How to surf today's information tsunami: On the craft of effective reading

SUMMARY

In this follow-up contribution to recent correspondence (“On the craft of effective lectures” [1] and “Complementary thoughts on the future of internet science: can digital libraries avoid scientific tunnel-vision and lead to innovation?” [2]) we provide suggestions to help individuals decide what scientific papers to read and how to read them. We do this in response to frequent questions by people with interest in science who want to know, and get some advice, as to how to effectively surf today’s information tsunami. This is particularly important in, but not confined to, universities and other research institutions where reading scientific papers is a fundamental task that forms the basis for all other academic activities such as writing papers or grant applications, providing reviews for a journal, preparing for postdoctoral positions, qualifying for collaborations or making oral or poster presentations. Included in our Advices 1–8 are concise suggestions which range from the appropriate motivation for reading articles in books, journals or on the internet to the very craft of systematically reviewing and, indeed, constantly challenging what one reads. We close this editorial with reading Advice 9 “You should always identify the roots of thinking and research” and 10 “The Golden Rule: set aside reading time” which should be necessary conditions for everyone who works in science. Importantly, while maintaining focus on material immediately pertinent to one’s primary research area, one should read about developments in other fields as well because this may be the key to original, and sometimes revolutionary, research.

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Advice 1: Before you start

Ask yourself the following questions: “Why am I reading a scientific paper? What do I hope to achieve?” The answer should be to check your present work and to be stimulated for and prepare your work in the future. You do not have time for “vanity reading”.

Advice 2: To read or not to read …

The title of scientific papers is most important since it determines whether or not you will have a closer look, usually at the abstract or summary of a paper (see Advice 3). A further guide may be the list of authors. While you need to be aware of Advice 4, it is often useful to follow publications from colleagues in your field.

Advice 3: … Depends critically on the abstract

Assess the abstract or summary of a paper for its relevance to your work, its potential scientific value, and whether or not it persuades you. The abstract must demonstrate that the work is scientifically sound. An abstract must not be abstract, but must be explicit and grounded in real facts and real observations. The readability and above all, the scientific quality of the abstract or summary may guide you to decide whether to read the entire paper or not. Abstracts that are difficult to read and understand often signal that the whole paper will not be any better and not worth the effort of reading.

Advice 4: Judge words rather than journals or authors

Judge work on its own merits and not on the basis of where it is published or by whom [3]. Many examples exist of landmark papers published in “low-impact” journals such as Poultry Science ([4]; this classic in immunology was rejected by Science and has since been cited 584 times) and conversely, of highly-acclaimed work in core journals such as Science or Nature which had to be retracted for reasons of fraud [5], misconduct or error. Many journals now hold back information about authors and their institutional affiliations from reviewers to allow them to form a more objective assessment of the scientific quality of a piece of work.

Advice 5: Organize how and be critical of what you read

Rather than reading the whole paper in one piece, organize your reading. If the title catches your eye and mind, look at the abstract or summary. Pause here, obey Advice 3. Provided that you decide to continue your reading of this paper, you may want to go straight from the Introduction to the Results and to how these are interpreted and put into the context of prior work in the Discussion. Be critical of all results and conclusions. If you decide that the results might be relevant to you, check if they are valid based on the experimental details given in the Materials and Methods section.

Advice 6: Peer review continues with your reading

Even though the editors and reviewers of a journal will have tried hard to assess the work they present, pre-publication peer review is not infallible. In fact, the real peer review occurs only after publication. Challenge what you read and ask the authors for more information if their data does not seem to add up [6].
You and the other readers determine if a given paper stands the
tests of time. A scientific paper is “an open invitation to inspect
ones results and to consider ones preliminary interpretation” [7].

Advice 7: Look for answers to these questions

What research question(s) does the paper address? What do the
authors conclude? What evidence supports their conclusions and
what is the quality of this evidence? Do the authors consider alter-
native explanations for their findings? Are the paper’s conclusions
relevant?

In most good papers you will note that the authors believed in
an a priori hypothesis enough to go ahead and test but that they
were also capable to doubt the a priori enough to notice errors
and faults as a basis to modify their a posteriori reasoning.

Advice 8: If a paper is difficult to read, be critical of yourself but
also of those who wrote the piece

If you find it difficult to follow the context, let alone details of a
paper, there are two possible explanations. You may be out of your
depth and may need to fill gaps in your knowledge before proceed-
ing. However, the explanation may also be that the paper is badly
written. If clarity does not ensue in a reasonable amount of time,
you are often better off cutting your losses and giving up.

Advice 9: You should always identify the roots of thinking and
research

Always use your reading to understand the root or origin of
ideas, hypotheses and research. This implies that you need to use
all tools for identification of published material that is relevant
for your reading, including PubMed, Google Scholar and the ISI
Web of Science. But years ago it was already anticipated in News-
week that eventually you may not have exhaustively researched a
topic unless you have also “googled” the theme. To have the basis
for better searches for information, Larry Page started out in the
mid 1990s with no less ambition than to download the entire World
Wide Web onto his desktop. Intriguingly, in a near(er) future, Goo-
gle’s ongoing digitizing of millions of books from libraries around
the globe will allow to search scientific literature – old and new –
easily and make them amenable to your qualified reading [2]. Note
that lack of appropriate reading is one explanation for the some-
what distressing fact that a considerable number of research papers
seem to stop with the reference catchment which the popular Medi-
dline database provides, i.e., references to journal articles from 1950
to the present, with limited older material. This can lead to aston-
ishing results. How else could one explain that Japanese and Amer-
ican researchers recently thought to have discovered new
chemistry which turned out to be a replication of diligent work
published as early as in 1904 [8]. This highlights how easy it is to
miss similarities to old results [9] and that in this instance errone-
ous novelty of findings can get even past the reading of experienced
peer reviewers (a further incentive to follow Advice 6). To avoid
these and other pitfalls, always discuss what you read with your
colleagues. This may be done formally within journal club settings
or informally during lunch or office conversations. Importantly, this
does, of course, have a bearing with regard to Advice 6 insofar as it
will help to continue peer review after the work was published.

Advice 10: The Golden Rule: set aside reading time

Especially when you are a young scientist with a less tight time
schedule, establish a defined period of time each week when you
do nothing but read and guard this time religiously. Apply all above
advice sensibly to economize your reading, but always try to obey
The Golden Rule. You may be tempted to use your reading window
for other activities such as writing, but remember that qualified
reading forms the basis of writing of papers or grant applications.
This advice is similar to that of Hamming to aside time for
“Great Thoughts” [10]: use your reading time to gather food for
thought and to identify and work on problems which are of central

Perspectives

What and how you read are key determinants of your research
career. While maintaining focus on material immediately pertinent
to your primary research area, leave time for reading scientific pa-
pers from other disciplines and fields. The latter is very important
to keep an eye on new developments in other fields that may be
the real key to original, and sometimes revolutionary [12], research
in your own area.

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