

Astrophysics Research Skills and Career Development

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How to Start a Research Project

- Look at the recent literature, including reviews
- Attend seminars, colloquia, conferences
- Find a topic that intrigues and excites you
- Figure out what you can try that is new or better



Alfred Hitchcock was a famous film director. Other directors were in awe of him because he achieved a 3:1 “use ratio” – for every 3 minutes of filming, 1 would be used in the final movie.

Other directors range from 10:1 to 100:1.

Don't expect every research idea to work out!
Try, fail, learn from failure, try, fail, learn, try, ...

How to Write Up Your Results

The start is the most important part.

At the beginning of the project, sit and **think** – what do you know about the subject (not much). **Remember this feeling!** When you write your results, you should be talking to that initial you.

Keep comprehensive notes, like a lab notebook – what worked, what didn't, what to try next, why, references. Build up a complete record of the project so you can look back a year later and see what you did.

There are many ways to write the article itself. I like to start with it as a repository for figures – a picture is worth 1000 words. Figures **always** come with complete, descriptive captions. As you begin to tie figures together into a **story**, the article “writes itself”...

“Begin at the beginning”, the King said, very gravely, “and go on until you come to the end: then stop”

– Lewis Carroll, Alice's Adventures in Wonderland

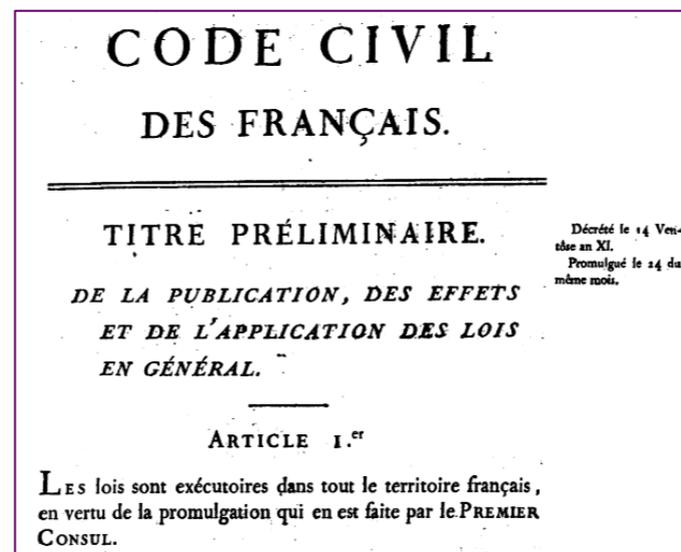


How to Write an Article

Of course the writing is not that easy. Always keep the **story** in mind! Conclusions are done last, and Abstract near last. Title should be attractive and succinct.

The End: I prefer as short an article (<10 pages) as tells a self contained story. S. Chandrasekhar worked on a project for 10 years, wrote a definitive textbook, and moved on to the next project!

Keep the story **interesting**, and specifically why the reader should be interested. A murder mystery that starts with the Code of Hammurabi, development of Napoleonic code, jury trials, etc. and only gets to the dead body in the last chapter will not have many readers! **Focus!**



How to Publish an Article

A journal common to several references could be a good choice.

Some institutions have rules about journal impact factors.

Many journals have no page charges – why pay when it's on arXiv free?

Reference articles that are relevant to your work.

Don't worry about citation count. It is unpredictable and not a true measure of quality/usefulness. However, many institutions use it despite its worthlessness.

Do not beg other authors for citations. It is demeaning, unprofessional. If your work had a **direct** impact on theirs, you can point out your article as “you might find of interest”. The impact must be **direct**.

See “Writing Scientific Papers in Astronomy”, by Knapen, Chamba, Black [arXiv:2110.05503](https://arxiv.org/abs/2110.05503) for lots of other good tips on research article writing

How to Make a Presentation

Story, story, story. You have a more limited time than with an article, so focus on what you want the reader to take away.

Make clear to the reader what is important by color, bold, italic (not all at once!). **Test:** stand back from your laptop by 2 meters; if you can't clearly read everything, redo the slide. Do not put red on blue, or dark text on dark background. Define abbreviations, special words.

elsevier.com/connect/how-to-give-a-dynamic-scientific-presentation

Ideally you focus on one point per slide. When I started giving talks, I used 50-60 slides/hour. Now I'm down to ~25. My dream is ~3!

The level must match the audience!

Practice, practice, practice. In front of a mirror, give the finished talk once for content, once for flow, once for timing. Then repeat.

Answering a question by "I don't know, I will get back to you on this" is perfectly ok. And do get back to them.

How to Prepare a Job Application

Basic information on the different parts of an application is at <https://jobregister.aas.org/postdoc-application-guidelines>

A cover letter is useful for highlighting any particular **connections** (in subjects or colleagues) you have with the specific institution, and summarizing your skills and specialty.

Research statements should use the **1/3:1/3:1/3 rule** on past, current, and planned work (this is good for grant proposals too). **End on a high note** – why are you the right person for the position; for your top ~3 places also specify why they are your desired place.

Emphasize **enthusiasm, skills, and flexibility**. Research details fill out examples of these, they aren't the only focus.

Always notify your referees, ideally a month in advance, that you want to request a letter from them. Send your latest cv and a good draft of your research statement, so they can support important points.

Other Resources

Communicating as a scientist:

<https://www.nature.com/scitable/ebooks/english-communication-for-scientists-14053993/communicating-as-a-scientist-14238273/>

Careers in academia:

<https://aas.org/careers/academic-career-advice>

Careers out of academia:

<https://aas.org/careers/nonacademic-career-advice>

Career profiles and paths:

<https://aas.org/careers/career-profiles>

Your colleagues – at the same level as you, those a few years ahead, and your adviser – are excellent resources. Ask them for tips, stories, advice, and with sufficient time comments on drafts.

They want to see you succeed!