Ten research principles

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1. Freedom of time and ideas

Traditional schedules don't work in science, since creativity doesn't have a schedule. Thus, beyond some activities (meetings, classes, laboratory), each researcher should adjust their own schedules at their convenience. A list of pending tasks per week eventually leads to the pressure of deadlines being more proper than external. Likewise, since the bachelor thesis there should be spaces for students to contribute their own ideas, which can always be corrected or improved. These spaces should increase in later stages, even when there are already research projects underway with well-defined objectives and methods. At any stage, it is vital to develop original ideas and encourage others to do the same. Negotiation, time, and trust development lead to this freedom of time and ideas, forming independent researchers.

2. Differentiation

The '*publish-or-perish*' system contributes to a constant comparison with academic peers. And while it is very important to publish articles in well-recognized journals, as (appropriately) this remains a central criterion for hiring, scholarships, and projects evaluation, it is equally important to stand out from peers. Young researchers should not be an exact copy of their supervisor - or of their peers, and there should be differences and complementation in research interests, techniques, and/or abilities.

3. Multiple interests

Over-specialization can lead to not surviving in the academic environment when the area of expertise loses popularity or its paradigms change. Having multiple interests - or being able to easily switch interests opens up multiple possibilities, even outside academia. For this, it is required to constantly learn new things, even at middle or late career stages. Under this interdisciplinary perspective, the distinction between '*basic*' and '*applied*' science becomes indelible. Finally, it is clear that all scientists should be interested in the sociology, history, and philosophy of their area(s) of study.

4. Human quality

Criteria such as productivity (No. of articles/projects), prestige of the university, and quality of life in the country, are important when choosing a place to study a graduate program or to establish as a young researcher. However, an equally important criterion -albeit ignored- is the human quality of supervisors and their teams. This is only known through previous interactions (for example during conferences), or by asking third parties. It is possible that a less productive supervisor provides more emotional

support and a warmer treatment, and in general that there is a greater personality and work ethics compatibility. This will contribute more to forming free, independent, and happy researchers, than environments where productivity could be higher but the treatment is less warm.

5. Horizontality

An extremely hierarchical academic system can have very negative effects. Practices where students/young researchers end up fulfilling secretarial or laboratory technician tasks should be avoided. Promoting a work horizontality implies greater delegation in tasks such as project management, supervision of bachelor thesis, classes, etc. This also implies a change in treatment and language, where excessive reverence, and distant and too cordial treatment can be very counterproductive.

6. Responsibility to publish

It is normal that during the initial stages of the academic career, results and manuscripts to be published accumulate, or that publications were rejected and must be improved and re-send. It is morally responsible to publish these results/manuscripts, as it took a lot of effort (and perhaps public funds) to obtain them. Also, of course, these publications benefit the *curriculum vitae*. Ideally, a good bachelor thesis should be published in a recognized journal. In graduate studies, it is recommended to publish additional results and reviews/meta-analyses to the results of the thesis -not necessarily with the supervisor. These may arise from additional projects or from courses taken. Finally, although the focus of publications should be articles indexed in *Web of Science*, other types of publications, such as articles in other indexes, outreach articles, technical reports, book chapters, among others, contribute to reaching another type of audience.

7. Networking

Recently, the formation of collaborative scientific networks has gained relevance by integrating researchers with common interests, from national to global scales. These networks allow constant communication, with less formality (and costs) than in traditional scientific societies. These networks also allow assessing research questions with dozens or hundreds of researchers from all over the planet, as it is increasingly required in various scientific areas. Founding, leading, and/or collaborating in research networks is increasingly important.

8. Teaching, outreach, policy

As soon as possible, bachelor students should begin to build their teaching *resume*, for example as teaching or laboratory assistants. This should be increased in graduate students and postdoctoral researchers, who should be invited to be collaborating/invited professors, and if possible, responsible professors. Also,

outreaching your own research results (and those of others) is essential when doing science today. This is a social and moral responsibility towards the public, the biggest science funder, and it also improves the ability to communicate complex ideas in simpler terms. Advertising your own work can also lead to it being more cited. Finally, it is recommended to get involved in policy matters, regarding scientific work, but also in specific areas of your expertise.

9. Hobbies

The positive effects of hobbies (crafts, art, sports) on mental health and work-life balance are widely recognized. In science, finding times and hobbies where the mind can rest from academic matters is critical. These hobbies can balance the negative effects of overwork, which is extremely common in science.

10. Introspection

The speed with which the scientific career passes leaves little time to reflect on it. Sometimes it seems to be an automatic process, with steps and ways of doing science that you "have" to follow, without further analysis or questioning. What kind of scientist do I want to be? Why should I only focus on my thesis, or publish articles only in *Web of Science*, or work solely with my supervisor? Can I build my own way of doing science? A healthy introspection implies asking many personal and more general aspects about the way of doing science.