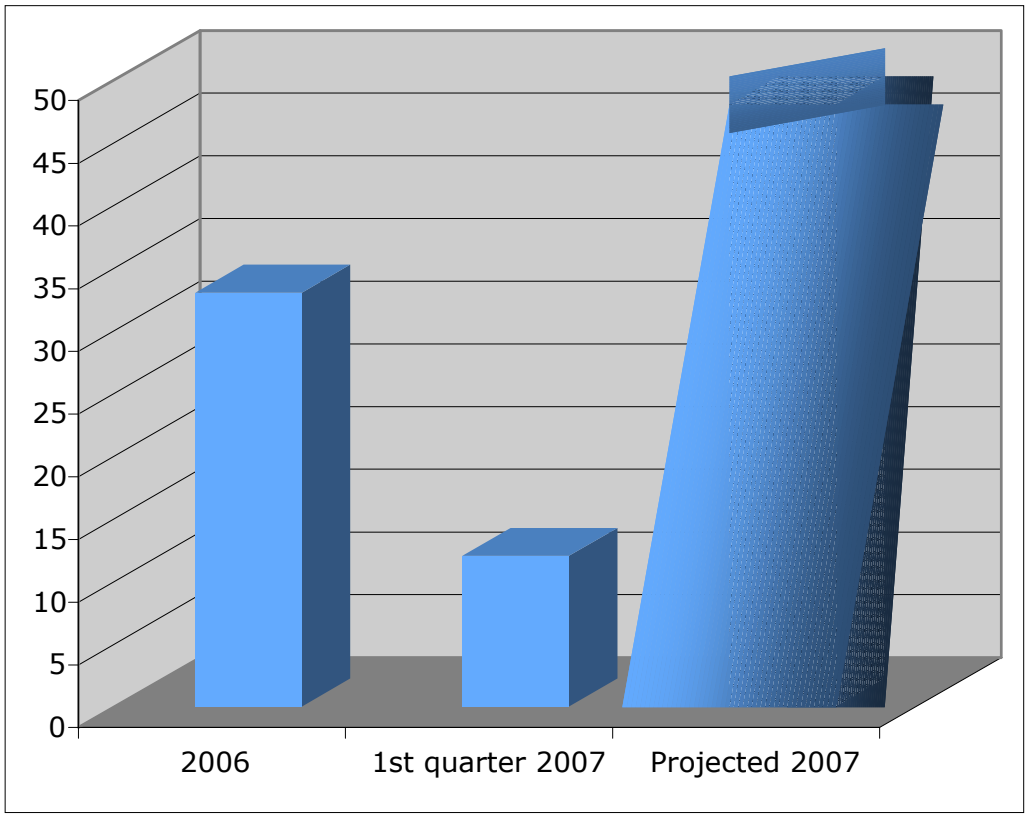
- Materials sharing
- Plagiarism
- Image manipulation
- Fraud and data fabrication
- Authorship disputes

It's only a tiny fraction of what is published

Tip of the iceberg?

-or-

Are most papers that matter uncovered?



Singapore statement

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http://www.singaporestatement.org/

Preamble

The value and benefits of research are vitally dependent on the **integrity of research**. While there can be and are national and disciplinary differences in the way research is organized and conducted, there are also principles and professional responsibilities that are fundamental to the integrity of research wherever it is undertaken.

Principles

- **Honesty** in all aspects of research
- **Accountability** in the conduct of research
- **Professional courtesy and fairness** in working with others
- **Good stewardship** of research on behalf of others

Journal responsibilities

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- Journals usually follow up any suspicions
- Journals alert funding institutions and employers, thereby starting investigations
- But journals are neither police nor judges
- Process often stalls if universities do not investigate fully or only slowly
- No clear international regulations exist across disciplines or countries

Retractions

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- There has been a dramatic increase in the number of retractions in the past ten years
- The Committee on Publication Ethics (COPE) introduced retraction guidelines in 2009 to counter the huge inconsistencies in the policies and practices between different journals
- Retractions are reserved for articles that are **so seriously flawed that their results and data are unreliable**

Retractions

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Committee on Publication Ethics (COPE) guidelines:

Journal editors should consider **retracting** a publication if:

- they have clear evidence that the findings are unreliable, either as a result of misconduct (e.g. data fabrication) or honest error (e.g. miscalculation or experimental error)
- the findings have previously been published elsewhere without proper cross-referencing, permission or justification (i.e. cases of redundant publication)
- it constitutes plagiarism
- it reports unethical research

Publicationethics.org

Corrections and errata

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COPE guidelines

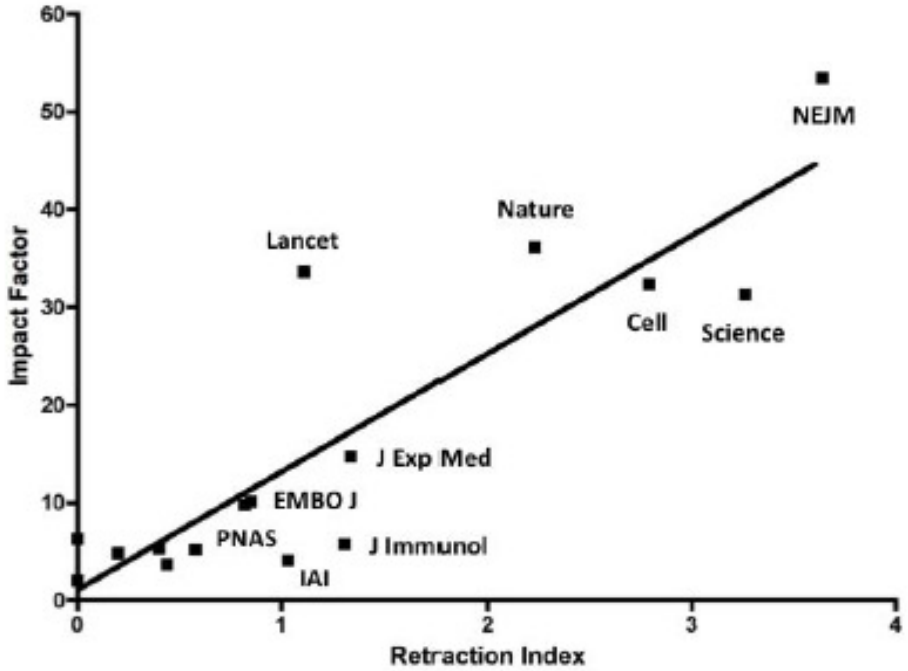
"If only a small part of an article reports flawed data, and especially if this is the result of genuine error, then the problem is best rectified by a **correction** or **erratum**. (The term erratum usually refers to a production error, caused by the journal. The term corrigendum (or correction) usually refers to an author error.) Partial retractions are not helpful because they make it difficult for readers to determine the status of the article and which parts may be relied upon"

Journal editors should consider issuing a **correction** if:

- a small portion of an otherwise reliable publication proves to be misleading (especially because of honest error)
- the author/contributor list is incorrect (i.e. a deserving author has been omitted or somebody who does not meet authorship criteria has been included)

Publicationethics.org

Retractions in top tier journals



- *Immunity and Infection* article November 2012
- Correlation between impact factor and retraction index (number of retractions in the time interval from 2001-2010, multiplied by 1000 and divided by the number of published articles with abstracts)

RETRACTED SCIENCE AND THE RETRACTION INDEX, Ferric C. Fang and Arturo Casadevall, doi:10.1128/IAI.05661-11

Further reading

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- *Avoiding plagiarism, self-plagiarism and other questionable writing practices: A guide to ethical writing*, Office of Research Integrity, US Department of Health and Human Services
http://ori.dhhs.gov/education/products/plagiarism/

- *Nature* journal editorial policies
http://www.nature.com/authors/policies/index.html

- Publication ethics policies for medical journals, World Association of Medical Editors
http://www.wame.org/resources/publication-ethics-policies-for-medical-journals

- Singapore Statement on Research Integrity
http://www.singaporestatement.org/

Summary

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Plagiarism can be:

- knowingly omitting a reference to earlier work
- copying text
- data fabrication
- image manipulation
- duplicate figures
- fraud
- self-plagiarism
- republication of papers already published

- Nowadays, plagiarism can easily be detected
- Be honest, have professional courtesy, be fair and be accountable

Questions

Any questions?

Course objectives

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- ✓ Understand successful science writing techniques
- ✓ Know how to organize, outline and plan papers
- ✓ Be able to construct effective sentences and paragraphs
- ✓ Understand the elements of a paper and what each should contain
- ✓ Understand journal editorial processes and the peer-review system
- ✓ Know how to submit and publish papers
- ✓ Have an awareness of ethical issues associated with science publishing

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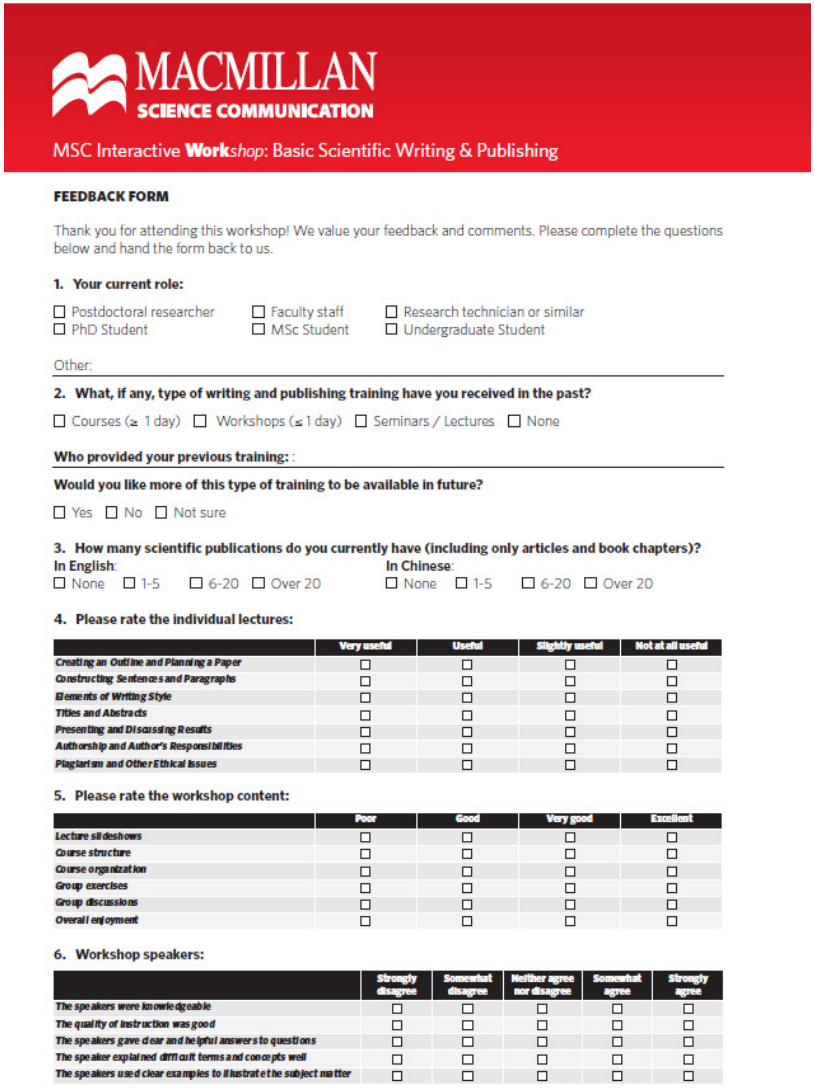

MACMILLAN SCIENCE COMMUNICATION

MSC Interactive **Work***shop*: Basic Scientific Writing & Publishing

FEEDBACK FORM

Thank you for attending this workshop! We value your feedback and comments. Please complete the questions below and hand the form back to us.

1. Your current role:

☐ Postdoctoral researcher ☐ Faculty staff ☐ Research technician or similar
☐ PhD Student ☐ MSc Student ☐ Undergraduate Student

Other:

2. What, if any, type of writing and publishing training have you received in the past?

☐ Courses (≥ 1 day) ☐ Workshops (≤ 1 day) ☐ Seminars / Lectures ☐ None

Who provided your previous training: :

Would you like more of this type of training to be available in future?

☐ Yes ☐ No ☐ Not sure

3. How many scientific publications do you currently have (including only articles and book chapters)?

In English: ☐ None ☐ 1-5 ☐ 6-20 ☐ Over 20

In Chinese: ☐ None ☐ 1-5 ☐ 6-20 ☐ Over 20

4. Please rate the individual lectures:

	Very useful	Useful	Slightly useful	Not at all useful
Creating an Outline and Planning a Paper	☐	☐	☐	☐
Constructing Sentences and Paragraphs	☐	☐	☐	☐
Elements of Writing Style	☐	☐	☐	☐
Titles and Abstracts	☐	☐	☐	☐
Presenting and Discussing Results	☐	☐	☐	☐
Authorship and Author's Responsibilities	☐	☐	☐	☐
Plagiarism and Other Ethical Issues	☐	☐	☐	☐

5. Please rate the workshop content:

	Poor	Good	Very good	Excellent
Lecture slideshows	☐	☐	☐	☐
Course structure	☐	☐	☐	☐
Course organization	☐	☐	☐	☐
Group exercises	☐	☐	☐	☐
Group discussions	☐	☐	☐	☐
Overall enjoyment	☐	☐	☐	☐

6. Workshop speakers:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
The speakers were knowledgeable	☐	☐	☐	☐	☐
The quality of instruction was good	☐	☐	☐	☐	☐
The speakers gave clear and helpful answers to questions	☐	☐	☐	☐	☐
The speaker explained difficult terms and concepts well	☐	☐	☐	☐	☐
The speakers used clear examples to illustrate the subject matter	☐	☐	☐	☐	☐

We really appreciate your feedback

Please complete the feedback forms in your handout folders, and hand them back to us

Thank you

MACMILLAN SCIENCE COMMUNICATION

Thank you for attending

Scientific Writing and Publishing Workshop

A training course provided by **Macmillan Science Communication** in collaboration with:

南京医科大学

NANJING MEDICAL UNIVERSITY

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