Methoden Wetenschappelijk Onderzoek

The review process
Loose ends

- References
- Proposal
- Statistics
References

• **Precision** is important!

• And quality of references is something that will **always** be checked

• If you are not sure how to do it, look for **examples** in the articles you use.
Proposal (1)

• Keywords
  – Do not have to be a single word
  – Use concepts known in your field
    • Agent-based models
    • Software engineering techniques
  – Don’t use broad, vague terms
    • Models, techniques, software etc.

• Keywords are used to classify your work and aid automatic search
Proposal (2)

• **Precision** is important in a proposal as well
  – Precision of questions, aims, methods
  – Don’t state goals without arguments
    • “We will improve this 30%” Why? How?
  – Precision in formulation
  – Precision of technical details (refs, figures, numbers etc.)

• **Don’t use** only half of your 1200 words
  – You haven’t given the level of detail required
Statistics (1)

- Generally made very well
- But don’t forget to report statistics (t-values, W-values, F-values etc.)
  - This helps understand what you did
  - And to detect errors
- And report exactly what you did
  - Null-hypothesis, two-sided or one-sided, equal or unequal variance etc.
  - Again, look for examples in your field
Statistics (2)

• Be careful not to say that a null hypothesis is accepted
  – We never accept hypotheses in science

• Of course, when testing you work with the assumption that the data is close enough to the null hypothesis that differences don’t matter
  – Normality, equality of variance
Criticizing others’ work

• For your thesis you will have to apply what you learnt actively
• But you can also apply your knowledge about scientific methods passively
  – By criticizing others’ work
  – This is part of the review process
  – Not just pointing out what is bad: also stating how to improve it
Let's look at some examples
A not-so-good abstract

All forms of singing as well as speech come about in syllables, and the sound of syllables mainly comes by their vowels. Thus we expected correspondences between the inventories of vowels and musical intervals (notes) across cultures and found them at least in the corners - lower limit, upper limit, and the position of frequency peaks in 5 (and 7) elements. Taking Nettl’s (2000) description of archaic songs as a model, these parallels and further coincidences in the rhythmic organization of linguistic and musical phrases are discussed in terms of an evolution of (vocal) music and speech out of a half-musical precursor. In the course of the specialization of speech its complexity may have increased while its sound decreased.
A not-so-good abstract

Not true

Why does this follow?

Background-results-background-results

What corners?

Is it understandable without Nettl?

Which elements?

What does that mean?
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 \(\sim 20 \text{ nm s}^{-1}\) towards the plus-ends of each of the two microtubules it crosslinks. For anti-parallel microtubules, this results in relative sliding at \(\sim 40 \text{ nm s}^{-1}\), 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.
During cell division, mitotic spindles are assembled by microtubule-based motor proteins. 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. Hypotheses for bipolar spindle formation include the 'push–pull mitotic muscle' model, in which kinesin-5 and opposing motor proteins act between overlapping microtubules. 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. 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.
An abstract according to *Nature*

- This is the abstract of the “letter” format
  - The abstract is the first paragraph of the introduction
  - The whole article has < 1800 words

- Therefore: “fully referenced”
  - In general, references in an abstract are a bad idea
  - Note that the abstract is understandable (to a biologist) without the references: specific theories are briefly explained
Figure 4. The Japanese vowel chart and several vowel systems in American English
A not-so-good figure

Both are scan-and-copy (but at least the quality is good)

Figure 4. The Japanese vowel chart and

Although this is easily corrected, such errors indicating sloppiness are deadly for your paper.
A really bad figure (1)

Figure 6. Structuralization of an utterance and Jakobson’s system of French vowels from the same author(s) (to whom I best express my acknowledgement by preserving their anonymity)
A really bad figure (2)

Figure 6. Structuralization of an utterance and Jakobson’s system of French vowels

What is the relation between these two panels?
None.

Another scan-and-copy this time lo-res (besides they are not all vowels)
"The larger the BD, the larger the separation. In this paper, the structural analysis of an utterance is similarly carried out with a BD-based matrix, which is shown in Figure 6. After converting a cepstrum vector sequence into a distribution sequence, all the BDs are calculated between any two of the distributions. It should be noted that BDs are calculated even between temporally distant events."

No matrix is shown

Is this clear in the figure?
“Figure 6 also shows Jakobson’s geometrical system of French vowels [9]. He claimed that the same vowel system should be found irrespective of speakers. It is well-known that Jakobson was inspired by the assertions of Saussure, the father of modern linguistics. He claimed that language is a system of conceptual differences and phonic differences and that the important thing in a word is not the sound alone but the phonic differences that make it possible to distinguish that word from all others [10]. The proposed speaker-invariant, holistic and contrastive representation of an utterance can be considered as a mathematical and physical interpretation of Saussure’s claims and Jakobson’s claims regarding language.”

*If anyone knows what this has to do with the figure, please explain it to me.*
A reasonable illustration (1)

**Figure 2.** An example of a ‘dappled’ pattern as resulting from a type (a) morphogen system. A marker of unit length is shown. See text, §9, 11.

Turing 1952, *The chemical basis of morphogenesis*

Illustrates the effect of Turing’s mathematical analysis
A good illustration (2)

Pearson, 1993 *Complex Patterns in a Simple System*

Lines are explained in figure 1

**Figure 2:** The key to the map. The patterns shown in the figure are designated by Greek letters which are used in Figure 3 to indicate the type of pattern found at a given point in parameter space.

**Figure 3:** The map. The Greek letters indicate that a pattern similar to the pattern with the same Greek letter in Figure 2 was found at that point in parameter space. The “B”’s indicate that the system evolved to a uniform blue state. The “R”’s indicate that the system evolved to a uniform red state.
Equations (1)

- There is **no excuse** for hairy equations

\[
\begin{align*}
R_{\mu\nu} - \frac{1}{2}g_{\mu\nu} R + g_{\mu\nu} \Lambda &= \frac{8\pi G}{c^4} T_{\mu\nu} \\
R_{\mu\nu} - \frac{1}{2}g_{\mu\nu} R + g_{\mu\nu} \Lambda &= \frac{8\pi G}{c^4} T_{\mu\nu}
\end{align*}
\]
Equations (2)

- Always **explain** all symbols you use
  - The meaning of symbols may only be understandable to **experts**!
  - This sounds obvious, but it is easy to **overlook** a symbol or two
  - **Re-explain** if they re-occur further on

It then becomes [12, equation 3.2]:

\[
\frac{\partial u}{\partial x} = -\frac{A}{\rho c^2} \frac{\partial p}{\partial t}, \quad \frac{\partial p}{\partial x} = -\frac{\rho}{A} \frac{\partial u}{\partial t}
\] (1)

where \( u(x, t) \) is volume velocity, \( p(x, t) \) is the differential pressure, \( A(x) \) is the cross-sectional area of the tract at point \( x \) along its length, \( \rho \) is the density of air and \( c \) is the speed of sound. It can be verified by substitution that if \( u_1 \)

(de Boer 2008)
Equations (3)

- **Number** the equations you wish to refer to (and possibly the ones you do not wish to refer to, too)
Equations (3)

• And never say:

probability density function. In this condition, what can be invariant with respect to any mapping function? We can easily derive the following identical equation.

\[ \iint_A \sqrt{p_1(x,y)p_2(x,y)} \, dx \, dy = \iint_B \sqrt{q_1(u,v)q_2(u,v)} \, du \, dv \]

This quantity is called overlap integral in quantum chemistry, where \(p_i\) and \(q_i\) are electron clouds and the quantity shows the separation between two electrons. The (in a paper on modeling language evolution…)

• If it is easy it is superfluous, if it is not it is insulting or ridiculous

– But it is used in the best of places…

Hobson et al. 2006
General Relativity
The peer review process
Theory (1)

• Published work is used as a basis for further research
  – Needs to be reliable

• Quality of contributions has to be checked before they are published
  – Completeness
  – Validity
  – Relevance (?)
Theory (2)

• Who can judge papers better than people working on the same things?
  – Your peers, hence peer review
  – Usually three per paper
  – Always anonymous, to protect from retaliation

• Depending on the subject, experts from different disciplines may be asked
  – For interdisciplinary fora
Theory (3)

• A does not just say “yes” or “no”, but also gives advice for improvements
  – Both for rejected and accepted manuscripts
  – Clarity
  – Correctness
  – Analysis
  – Relevance (?)
Practice

• In theory this is an excellent system

• However, it is implemented by humans
  – With their likes and dislikes
    • Personal and professional
  – Working in a social network
  – Working in a paradigm
  – With (scientific) cultural biases
The parties involved

• The author

• The editor (s)
  – Administrative
  – Scientific
    • Usually overworked

• The reviewers
  – Tend to be established, experienced people
  – Perhaps a tad conservative?
  – Also usually overworked
The process (1)

• The author writes a manuscript according to guidelines, and submits it
  – Guidelines assure uniformity and clarity
  – Nowadays all done electronically

• The administrative editor decides whether the paper is interesting for his journal
  – Only happens for high-impact journals (Nature, Science, PNAS,…)
  – Decision: sent out for review or not
The process (2)

- The **scientific editor** selects reviewers
  - Mostly on the basis of **keywords** and **abstract**
  - From his list of **known reviewers**
  - From suggestions by the author
- **Invites** reviewers by sending an **abstract**
  - Reviewers decide whether they have **time** and **expertise** to do the review
- Sends **paper** and **instructions** to reviewers
  - Usually with a **deadline**
  - And with a **web form** to fill out
  - In some fields, manuscripts are **anonymized**
The process (3)

• The big wait begins...

• When the reviewers have time, they read the paper and write their review
  – Costs at least half a day for a journal paper
  – Conference papers are handled more quickly
  – Reviewers don’t get paid for this

• If the reviewers don’t respond in time, the editor may have to choose a different reviewer, or review the paper themselves
The process (4)

• The editor receives the reviewers’ reports
  – Based on their advice makes a decision
  – Reviewers’ advice is to be followed closely

• Usually reviews are pretty consistent, but sometimes they are not
  – The editor may ask for an extra review
  – They are allowed to make their own decision
The review report (1)

• Usually contains a list of closed questions
  – Usually on a scale from 1..5
  – How confident are you?
  – How relevant is the paper?
  – Is the writing clear?
  – Is the method clearly explained?
  – Is it technically sound?
  – Are the findings relevant?
  – Is related work cited correctly?
The review report (2)

• Contains an open section to provide feedback to the authors
  – Anything from general comments to typos
  – Should be formulated diplomatically

• Contains an open section for feedback only to the editor
  – Sometimes it may be necessary to provide confidential feedback
The process (5)

- The review reports go back to the author, with the editor’s decision and advice
  - Accept
  - Accept with minor revisions
  - Accept with major revisions
  - Reject with encouragement to resubmit
  - Reject outright
The process (6)

• The author **reacts** to the reviews
  – Reject: revise and resubmit it **elsewhere**
  – Otherwise: make revisions and resubmit

• Making revisions can be a lot of work if they involve **adding content** to the paper
  – If they only involve **presentation**, they may be less labor-intensive

• It is very important to write a clear **revision letter**
  – Outlining all the **changes** you made in response to each of the reviewers’ **comments**
  – Making it easier to **verify** your changes
  – Showing you take the reviewers **seriously**
The process (7)

• After **major** revisions, the manuscript is sent to the **most critical** reviewers again
  – The whole process is **iterated**
  – This can go on for **a few rounds**

• After **minor** revisions, the changes are usually verified by the **editor** alone

• The manuscript is **accepted** or **rejected**
  – And sent on to the **production department**
What can go wrong (1)

• The peer review process can go wrong in many ways
  – Reviewers’ biases
  – Reviewers’ expertise
  – Social engineering
  – Fraud
Reviewers’ biases (1)

• **Personal** reasons to like or dislike you
  – *Double blind* review is no solution

• **Bias about your** scientific views

• **Bias about your** background
  – Nationality (USA = good, 3\textsuperscript{rd} world = bad)
  – Institution (MIT = good, unknown university = bad, independent researcher = very bad)
  – Gender (male = good, female = bad)

• **Bias about your** reputation
  – Well-known = good, unknown = bad
Reviewers’ biases (2)

- The biases may cause a pressure to conform to the majority
  - Conformist research is easier to publish than innovative, original stuff
  - But this is understandable (although not good)
Reviewers’ expertise

• Peer review implies that your reviewers have the same expertise as you
  – But what about geniuses?
    • Turing, Higgs, Krebs…
  – And what about interdisciplinary work?

• For interdisciplinary work it may be impossible to find reviewers with your combination of expertise
  – Usually a specialist in the each discipline
  – May be good, may be bad
Social engineering

• If you know the editor-in-chief, it helps
• You favorably review your friends, and they return the favor
• You reject your competitors

• A group of researchers all help each other
  – This way, you can “lift” a journal
Fraud

• You can wait very long with your review
• You can reject unnecessarily
  – This is fraud, but hard to prove

• You can reject and steal someone’s ideas
  – This is of course real fraud, but it happens
Assignment 4
Assignment 4

• You will review 1 (short) paper
  – From a prestigious general science journal (PNAS)
  – These papers are available on-line through the VUB

• You will write a 800-word review report
  – Addressing the questions mentioned in the lecture
  – Giving suggestions to improve the paper
  – You will do this individually

• Email me for numbers of the papers assigned to you
  – You get three numbers, you choose one

Deadline: December 21
A good review

- Contains the reference of the paper
- Summarizes the papers very briefly
  - Not paraphrasing the paper’s abstract, but stating what the reviewer learnt
- Gives a brief opinion about the paper
- Explains the basis for this opinion
- Gives suggestions how to improve the paper
  - Both for content and form
- In your case: do not forget to put your name on the assignment!