Publishing a world class scientific paper

www.ees.elsevier.com/JEP

Robert Verpoorte
Editor-in-chief Journal of Ethnopharmacology, IBL, Leiden, The Netherlands

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Science is based on communication

- To use results from previous studies to plan your own research
- Your results are important for others
- Avoid duplication of research
- As a basis for discussions between colleagues
- To inform the public about research

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What kind of communication?

- **Written:**
  - publications
  - reports
  - grant applications
- **Posters**
- **Oral:**
  - lectures
  - meetings
  - interviews

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Why do you want to publish?

- You like to write
- You have a message to tell
- You like to comment on something
- You need it for your career
- You have some interesting scientific results
- You want to give a review of previous work

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Where to publish?

- Journal read by colleagues that work in the same field
- The best journal in your field
- Highest impact for the field
- Fast in publishing

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Role Journal

- Facilitate communication in science
- Organize peer review of publications
- Support authors in improving their papers and research
- Store the scientific information
- Disseminate your work to all your colleagues worldwide

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Differences “classical” or “open access” journals

- Costs are the same
- But who pays for publishing:

you as author

or

the user of your knowledge

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Open access vs subscription model

- Everybody has free access
- Larger audience compared to small classical journals

- High fees for authors
- In applied sciences why free information for industry?
- No quality control by reader subscribing a journal
- Earning model on numbers not on quality of papers
- Flood of more of the same papers
- Lower quality journals

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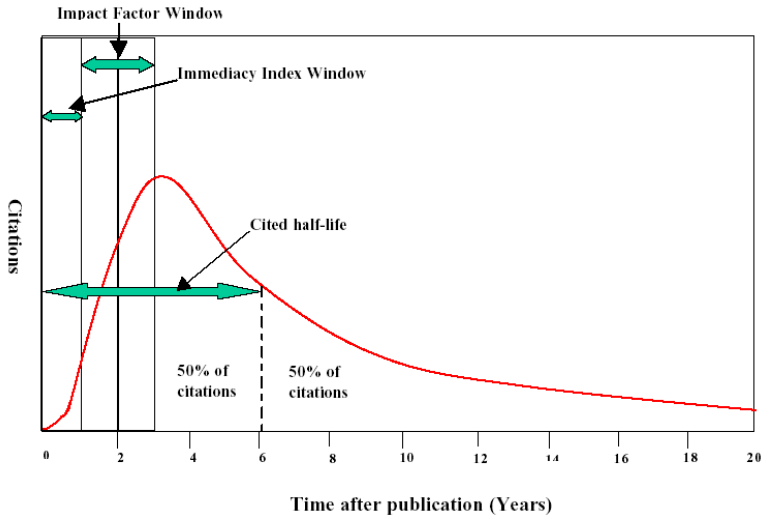
Impact factor

- The average number of citations in a year to articles in that journal published in the preceding two years
- Is used in an attempt to describe the quality of a journal, but a high impact factor means not necessarily a better journal



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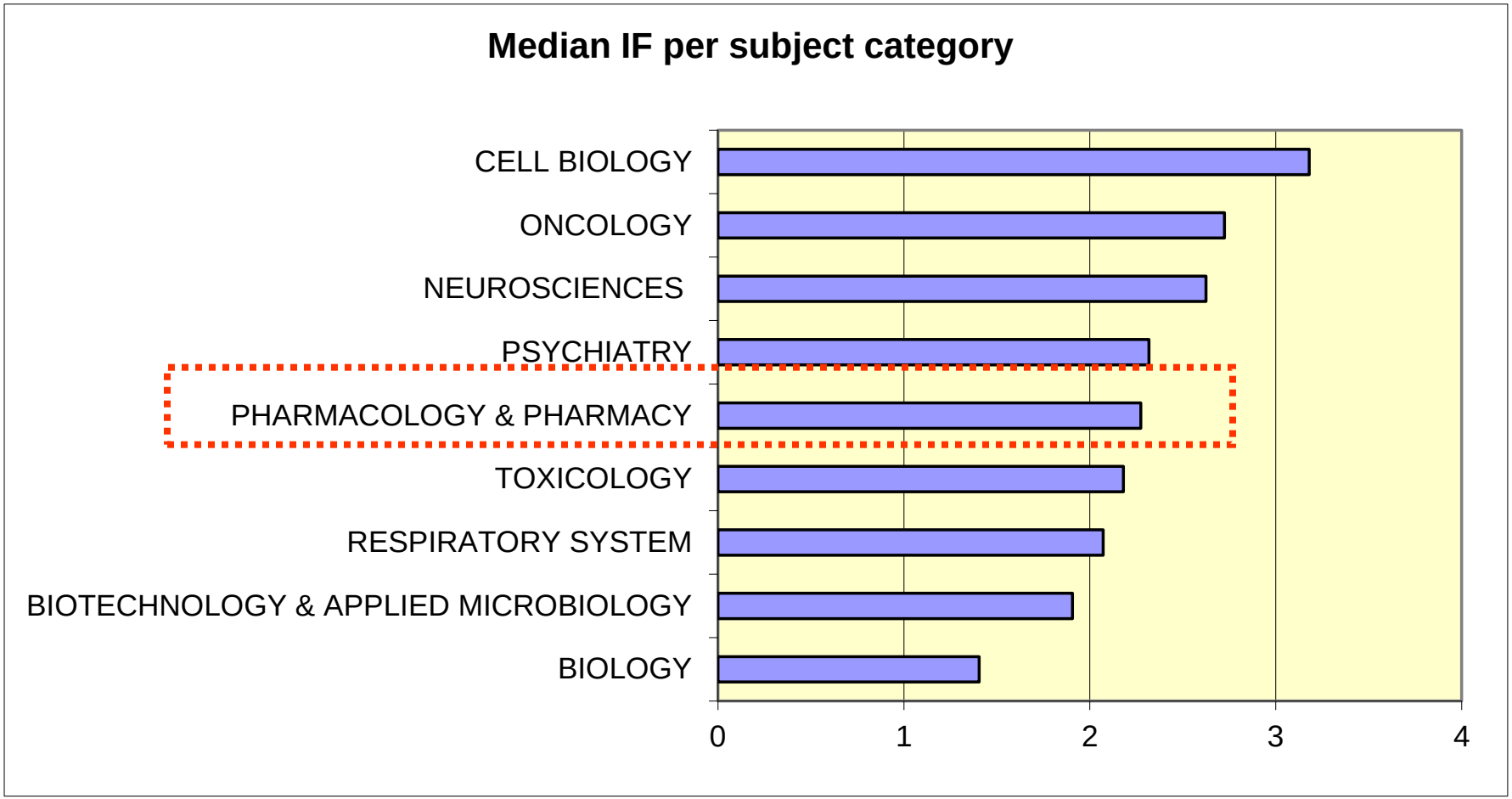
Influences on Impact Factors: Subject Area



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Impact factor

- In fact an impact factor tells mainly something about
  - the number of people working on a certain topic
  - the average number of references in an article
  - the percentage of references from the preceding two years
- A method will have most citations on short term (2-3 years)
- A new compound will be cited over many years (2-50 years)
- An impact factor can be manipulated!

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Manipulation Impact factor

- Encourage authors for self citations
- Editor asks authors in revision to look for some relevant references in the past 2 years of the journal
- Instead of all new compounds of a plant in one paper each in a separate paper
- Publish reviews in the beginning of the year (citation window is 2 years, but in fact 13-24 months)

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Impact factor

Journal of Ethnopharmacology

impact factor is:

2.939

Number of full text downloads:

Almost 2 million per year = >5000/day!

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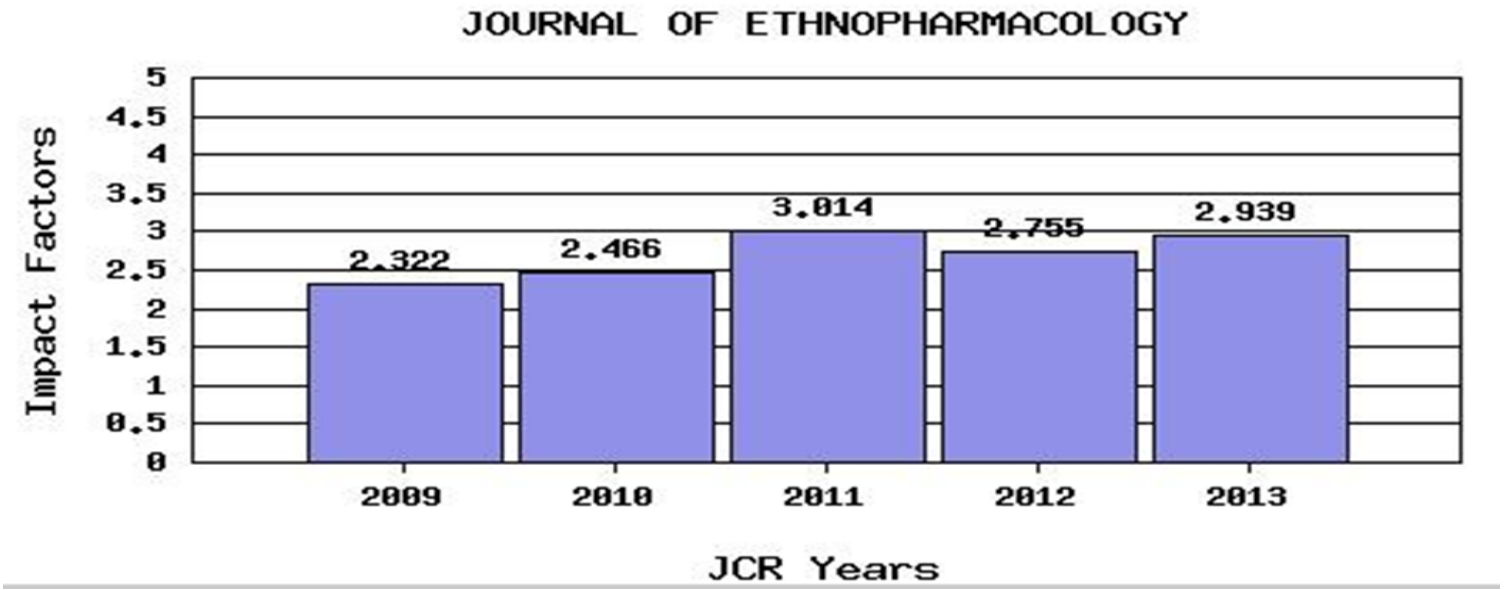
Impact factor

Impact factor past 5 years



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Impact Factors 2011 & 2012 of related journals

Title	2012	2013	Diff%
Journal of Natural Products	3.285	3.947	20%
Phytochemistry	3.050	3.350	10%
Journal of Ethnopharmacology	2.755	2.939	7%
Phytomedicine	2.972	2.877	-3%
Phytotherapy Research	2.068	2.397	16%
Planta Medica	2.348	2.339	0%
Fitoterapia	2.231	2.216	-1%
Molecules	2.428	2.095	-14%
Journal of Ethnobiology and Ethnomedicine	2.423	1.978	-18%
Phytochemistry Letters	1.179	1.542	31%
South African Journal of Botany	1.409	1.340	-5%
Pharmaceutical Biology	1.206	1.337	11%

Publications

- Full paper: larger part of research
- Letter: comment or small but interesting result
- Short communication: small but interesting result
- Review article

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For who do you write?

- Colleagues in the field
- Scientists not in your field
- Evaluators of grant proposals
- Students
- General public

What do you write about?

- Clinical experiments
- Biological experiments
- Method
- Chemical experiments
- Review

Biological/pharmacological experiments

- Based on a hypothesis you do experiments with living organisms, but you measure only a few parameters.
- Usually many explanations are possible, but your evidence needs to be such that it (dis)proves the hypothesis
- One thus needs an extensive discussion

(Phyto)chemical experiments

- Identification of compounds in plant extracts
- Structure elucidation
- Synthesis
- Characterization of an enzyme

- No hypothesis
- Descriptive and explain how conclusions are made from data
- Only one solution fits the data

Writing (phyto)chemical papers is very different from writing pharmacological papers

Elsevier suite of medicinal plant journals

	Chemistry	Activity in vitro
traditional medicines	**Fitoterapia** Novel activities phytomedicines Chemistry, quality control	**Phytochemistry Letters** Chemistry
	JEP From Ethnopharmacology to Evidence-based traditional medicine	**Phytomedicine** Registered phytomedicines
		Activity in vivo

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Scope Journal of Ethnopharmacology

A paper should report on traditional uses or present results on pharmacological or toxicological studies directly related to the traditional use. The data should contribute to evidence-based traditional medicines.

"Rules of 5" *www.ees.elsevier.com/JEP*

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Evidence for activity first priority

- Active compounds not yet known
- First confirm pharmacological effect
- Chemical profiling of little use if no active compounds are known
- Voucher specimen for future comparison
- NMR-metabolomics is now being considered as a possible reproducible fingerprint that will be stored in a repository connected with the journal

What have these in common?

Storage of GB of information

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General set-up paper

- Title
- Abstract
- Introduction
- Material and methods
- Results
- Discussion
- Conclusion

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Title of the publication

- First determine the title before you start writing
- Title should be informative
- Not too general, but neither too long
- The title is what people attracts in reading your paper
- No unnecessary words (e.g. “a” or “the” to start with)

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Titles

- **A study on Catharanthus roseus**

- *What did you study? How did you study it?*

- **Isolation of new alkaloids from Catharanthus roseus**

Titles

- Do not use abbreviations in title
- Make that people will find the article if they search on keywords in titles
- Do not number your paper in the title (Studies on Papaveraceae. VII)
- Grammatically it should be sound

Who are authors?

- Intellectual contribution to the work
- Substantial part of the work
- Technicians who did experiments according given protocols, should not be co-author
- Avoid too many!
- Each author is responsible for content!

Who are authors?

- Do not use too many authors, people that only had a small technical contribution should be in the acknowledgement
- Ask people always if they appreciate to be an author or not
- Never send in a paper in which someone is among the authors, without him/her having read it

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Authors sequence

- May be difficult to find the right order
  - no official rules for whom is first author
- Three approaches:
  - First author has done most of the work
  - Person responsible for the research is first author
  - Strict alphabetically

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Authors, most common sequence

- Main researcher (e.g. PhD-student or postdoc) as first author
- Supervisor as the last one and often as corresponding author
- The journal only allows changes in sequence or number of authors when a valid reason is given in a letter signed by all authors

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More than 1 first author?

- Footnote that two authors have contributed equally
- At the end of the paper each author's role is described
- Splitted sets of authors

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First authors

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Name and address

- Because of literature search programs it is important that you are always recognized by your name
  - e.g. R. Smith will give many hits, Roland Smith will already reduce the number of hits
- Always use the same spelling
- Women who marry have to decide if they take a new identity in the literature databases

Acknowledgment

- Here you can thank technicians, etc., that have done part of the work
- Thanks to sponsors

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Abstract

- Many people only read abstracts
- Everything should be there, nothing more and nothing less
- Clear structure

Abstract: most read part of your paper!

- Short
- Informative
  - ethnopharmacological relevance
  - objectives
  - methods used
  - results
  - conclusion
- Not too much detail
- No abbreviations
- No literature references

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Keywords

- Most journals ask for about 5 keywords
- Use at least plant name and family, type of compounds and activity
- Think about the keywords you use yourself to find publications in your field.
- Keywords are also used to find appropriate reviewers

Classification system used in JEP

- When you submit to JEP you are asked to chose from a series of given classifications the ones that best describe the paper. These are used to find suited reviewers.
- The system is based on the BNF classification of diseases plus some others like “ethnopharmacological survey”.

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Introduction

- Overview of the importance of the topic
- Give an overview on the state-of-the-art
- Define the problem and state your hypothesis and/or goal (systems biology, survey)
- Clearly describe the objectives
- Describe experimental design to prove your hypothesis
- State the principle results and conclusion

References

- Try to be concise, the introduction should not be a complete review in itself
- Submitted papers cannot be in the list of references, only in press is allowed
- Give reference on the right place:
  - Strychnine can be determined by GC and HPLC (1,2,3) *Not clear!*
  - Strychnine can be determined by GC (1) and HPLC (2,3) *Clear!*

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References

- Follow format journal
- Numbering according sequence in text
- Alphabetically, and chronological for each first author

References

- Use in first draft a system with first author and year in the text
- When paper is in its final form you can change to numbering if that is required for the journal
- For format references follow strictly rules of the journal!

References

- Different systems used:
  - numbering, in general one starts with 1, 2 etc. throughout the text
  - numbering an alphabetical list, so no numerical sequence in text
  - author based (author + year, two authors + year, author et al.+ year)

References in text

- One author:
  - Smith, 2000
- Two authors:
  - Smith and de Vries, 1998
- Three authors and more
  - Smith et al., 1995
  - NB: *et al.* is abbreviation of *et alia*, so it should be with only one full stop!

References in text

- More than one paper of the same author(s) from the same year:

- Smith et al. 2000a, 2000b

References

- In writing the author-based system is easiest
- Once in final form you can change authors into numbers

References format

- American Chemical Society. 2012. Ethical guidelines to publication of chemical research. http://pubs.acs.org/userimages/ContentEditor/1218054468605/ethics.pdf. Accessed on March 31, 2012.

- Cargill, M. and O'Connor, P. *Writing Scientific Research Articles: Strategy and Steps*, 2009. Wiley-Blackwell, Chichester, UK, pp. 184.ch 31, 2012.

- van Neirop, E. 2009. Why do statistics journals have low impact factors? *Statistica Neerlandica* **63**, 52-62.

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Figures

- Figures should be easy to understand, also in black and white!
- Figure must be functional for results and discussion
- Not too many curves in one figure
- Give only structures of compounds if needed for discussion
- Give numbering of compounds if needed

Figures

- Be careful in drawing lines between measuring points when you only have a few time points, better use bar graph.

Colors are not the same for everybody!

Figures and tables

- Legend should explain what is seen in the figure/table, e.g. all relevant aspects like concentrations, but no abbreviations
- Give statistics as error bars or numbers and give number of replicates in legend
- Compare different ways of presenting data, e.g. a bar diagrams, a graph, or a table

Tables

- Complete legend
- Not too detailed
- Consider possibility of a figure
- Do not repeat data which are also in Materials-&-Methods, in a figure, or in text of results, e.g. NMR-spectral data

Tables

- Look at the precision of your data and standard deviation, are they reasonable and do they have the same precision
- Avoid tables with many: “-” for data that you do not have, e.g. lost or not measured samples
- *n.d.* = non-detectable or not detected? Avoid confusion!

Material and Methods

- All details should be given that allows the reader to reproduce your experiment.
- Only descriptive, so no discussion or explanations.
- Avoid repeating data in text and tables.
- In (phyto)chemical papers spectral data compounds often in M&M.

Materials and Methods

- Read the instructions of the journal you want to publish!
- Mention source of materials used.
- Mention equipment used.

Species names (e.g. plant)

- At one place full name, including all authors (*Papaver somniferum* L.), if appropriate give possible synonyms
- In text you can use abbreviation, e.g. *P. somniferum.* But never use an abbreviation at the beginning of a sentence.
- Systematic names are always in italics, the authority of a plant name are not.
- Species name never with capital.

Always give full official botanical plant name

- *Catharanthus roseus* (L.) G. Don ”Twinkling Anja”
- Family Apocynaceae

See: K. Chan, et al. (2012) J. Ethnopharmacol. 140: 469–475

Check names with: www.theplantlist.org

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Names plant compounds

- Check for official name and commonly used numbering of carbons
- Many end on: -in
  - e.g. amyrin, luteolin, loganin
- Alkaloids usually end on -ine
  - e.g. strychnine, vincristine
  - exception is heroin, as this was of origin a trademark: Heroin®

Abbreviations

- Usually journals have a list of allowed abbreviations
- Special abbreviations need to be listed
- Never start a sentence with an abbreviation
- Abbreviations may be confusing, as for example completely different enzymes may end up with a similar 3 letter abbreviation. Check!

Results

- One figure can give more information than you can describe in many words
- Figures are independent of language
- Try different ways of presenting your results in figures before writing results and discussion
- Do not repeat data present in figure or table
- No discussion!

“Absence of evidence is not evidence of absence”

Carl Sagan, 1977

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Discussion

- Discuss the results in the context of your hypothesis/problem
- Avoid repeating the results
- Compare with findings reported by others
- What are the implications of your findings
- Try to explain unexpected results
- Come to clear conclusions and give the evidence

Discussion

- Be Honest!!!!
- Give all your results, even those that might be contradictory, later these might be useful when new knowledge will shed new light on your experiments
- Be aware: In biology you are looking only to a very small part of the total system

Discussion

- At the end you may say some words about future studies needed
- If you say that further studies are in progress, be careful, as reviewers may ask you to add the results of these if they find that your paper does not contain sufficient evidence

JPA Ioannidis:
"Why most published Research Findings are False"

PLoSMedicine 2(2005)696-701 (www.plosmedicine.org)

- "For many current scientific research fields, claimed research findings may often be simple accurate measures of the prevailing bias"
- "Simulations show that for most study designs and settings, it is more likely for a research claim to be false than true"

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Be Honest!

"….conclusions drawn in many, if not most, of the 18,000 publications referencing qPCR are open to question."

> "They describe and use inappropriate protocols, present insufficient details in the method section, or are guilty of both issues"

"The higher the impact factor of the journal, the higher the percentage of papers using inappropriate qPCR methods."

Genetic Engineering and Biotechnology News, June 2010. p 5

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Be honest, be realistic

- Avoid subjective superlatives like dramatical, ...
- Significant is a statistical term!
- No claims without comparison with proper controls and considering the full context

Ubiquitious compounds like sitosterol, ursolic and oleanolic acid, α- and β-amyrin are very promising panaceas

What an Editor will do?

- Sending you a confirmation of receipt of your manuscript.
- Make a general assessment about format and scope.
- If OK send it to two or three reviewers.
- Based on the reviewers' reports make a decision about acceptance.
- After acceptance forward the paper to the publisher.

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Reviewer

- We now use the term reviewer as he/she gives only an advise,
- the editor makes the decision based on the advises of the reviewers, and in fact acts as the referee!

What is the task of a reviewer?

- Advise accept, revise or reject to editor, based on:
  - Within scope?
  - Clear hypothesis/objectives
  - Appropriate experimental design
  - Significance results: novelty, innovative, impact
  - Reference to previous work approriate
  - Discussion and conclusions fit the results

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Decision Editor

- Accept as it is
- Accept with minor revision, usually not back to reviewers
- Major revision, revised manuscript goes back to reviewers
- Reject

Decision Editor: rebuttal

- Always clearly tell what changes you made based on the reviewer reports
- If you disagree with certain points of the reviewers, write why
- Even in case of rejection, you can still try to convince the editor of your points, in case you have good arguments against the reviewers criticism

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Time path after submission

- Within1 week after electronic submission confirmation of receipt
- 2- 4 months for decision editor
- In case of revised paper repeat of this cycle
- After acceptance immediate on-line, 2 month for printing
- In average 6 month to printed paper

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When can you start to ask questions?

- If you have not got a confirmation of receipt one week after electronic submission (give the right Email address!!)
- 3 months after confirmation and no decision yet of editor
- After acceptance, do not ask the editor but the publisher about progress
- If available use tracking system of the journal to follow the fate of your paper

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Frustrations of an Editor

- Not right format of references.
- Statistics not OK (e.g. 12 ± 0.51).
- Sloppy manuscripts (e.g. many typing errors).
- No clear statement of what changes has been made in revised manuscript.
- Without arguments not following recommendations for revision.
- Cutting up your work in many short publications.
- Publish two times the same paper.
- Plagiarism
- I am not your enemy, I try to be your friend!

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Ethics Issues in Publishing

- **Scientific misconduct**
  - Falsification of results
  - Plagiarism
    - Different forms / severities
    - The paper must be original to the authors

- **Publication misconduct**
  - Duplicate submission
  - Duplicate publication
    - Includes translations!
    - Redundant publications
  - Inappropriate acknowledgement of prior research and researchers
  - Inappropriate identification of all co-authors
  - Conflict of interest

Data Fabrication and Falsification

A Massive Case Of Fraud
Chemical & Engineering News
February 18, 2008

Journal editors are left reeling as publishers move to rid their archives of scientist's falsified research
William G. Schulz

A CHEMIST IN INDIA has been found guilty of plagiarizing and/or falsifying more than 70 research papers published in a wide variety of Western scientific journals between 2004 and 2007, according to documents from his university, copies of which were obtained by C&EN. Some journal editors left reeling by the incident say it is one of the most spectacular and outrageous cases of scientific fraud they have ever seen.

…

Chinese scientists dismissed after 70 suspect papers

[BEIJING] Two Chinese university lecturers have been dismissed after 70 papers they published in an international journal were revoked because of alleged fraud.

Hua Zhong and Ta
University in soutl
the papers in 200

"Although the Chinese government declares zero tolerance on academic fraud, in practice, few researchers are seriously punished for their misconduct. Universities tend to cover for those offenders with high academic status for fear of their power and the reputation of the school" said Fang

Chinese scientists dismissed after 70 suspect papers
[SciDev.Net - 01/13/2010]

"A researcher is rewarded and promoted largely based on the number of published papers, which poses dangerous incentives for researchers to commit fraud" he said

Plagiarism and fake publications c

Anwar Tumur (*University of Xinjiang, Urumqi, People's*
from the Swiss Federal Commission for Scholarships f
Switzerland from July 2003 to July 2004. From July to Octol
in Fribourg (Switzerland) and then worked as visiting scie
Ecology (University of Bern, Switzerland) from October 20
had free access to our infrastructure and contributed to a s
mammals (rodents) in set aside areas under my supervisic
(November 2003 to May 2004) A.Tumur did field work (2
collected was barely sufficient for a publication. He wrote
depth to correct the poor English and weed out many flaw
China, he asked me whether I would agree to have this repo
the text would not be modified. Anwar Tumur only sent
identical to th
study was pu
copy of the a
is included in
on the same d
Incidentally v

Plagiarism and fake publications of Anwar Tumur

Anwar Tumur (*University of Xinjiang, Urumqi, People's Republic of China*) received a
July 2003 to July 2004. From July to October 2003 he attended a French course in Fribourg
Switzerland) from October 2003 to July 2004. During this time, he had free access to our infrast
supervision (J.-P. Airoldi). During 7 months (November 2003 to May 2004) A.Tumur did fie
report, which had to be edited in depth to correct the poor English and weed out many flaws
agreed, assuming that the text would not be modified. Anwar Tumur only sent me the abstract,
The study was published in Acta Theriologica Sinica (25: 254-260, 2005). Anwar never sent me
All the information gathered by Anwar Tumur during his stay in Switzerland is included in the abc
Incidentally we detected quite recently 5 other publications which were never authorized by me
published or unpublished results of our scientific work, but they also contain data which are comp
authorship. This is completely unacceptable since the publication of fake data will damage my sci
I would not agree to co-author a publication based on data already published elsewhere or whic
to the editors and reviewers. Anwar Tumur intentionally misled and fooled the scientific comm
published with our agreement, and we examined it in more details. To our astonishment, we reali

The incriminated publications:

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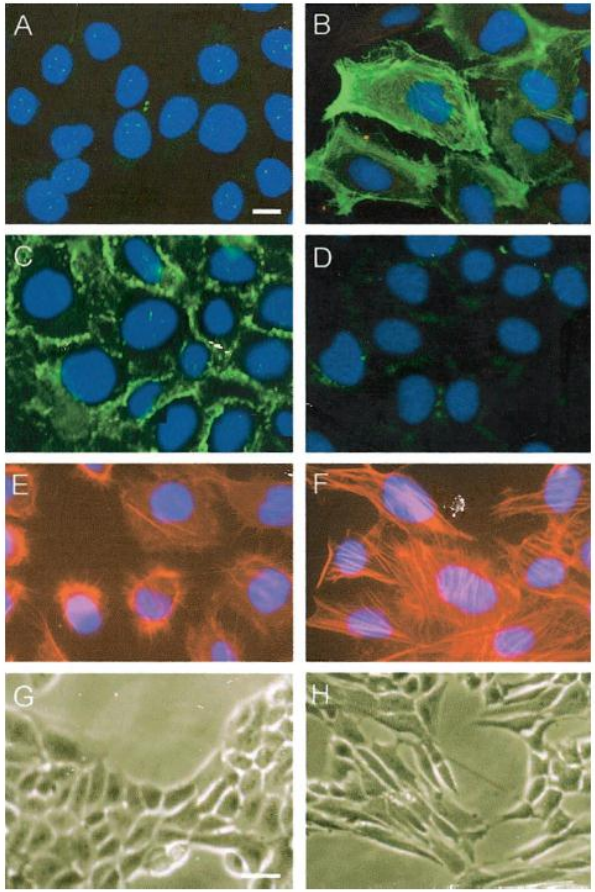
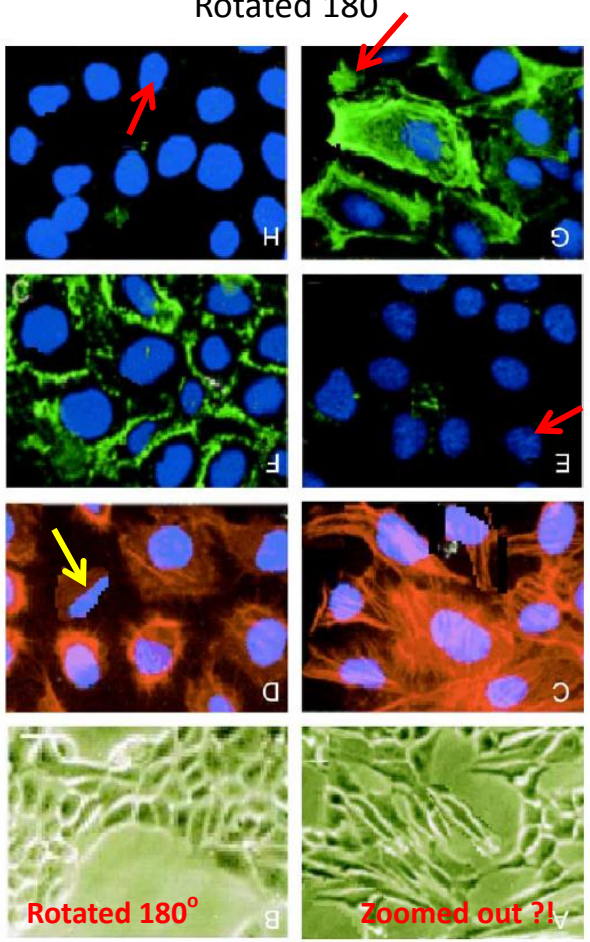
Figure Manipulation – Example: “different”experiments

Am J Pathol, 2001

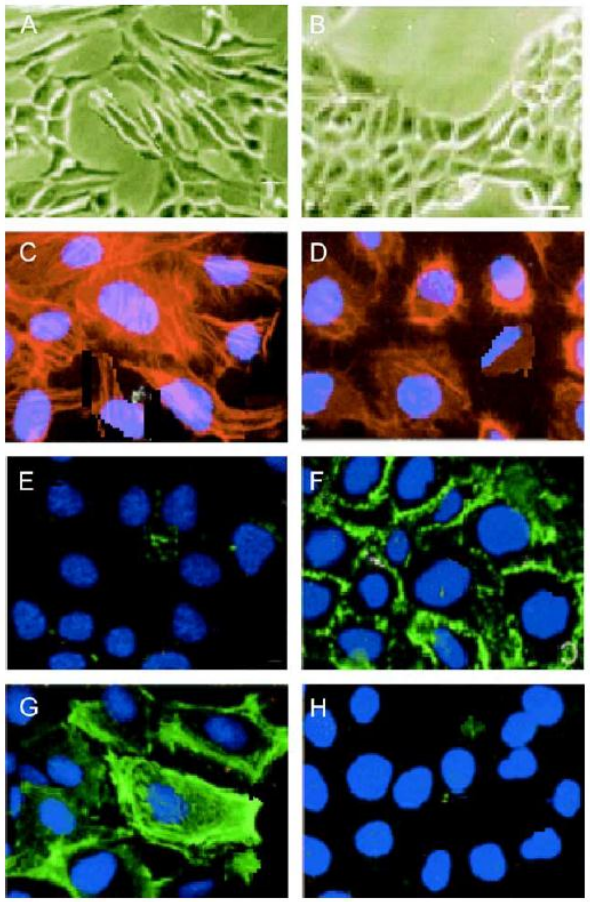


Life Sci, 2004

Rotated 180°



Life Sci, 2004



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Publication ethics – How it can end .....

"*I deeply regret* the inconvenience and agony caused to you by my mistake and request and beg for your pardon for the same. As such *I am facing lot many difficulties in my personal life* and request you not to initiate any further action against me.
I would like to request you that all the correspondence regarding my publications may please be sent to me directly so that I can reply them immediately. To avoid any further controversies, *I have decided not to publish any of my work in future*."

E-mail from a "pharma" author
December 2, 2008

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ScienceDirect

doi:10.1016/j.sigpro.2005.07.019 Cite or Link Using DOI

RETRACTED: Matching pursuit-based approach for ult

[a]Electronics and Telecommunication Engineering Department, University of Jaen, Lin
[b]Signal Theory and Communications Department, University of Alcalá, Alcalá, Madrid,

Available online 24 August 2005.

This article has been retracted at the request of the Editor-in-Chief and Publisher.
http://www.elsevier.com/locate/withdrawalpolicy.

Reason: This article is virtually identical to the previously published article: "New algorithm for SNR improvement in ultrasonic NDT" , *Independent Nondestructive International,* volume 38 (2005) 453 – 458 authored by N. Ruiz-Reyes, P. Vera-Ca Mata-Campos and J.C. Cuevas-Martínez.

Signal
Volume 86, Issue 5, May 2006, Pages 962-970

the echoes issuing from the flaws to be detected. Therefore, it cannot be cancelled by classical time averaging or matched band-pass filtering techniques.

Many signal processing techniques have been utilized for signal-to-noise ratio (SNR) improvement in ultrasonic NDT of highly scattering materials. The most popular one is the split spectrum processing (SSP) [1–3], because it makes possible real-time ultrasonic test for industrial applications, providing quite good results. Alternatively to SSP, wavelet transform (WT) based denoising/detection methods have been proposed during recent years [4–8], yielding usually to higher improvements of SNR at the expense of an increase in complexity. Adaptive time-frequency analysis by basis pursuit (BP) [9,10] is a recent technique for decomposing a signal into an optimal superposition of elements in an over-complete waveform dictionary. This technique and some other related techniques have been successfully applied to denoising ultrasonic signals contaminated with gain noise in highly scattering materials [11,12], as an alternative to the WT technique, the computational cost of the BP algorithm being the main drawback.

In this paper, we propose a novel matching pursuit-based signal processing method for improving SNR in ultrasonic NDT of highly scattering materials, such as steel and composites. Matching pursuit is used instead of BP to reduce the complexity. Despite its iterative nature, the method is fast enough to be real-time implemented. The performance of the proposed method has been evaluated using both computer simulation and experimental results, even when the input SNR (SNRin) is lower than 0dB (the level of echoes attributed to microstructures is above the level of the echoes).

2. Matching pursuit

Matching pursuit was introduced by Mallat and Zhang [13]. Let us suppose an approximation of the ultrasonic backscattered signals $x[n]$ as a linear expansion in terms of functions $g_i[n]$ chosen from an over-complete dictionary. Let H be a Hilbert space. We define the over-complete dictionary as a family $D = \{g_i;\ i = 0, 1, \ldots, L\}$ of vectors in H, such as $\|g_i\| = 1$.

The problem of choosing functions $g_i[n]$ that best approximate the analysed signal $x[n]$ is computationally very complex. Matching pursuit is an iterative algorithm that offers sub-optimal solutions for decomposing signals in terms of expansion functions chosen from a dictionary, where l^2 norm is used as the approximation metric because of its mathematical convenience. When a well-designed dictionary is used in matching pursuit, the non-linear nature of the algorithm leads to compact representative models.

In each step of the iterative procedure, vector $g_i[n]$ which gives the largest inner product with the analysed signal is chosen. The contribution of this vector is then subtracted from the signal and the process is repeated on the residual. At the mth iteration the residue is

$$r^m[n] = \begin{cases} x[n], & m = 0, \\ r^{m-1}[n] + a_{g_{i(m)}}[n], & m \neq 0, \end{cases} \quad (1)$$

where $a_{g_{i(m)}}$ is the weight associated to optimum atom $g_{i(m)}[n]$ at the mth iteration.

The weight a_i^m associated to each atom $g_i[n] \in D$ at the mth iteration is introduced to compute all the inner products with the residual $r^m[n]$:

$$a_i^m = \frac{\langle r^m[n], g_i[n] \rangle}{\langle g_i[n], g_i[n] \rangle} = \frac{\langle r^m[n], g_i[n] \rangle}{\|g_i[n]\|^2} = \langle r^m[n], g_i[n] \rangle. \quad (2)$$

The optimum atom $g_{i(m)}[n]$ (and its weight $a_{g_{i(m)}}$) at the mth iteration are obtained as follows:

$$g_{i(m)}[n] = \underset{g_i \in D}{\operatorname{argmin}} \|r^{m+1}[n]\|^2 = \underset{g_i \in D}{\operatorname{argmax}} |a_i^m|^2 = \underset{g_i \in D}{\operatorname{argmax}} |a_i^m|. \quad (3)$$

The computation of correlations $\langle r^m[n], g_i[n] \rangle$ for all vectors $g_i[n]$ at each iteration implies a high computational effort, which can be substantially reduced using an updating procedure derived from Eq. (1). The correlation updating procedure [13] is performed as follows:

$$\langle r^{m+1}[n], g_i[n] \rangle = \langle r^m[n], g_i[n] \rangle - a_{g_{i(m)}} \langle g_{i(m)}[n], g_i[n] \rangle. \quad (4)$$

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- Make a draft and discuss this with your colleagues.
- Step by step improve your paper.
- Finally give it to some colleagues that are not directly involved and ask their opinion.

Write, write, write

- From every experiment you should learn how to do better next time.
- Do not think: “ Oh, this experiment I could have done better, and that is not so good, so I will not write this down”.
- In that case you will never publish anything before your retirement.

Write, write, write

- Writing is a process, that first requires that your ideas ripen in your head. That can takes days, or even weeks.
- Once the idea is clear writing goes easy.
- Sometimes you write many pages in a day, sometimes just a few lines.

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- Every scientist has published things that later turned out to be wrong, that means that new knowledge has given a new perspective to your data.
- So do not be afraid of publishing your results. If your experiments have been properly done with the right controls, your data will be OK, but the explanation might be different.

Write, write, write

- Science is like a building, it is made out of small blocks put together, step by step. You cannot make a whole building at once.
- Your work is one of these small blocks.

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Some reading

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