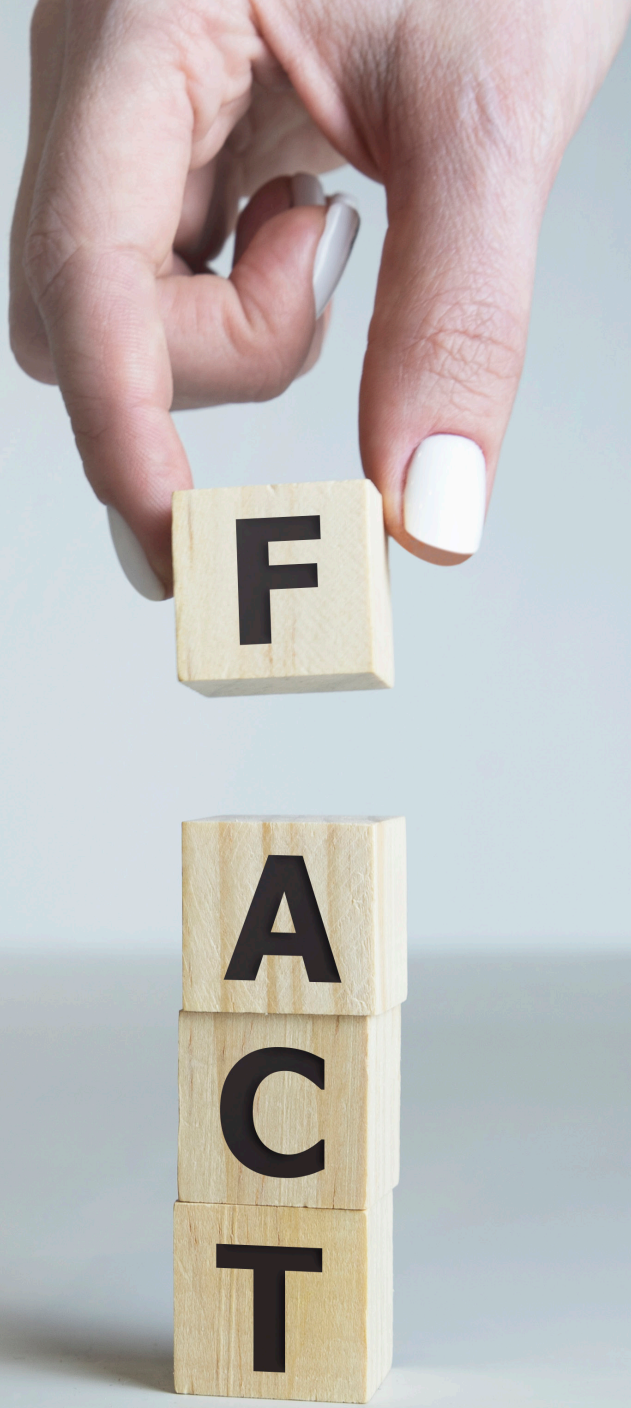
Promoting Good and Honest Research

How Research Integrity improves research quality



Path 2 Integrity

This publication has been produced within the framework of the Path2Integrity project, funded by the European Union's Horizon 2020 research and innovation programme, under grant agreement No 824488.

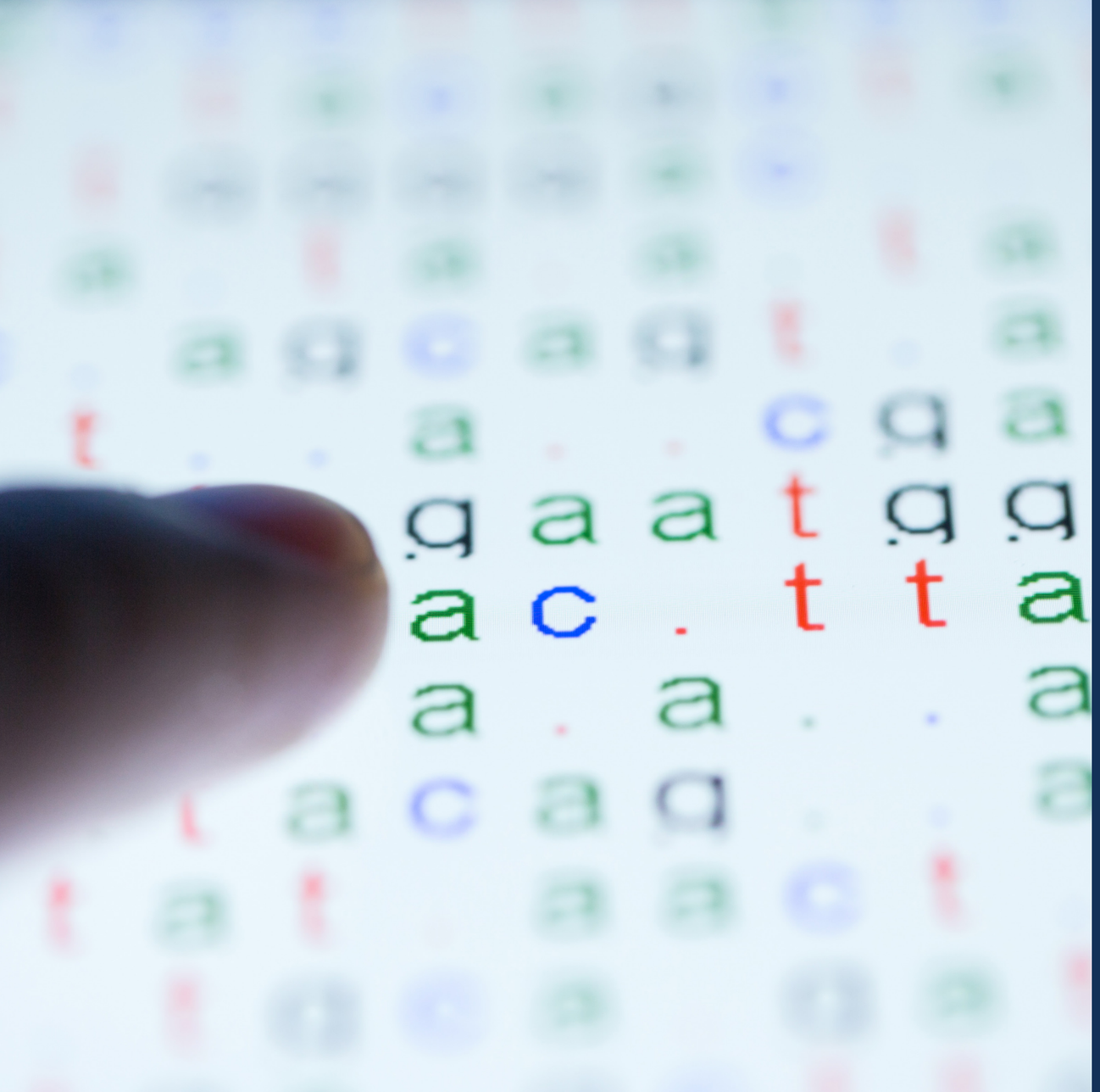
Images: iStock by Getty Images

Path 2 Integrity

www.path2integrity.eu

Promoting Good and Honest Research

How Research Integrity improves research quality



Content

Introduction 9

Why is research important to us? 13

Sources of information and data 15

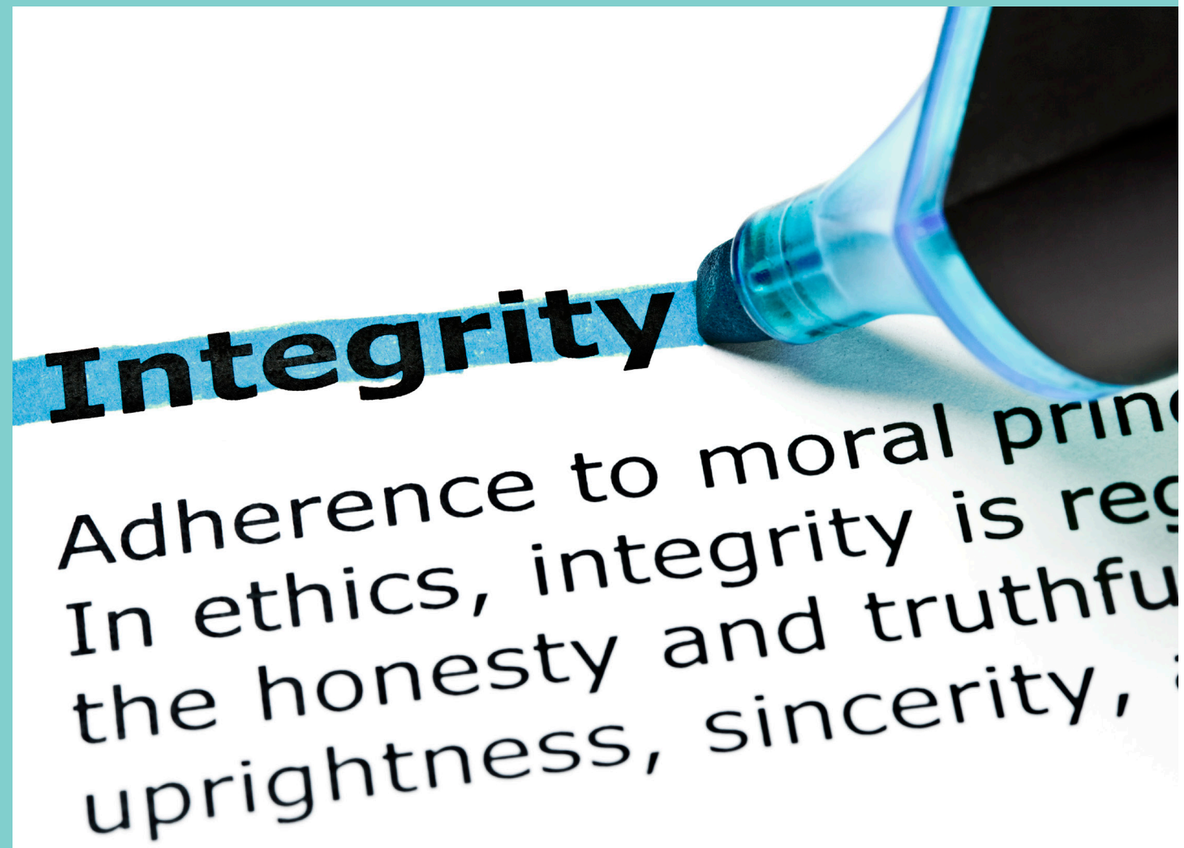
What is research integrity and why is it important? 21

What is research? 21
Different stakeholders of research 21
Principles of research integrity 22
Good research practices 22
Violations of research integrity 24
Research misconduct and unacceptable practices 25
Dealing with violations and allegations of misconduct 25

The Open Scientific Career 27

References 33

About the authors 35



Introduction

Julia Prieß-Buchheit

"Research is a quest for knowledge that is conducted in a way that is systematic, calculated, considered, well planned, thought out in advance"[1] and more. What often starts with a hunch, a bit of serendipity, and enduring curiosity leads researchers to build up knowledge, develop technology, inform policy, and solve everyday problems.

Researchers observe materials at a tiny scale, as well as deep sea phenomena, light structures from outer space, and much more. Researchers develop theories, like the big bang theory or the theory of relativity. In other words, researchers discover our world and work to understand its meaning. They work in various fields such as natural sciences, humanities, economics or others, where they carry out basic research, as well as practical application and further development of what they have discovered. They analyse the impacts of climate change, examine the effects of medicines, document difficult diseases, discuss societal rules and complex generation structures, and look for answers to many more questions. That's right: researchers discover and communicate facts about our world. As a result, researchers are an important resource for societies to learn more about themselves and the world they live in.

Now, imagine a worst-case scenario: a con artist, posing as a researcher, produces unreliable research results. Eventually, these results make their way into society and can lead to medical mistreatments, the collapse of a car park, or ineffective strategies for crime prevention. No matter which of these consequences occurs, some people will suffer from them – because the con artist clearly and deliberately cheated. Through their research misconduct, the con artist has endangered society. Think about it! Nobody wants a con artist to be a researcher. On the contrary – everybody wants researchers to uphold their research integrity; everybody wants them to work responsibly.

That is why this booklet explains in depth that **Research Integrity** is of the utmost importance for both researchers and for society. Research Integrity is valuable and worth protecting, because without it, citizens'

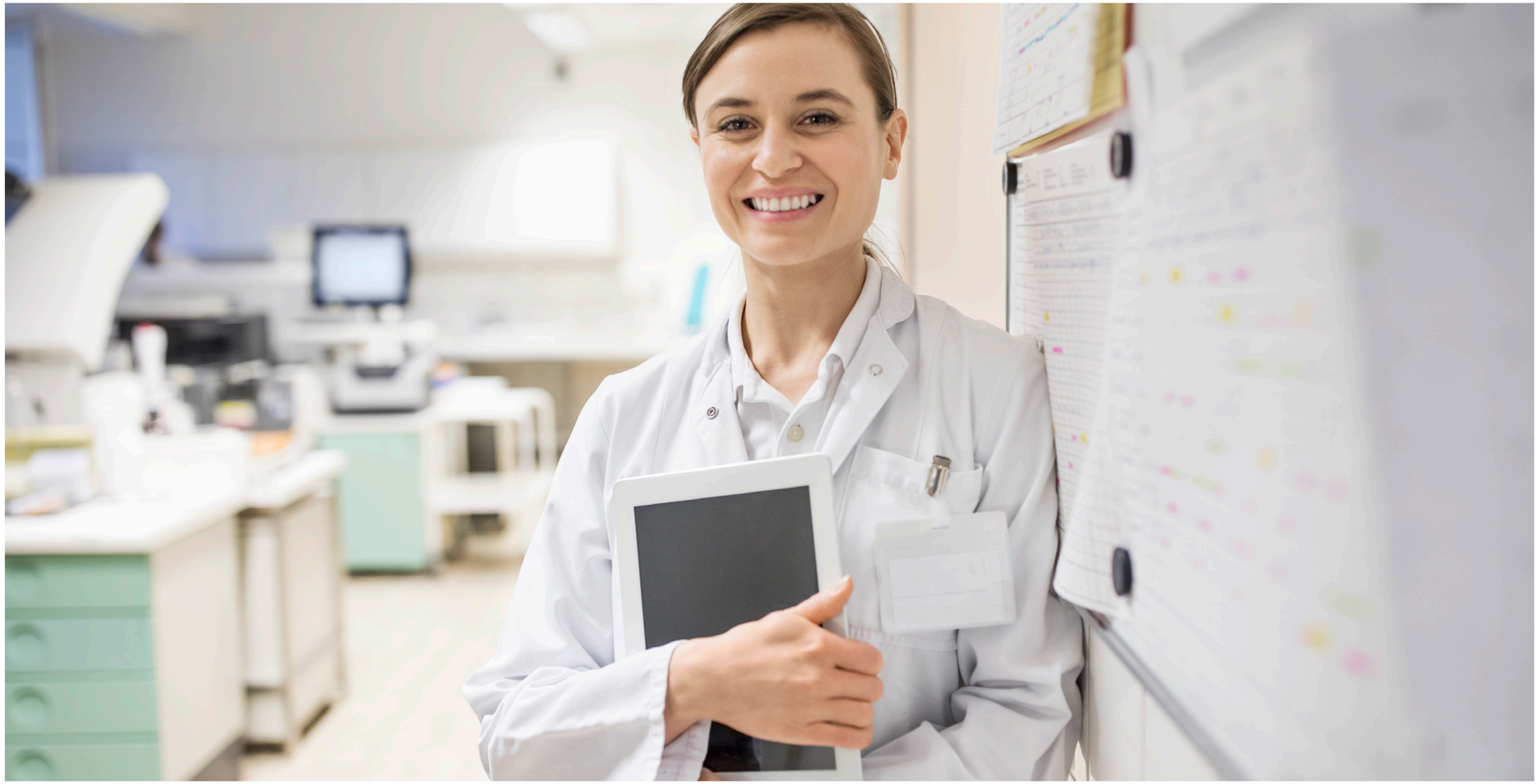
[1] Prieß-Buchheit, Julia & Haeberlein, Lisa. (2019, September). Learning Card For Research Integrity (S2) (Version 1). Zenodo. http://doi.org/10.5281/zenodo.3383805.

trust in research inevitably fades, leaving them "vulnerable to misinformation, suspicion and poorly formulated choices"[2].

In the following pages, as part of Path2Integrity (www.path2integrity.eu), authors outline how Research Integrity is a cornerstone of reliable research results. The main aim is to explain how important it is both for you as a citizen and for you as a (future) researcher to have a culture of research integrity. What is Path2Integrity? Path2Integrity is a European project, funded by the European Commission, that raises awareness about Research Integrity and educates on how to argue in favour of responsible research and reliable research results.

So, what is important for researchers and citizens again?
Researchers are reliable, meaning that we can trust in them.

- Researchers do not lie; they are honest.
- Researchers do not cause harm; they respect everyone and everything.
- Researchers do not act irresponsibly; they are accountable[3].



[2] Seven Reasons to Care About Integrity in Research. Science Europe: https://www.scienceeurope.org/our-resources/seven-reasons-to-care-about-integrity-in-research/

[3] See ECoC, 2017, p.4.

Why is research important to us?

There are many things based on scientific research that we use in our everyday lives without even thinking about it. For example, we take electricity for granted every day when we charge phones or cook meals. When this supply is suddenly unavailable, we become more conscious of how much this resource influences our lives. Although we probably do not explicitly think about Ben Franklin's studies of static and lightning, or about Alessandro Volta's first battery, we are nevertheless reminded of the close relationship between research and society whenever we benefit from the contributions made by researchers like these.

For example, when your phone battery runs out during a long train ride and no plugs are available, you may suddenly realise how important electricity and magnetism are as you find yourself hoping that the connecting train has plugs. In these moments we understand that inventions like these, which are based on reliable research, make life easier and more comfortable.

Research enhances our knowledge about the world we live in. Research results filter into society and guide and influence our actions. Look at meteorologists, for instance. They provide reliable tools to accurately forecast weather. Whenever we decide what to wear, we just have a look at what the weather forecast says. If we want to know what to pack in our suitcase for the holidays, whether our desired holiday destination is safe from storms, or what the odds are that a hurricane might threaten our family, meteorology can help us make decisions by providing us with weather reports that are based on scientific insights.

Whether research is conducted in a reliable manner is in the hands of the researcher as well as their workplace. Researchers' workplaces can greatly vary. Some researchers conduct their research at their desk at home. Others are part of more complex workplaces at universities, laboratories, institutions etc. One example of an extraordinary research workplace is the CERN institute, in Switzerland[3]. To conduct experiments in high energy physics, the CERN built a particle accelerator called a large hadron collider. At 27 kilometres – twice the length of the Ponte Vasco da Gama bridge in Lisbon, Portugal – the large hadron collider represents a very special research workplace. A completely different workplace is the world's largest library for economic literature. The ZBW – the Leibniz Information Centre for Economics[4] in Kiel, Germany – provides economists and related researchers with access to important information and data within their field. These two examples demonstrate that workplaces can greatly influence what researchers do. Furthermore, these workplaces are embedded in larger research systems, as researchers work and collaborate with scientific journals such as Philosophical Magazine or Nature, government and regulatory agencies, funding agencies, and much more. All of these moving parts play important roles in ensuring **Research Integrity**.

[3] https://home.cern/

[4] http://www.zbw.eu/en/

Sources of information and data

Dolors Grillo Bosch

1. Prior to starting any written piece of work you should think about these questions:

- What is my area of expertise and speciality?
- What kind of work do I want to do?
- What do I know about this topic?

The answer will determine what and where to look for information. For instance, the information sources might not be the same for humanities as for biology, or they could differ according to whether you are going to write a monograph, a review or an original piece of work.

2. In order to prepare a new piece of work you also need to know what kind of sources of information there are in order to define what to look for.

The sources of information can be classified as:

Primary information source: the source where the new and original research findings and theories are made public, such as research journals or conferences, including their proceedings and publications.

Secondary information source: the information source that in general is an analysis of the original research findings and theories described in the primary sources. Examples of secondary sources are books, encyclopaedias, and reviews.

Tertiary information sources: a list of facts and key information items such as dictionaries, encyclopaedias or other reference material.

3. To determine where to look for information you should first:

- Ask your teacher or supervisor for advice. He or she is an expert on how to prepare different pieces of work for a given research area.

- Check the library or the library website of your school, college or university. Library staff are professionals who know the library and the different kinds of information sources you could be interested in.

4. Sources of information and their quality: Depending on the aims of your work, good sources of information can include:

Books, textbooks and monographs: These kinds of sources, in general, provide an in-depth overview of a subject. In general, they include a lot of references, which can be good if the topic you are writing about is new for you.

Journal articles: This type of information resource includes original research papers and reviews. The first provide emerging research results. Reviews are also really good sources of information, as in general they assemble, comment and give a perspective on what has been done and what will or must be done on a hot research topic. When looking for Journal articles you should take into account that there are two different kinds of journals in terms of the availability of their articles: some are fully open access, and you will be able to read all the articles whenever and wherever you want, e.g. eLIFE or PLOS ONE, while for others you will only be able to access the article if its authors have paid a fee for being open, which is already the case for many journals.

Dissertations and their repositories: This is first-hand information on what is carried out in research at a given moment. In general, they also contain a good review of information on a given topic. Right now, there are plenty of repositories that either contain a summary of the thesis or even a PDF file of the whole document.

Technical reports and Patents: These are technical documents that also contain information that could be relevant for some pieces of work. There are international patent offices such as the European Patent Office (EPO) and World Intellectual Property Organization (WIPO), and national ones such as the OEPM in Spain. In general, each country has its own patent office.

In order to search for the aforementioned documents and be aware of the quality of the research journals, you should take into account that there are **specific databases, some of them open, others partially open and other available just by subscription.** You can access these databases via the Internet.

The quality of the journals is evaluated in databases such as the Web of Science and its Journal Citation Reports (appearing each year) and by scientometric indexes such as the Impact Factor. Carhus Plus, ERIH PLUS and ANVUR are also good tools to evaluate the quality of the journals in Social Sciences and Humanities.

There are specific databases such as PubMed and the European EUROPE PMC for Life Sciences that provide access to at least abstracts for many of the aforementioned information sources.

Pieces of advice

- The Internet and Wikipedia are great tools and in some cases they can provide a starting point. However, they also contain information that is unreliable (for instance there are doubts about the authorship, the author affiliation is not known, the information obtained is not updated, among others) and too lax. Thus, frequently starting with these tools in your academic or professional works is a bad decision.

- Defining a good search strategy in databases can save time and provide better quality results on your searches.

Section 2, 3 and 4

- Undergradate Library. University of Illinois at Urbana champaign. https://www.library.illinois.edu/ugl/howdoi/selectingsources/ [Source consulted on 13/09/2019]

- Centre de recursos per a l'aprenentatge i la investigació. Universitat de Barcelona. https://crai.ub.edu/ca/recursos-d-informacio/guia-general-i-de-referencia [Source consulted on 13/09/2019]

- University of Nottingham. Studying effectively. Reading and interpreting sources of data. Types of information resources. https://www.nottingham.ac.uk/studyingeffectively/reading/infotypes.aspx [Source consulted on 13/09/2019]

- Centre de recursos per a l'aprenentatge i la investigació. Universitat de Barcelona. Bif List of sources of thesis. https://tagpacker.com/user/crai.universitat.de.barcelona.guia.general.i.de.refer.ncia?t=tesis [source consulted on 08/11/2019]

5. Citing the information sources

Properly citing your sources is a fundamental part of your work. We provide some indications in the References section that can be useful for doing this part of your work properly.

6. Some final general remarks

Before using the information you found in the paper you want to write, you should answer the following questions yourself:

- Is this information that I easily found relevant for the paper I want to write?
- Does this information I easily found have enough quality to be used in the paper I want to write?
- Is the information I found valid enough for the paper I want to write?
- Does the information I gathered have any bias that lowers the quality of the paper I want to write?

Finally, have you been honest about the paper you wrote?

- Have you used appropriate information sources?
- Are the information sources you used of good quality?
- Have you correctly cited all the sources used?
- Have you actually written the paper by yourself?

Section 5 and 6

- Eco, U. 1999. Cómo se hace una tesis: técnicas y procedimientos de estudio, Barcelona. Ed. Gedisa.

- Harvey, G. 2001. . Madrid. Ed. Cómo se citan las fuentes: [guía rápida para estudiantes] Ed. Nuer.

- Martinez de Sousa, J. 1987. Diccionario de ortografía técnica: normas de metodología y presentación de trabajos científicos. Bibliológicos y tipográficos. Salamanca. Ed. Fundación Germán Sánchez Ruperez,.

- Molina Villar, J. J. 2010. Cómo hacer un trabajo final de carrera para los estudios de grado: notas para estructurar de manera práctica el trabajo final de carrera y plan de marketing para los estudios de grado. Barcelona. Ed. Astro Uno

- Puig, I. 2001. De cómo hacer un trabajo escrito. Barcelona. Ed. Octaedro

- Serafini, M. T. 1993. . Barcelona. Ed. Paidos. Cómo redactar un tema; didáctica de la escritura.

- Vázquez, G. 2001. Guía didáctica del discurso académico escrito ¿cómo se escribe una monografía?. Madrid. Ed. Edinumen.

- Phillips,M; Fosmire, M; Turner,L; Petersheim, K; Lu, J. Comparing the Information Needs and Experiences of Undergraduate Students and Practicing Engineers. The Journal of Academic Librarianship 2019 (45) 39–49.

What is research integrity and why is it important?

Arja R Aro, based on ALLEA: The European Code of Conduct for Research Integrity, revised edition.

What is research?

Research can be understood as a systematic and transparent way to gain knowledge. Knowledge is needed to understand our world, develop technology such as robots, treatments for diseases, or ways to protect the environment. Thus, research is very important to society. Research needs to be trustworthy and carried out transparently. Research knowledge is not only about technology and science; it also needs to consider individual, community, and cultural values. New technology based on research (e.g. self-driving cars) needs to be carefully evaluated to decide if, where and how it could be used to serve humankind instead of causing additional harm.

Different stakeholders of research

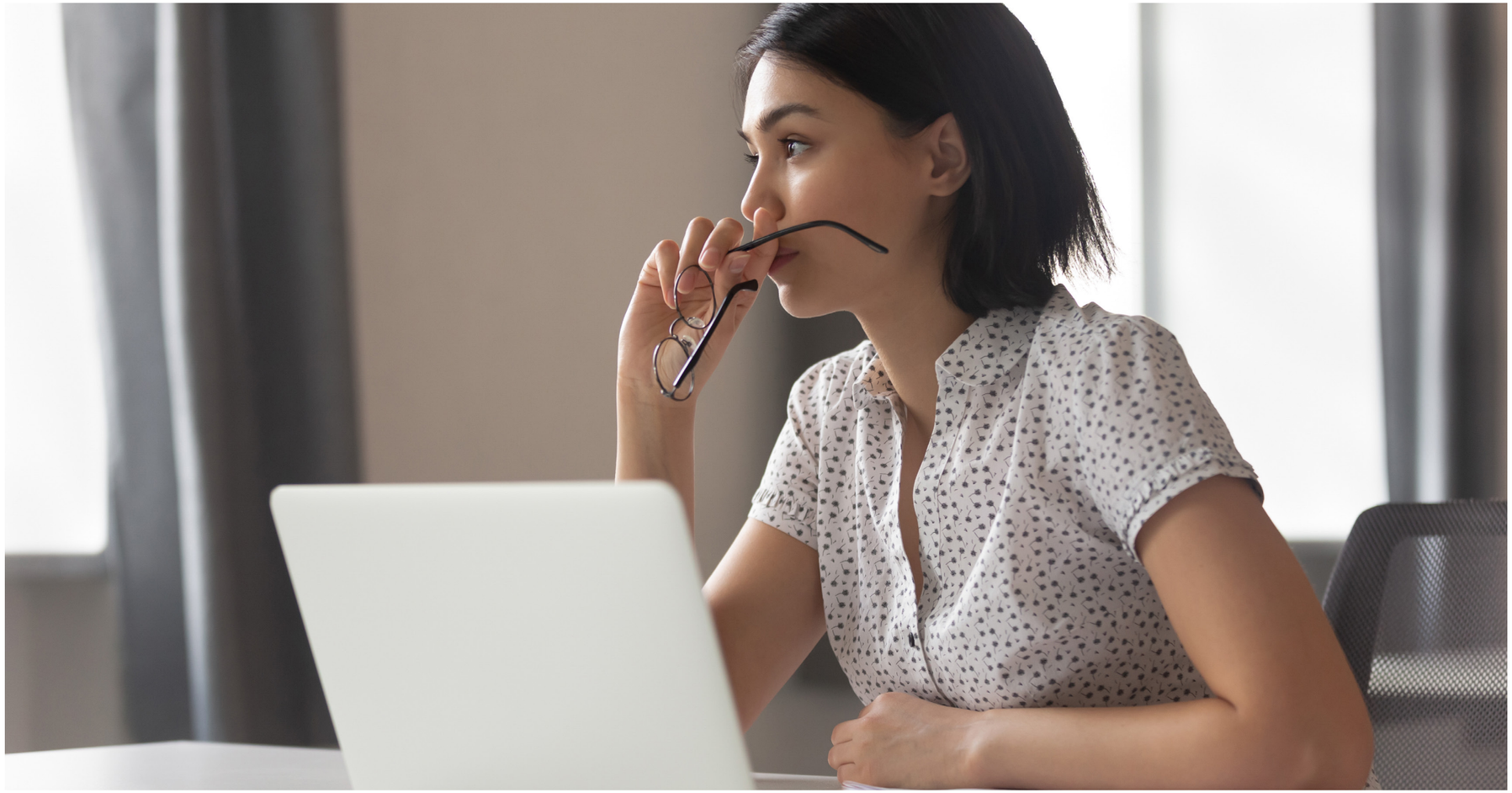
Researchers are not fully independent in their work. Those who finance research (e.g. industry, ministries giving money) have the power to decide which research topics are studied. Research can be done in humans, animals, or the environment; integrity means that they all need to be treated with respect and harm should be avoided. Further, researchers need to respect each other. Most societies have established research integrity or research ethics committees to safeguard research quality.

Principles of research integrity

The central principles of research integrity are reliability, honesty, respect, and accountability[1]. Reliability means that the research is done well, with a proper research design, relevant methods, good data analysis, and rational use of resources. Honesty means that research is planned and done, evaluated and communicated transparently, fairly, and without biases. Respect covers colleagues, research participants, the society, ecosystem, culture and environment. Accountability (=responsibility) covers the research process from conception to publication, management and organisation, training, supervision and mentoring juniors, and managing the wider impact of research.

Good research practices

The research environment should value integrity and deal with violations to good research practice. When research material and management are well organised, research can be reproduced. Training, supervision, and mentoring should aim at good and rigorous research process and methods, relevant integrity and ethics regulations and codes, and it should involve researchers, leaders, supervisors and mentors.



[1] The European Code of Conduct for Research Integrity https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf

Research procedures need to be based on what is known about the topic already. Careful research process uses resources reasonably, publishes results with correct interpretations, respects the confidentiality of the information, and follows relevant reporting guidelines[2].

Safeguards cover relevant regulations and codes and deals with research subjects (human, animal, cultural, biological, environmental, physical) with respect and care; considers the health, safety and welfare of the community and collaborators; and is sensitive to age, gender, culture, religion, ethnic origin, and social class.

Data practices and management need to ensure transparency and access to data 'as open as possible, as closed as necessary' and be FAIR (Findable, Accessible, Interoperable, Re-usable) as well as to respect the intellectual property rights (IPR) of research outputs. In Europe, new regulations have been produced for data protection[3].

Collaborative working means that all partners take responsibility for research integrity, agreeing on the goals and the need for open communication; on following codes, laws and regulations; and on handling conflicts. All partners are informed and consulted about submitting the research report for publication.

Publication and dissemination: All authors are fully responsible for the content of research publications (unless otherwise stated).

Author order is agreed together; authorship needs to based on significant contributions to the design, data collection, analysis, and interpretation of results.
Generally, results should also be openly communicated to the general public both in traditional and social media. All collaborators, funders, and assistants need to be acknowledged; conflicts of interest need to be declared. Negative results (meaning e.g. that the intervention studied did not work) are as valid as positive ones.

Reviewing, evaluating and editing: Researchers take seriously their commitment in refereeing, reviewing, and evaluating research manuscripts, funding or job applications, promotions, and rewards; they carry out these tasks transparently and justifiably, declaring a conflict of interest when relevant.

Violations of research integrity

Failing research integrity and good practices means renouncing one's professional responsibilities; it damages the research process, degrades relationships between researchers, undermines the trust and credibility of research among people and society, wastes resources, and may also bring danger or even harm to research participants, users, the society, or the environment.

[2] Reporting guidelines: example: Enhancing Quality and Transparency of Health Research https://www.equator-network.org/about-us/what-is-a-reporting-guideline/

[3] General Data Protection Regulation (GDPR) https://gdpr-info.eu/

Research misconduct and unacceptable practices

Misconduct can happen in writing a research plan, doing research, reviewing it, or reporting it. Fabrication means making up results and presenting them as real. Falsification is manipulating research material, equipment, or the process, or changing, leaving out data or results without justification. Plagiarism happens when someone uses other people's work and ideas without giving proper credit (=referencing) to the original sources, thus violating the IPR of the original authors.

Dealing with violations and allegations of misconduct

Violations need to be dealt with transparently and consistently, considering integrity and fairness. Integrity means that investigations of suspected misconduct are fair, confidential, comprehensive and quick. Investigations should be accurate, objective and thorough. Conflicts of interest need to be declared; conclusions should be reached; and whistle blowers need to be protected. Further, the procedures for dealing with violations need to be publicly available and accessible to ensure their transparency and uniformity.

Fairness means that the process is fair to all parties; those accused of misconduct are given full details of the allegations and allowed a fair process for responding to allegations and presenting evidence. Action to those shown to have participated in misconduct has to be proportionate to the severity of the violation. Appropriate restorative action is taken when researchers are freed from suspected misconduct. It needs to be remembered that anyone accused of research misconduct is presumed innocent until proven otherwise.

The Open Scientific Career

Jordi Mas-Castellà

We all agree that the modern scientist is made, not born. Thus the main features of scientific work, such as the generation, maintenance, transmission and authority of knowledge can be learnt and mastered. We cannot doubt that scientific research is a social activity and, in order to understand it, special emphasis should be placed on how scientists behave towards one another, how they are organised and how information passes between them. Scientists form part of a community that is auto regulated since its members have to participate in the approval of other scientists' research output (by accepting manuscripts to be published in scientific journals that are added to the author's curriculum vitae), on the boards that hire or fire scientists for different positions, on the committees that rank research proposals or grants, etc. As an academic community, however, it needs to become more articulate, persuasive and influential in holding up the values of science and the leadership that this requires, in all its forms[1]. Some authors may think that scientists are internally motivated, dedicated, even called, to their work; they are selfless, resistant to convention and authority, intentionally blind to social convention and prejudice, unconcerned for fame and material reward, open[2].

The Open Science movement has been unfolding intensely over the past years to improve the credibility and reproducibility of science. Key domains of Open Science practices include Open Data; Open Source; Open Notebook; Open Access; Open Peer Review; Open Education; and citizen science (involving the general public in scientific research). Open Science aims to make scientific data and research accessible to all levels of an inquiring society. We should then include the personal endeavour of a scientist (their science career) in this same movement and assess the career of a scientist as an Open Scientific Career.

[1] Steelman, T. A., & McDonnell, J. J. (2017). *Look for the leaders.* Nature. https://doi.org/10.1038/nj7664-483a

[2] Shapin, S. (2008). *The Scientific Life: a moral history of a late modern vocation.* Chicago: The University of Chicago Press.

Scientific careers should be Open, in the broadest sense of the term. Besides Open Science, Open Innovation defines the multiple paths of knowledge going from academia to companies, to users and back. In this context, science careers should also be open, meaning that scientists should have the skills to succeed in different working environments. Programmes that facilitate the contact and transit between the academic and business worlds are now usual. Flexibility of working conditions, hiring requirements, and different types of job agreements should allow the positive flow of scientists to the companies' labour market. This, however, is not an easy task, since the science community and the business community still have their own standard rules. Ostensibly doctoral graduates secure better employment than those with only an undergraduate degree, enjoying a higher employment rate, more highly skilled work, increased earnings and a reduced gender pay gap[3]. For instance, some studies show that most postdocs will not find tenure-track positions within universities, while postdoctoral fellowships are viewed as positions that prepare PhD students for academic careers. Postdocs consequently pursue non-academic jobs that differ in the degree to which they utilise postdoctoral scientific training. Multiple individual, principal investigator (PI), as well as organisational and policy factors, including the lack of relevant skills, absence of support—and in some cases opposition—from their PIs, and poor availability of non-academic career preparation opportunities, influence scientists' transition to non-academic careers. Viewed collectively, these elements likely hinder a move to non-academic scientific positions and thus have consequences for postdoc career trajectories and, by extension, the utilisation of new knowledge[4].

An Open Scientific Career implies that all decisions taken should be strategic. The scientific career should be goal oriented, planning for and addressing the researcher's own objectives. An internal analysis of our personal strengths and weaknesses should precede the external assessment of the opportunities out there. The alignment of personal assets with foreseen objectives and milestones should be carried out in a strategic way. For example, changing institutions is a key career decision for scientists, playing an important role in education, scientific productivity, and the generation of scientific knowledge. Some authors affirm that a scientist's profile determines their decision to move (i.e., change institution). Their recent scientific career, the quality of their scientific environment, and the structure of their scientific collaboration network influence to a high degree the next researcher's move and which institution they will choose[5].

[3] Hancock, S. (2017). *Who gets what? Understanding UK doctoral degree outcomes in terms of graduates' background characteristics and prior higher education experience.* Retrieved from https://www.srhe.ac.uk/downloads/reports-2016/HANCOCK-Sally-SRHE-NR-Final-Report.pdf

[4] Hayter, C. S., & Parker, M. A. (2019). *Factors that influence the transition of university postdocs to non-academic scientific careers: An exploratory study.* Research Policy, 48(3), 556–570. https://doi.org/10.1016/j.respol.2018.09.009

[5] James, C., Pappalardo, L., Sîrbu, A., & Simini, F. (2018). *Prediction of next career moves from scientific profiles.* ArXiv: 1802.04830v1. Retrieved from https://arxiv.org/pdf/1802.04830.pdf

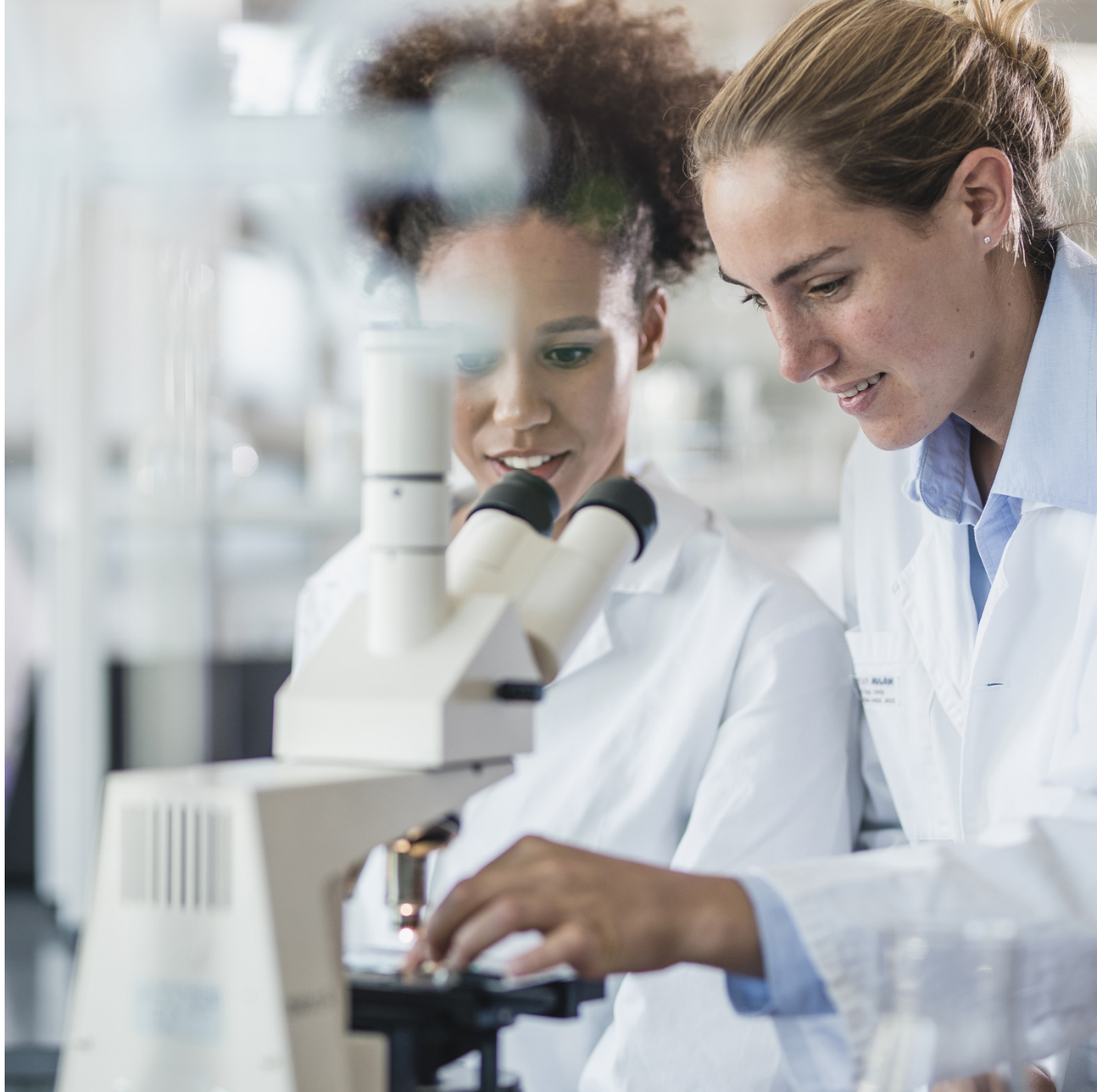
Stating the obvious, an Open Scientific Career should be international. Even though in some cases the research focus has some local aspect to deal with, the general scope and the interrelations with others have to be in the international context. In this respect, mobility programmes are extremely important, allowing scientists to stay for short or long periods of time with groups in other countries. These programmes help to reinforce (for the hosting lab and for the visitor) the social dimension of the scientific activity. Special emphasis should be placed on links to science in developing countries. As Mirjana Povic states[6]: "More scientists should consider sharing their experience and knowledge in developing countries ... You can make huge personal and professional progress by going outside your normal routine and comfort zone. You learn many things when you adapt to different conditions ...This life isn't easy. But scientists can adapt and find ways to get things done. We learn new ways to do things and discover patience that we didn't know we had. That comes in handy in many areas of life."

Finally, the Open Scientific Career has to be ethical. The scientist's behaviour and activities have to be respectful of oneself, others, and the environment. And knowledge is called on to play an essential role. As Hans Jonas[7] states: "No previous ethics had to consider the global condition of human life and the far-off future, even existence, of the race ... Knowledge, under these circumstances, becomes a prime duty beyond anything claimed for it heretofore, and the knowledge must be commensurate with the causal scale of our action."

Science may err, but it is, after all, self-correcting. And similarly, the Open Scientific Career may err, but adaptation and redirecting is an intrinsic part of it.

[6] Dance, A. (2018). *Meet the space researcher smoothing the path for women in science across Africa.* Nature, 563(7729), 148. https://doi.org/10.1038/d41586-018-07198-z

[7] Jonas, H. (n.d.). *Technology and Responsibility: Reflections on the New Tasks of Ethics | Inters.org.* Interdisciplinary Encyclopedia of Religion and Science. Retrieved 7 September 2020, from http://inters.org/jonas-technology-responsability



References

All European Academies ALLEA. (2017). *European Code of Conduct for Research Integrity*. Retrieved December 16, 2019, from https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf

Dance, A. (2018). *Meet the space researcher smoothing the path for women in science across Africa.* Nature, 563(7729), 148. https://doi.org/10.1038/d41586-018-07198-z

de Puig, I. (1994). *Cómo hacer un trabajo escrito*. Barcelona: Octaedro.

de Sousa, J. M. (1987). *Diccionario de ortografía técnica: Normas de metodología y presentación de trabajos científicos, bibliológicos y tipográficos* (Biblioteca del libro. Serie maior). Salamanca: Fundación Germán Sánchez Ruipérez.

Eco, U. (1997). *Como Se Hace Una Tesis* (Spanish Edition). Barcelona: Gedisa.

Guia General i de Referència | Centre de Recursos per a l'Aprenentatge i la Investigació - CRAI UB. (n.d.). Centre de Recursos per a l'Aprenentatge i La Investigació - CRAI UB. Retrieved 7 September 2020, from https://crai.ub.edu/ca/recursos-d-informacio/guia-general-i-de-referencia

Hancock, S. (2017). *Who gets what? Understanding UK doctoral degree outcomes in terms of graduates' background characteristics and prior higher education experience*. Retrieved from https://www.srhe.ac.uk/downloads/reports-2016/HANCOCK-Sally-SRHE-NR-Final-Report.pdf

Harvey, G. (2019). *COMO SE CITAN LAS FUENTES: GUIA RAPIDA PARA ESTUDIANTES*. Madrid: NUER EDICIONES S.A.

Hayter, C. S., & Parker, M. A. (2019). *Factors that influence the transition of university postdocs to non-academic scientific careers: An exploratory study*. Research Policy, 48(3), 556–570. https://doi.org/10.1016/j.respol.2018.09.009

Illinois University Library. (n.d.). *Select the Best Information Source – Undergraduate Library – U of I Library. Illinois Library*. Retrieved 7 September 2020, from https://www.library.illinois.edu/ugl/howdoi/selectingsources/

Intersoft Consulting. (n.d.). *General Data Protection Regulation GDPR*. Retrieved December 16, 2019, from https://gdpr-info.eu/

James, C., Pappalardo, L., Sîrbu, A., & Simini, F. (2018). *Prediction of next career moves from scientific profiles.* ArXiv:1802.04830v1. Retrieved from https://arxiv.org/pdf/1802.04830.pdf

Jonas, H. (n.d.). *Technology and Responsibility: Reflections on the New Tasks of Ethics | Inters.org.* Interdisciplinary Encyclopedia of Religion and Science. Retrieved 7 September 2020, from http://inters.org/jonas-technology-responsability

Molina Villar, J. J. (2010). *Cómo hacer un trabajo final de carrera para los estudios de grado: notas para estructurar de manera práctica el trabajo final de carrera y plan de marketing para los estudios de grado.* Barcelona: Astro Uno.

Phillips, M., Fosmire, M., Turner, L., Petersheim, K., & Lu, J. (2019). *Comparing the Information Needs and Experiences of UndergraduateStudents and Practicing Engineers.* The Journal of Academic Librarianship, 39–49.

Prieß-Buchheit, J., & Haeberlein, L. (2019, September 2). *Learning Card For Research Integrity (S2).* Retrieved December 16, 2019, from https://zenodo.org/record/3383805#.XfelEfx7mUk

Science Europe. (2015, June 17). *Seven Reasons to Care About Integrity in Research.* Retrieved December 16, 2019, from https://www.scienceeurope.org/our-resources/seven-reasons-to-care-about-integrity-in-research/

Serafini, M. T. (1989). *Cómo redactar un tema: didáctica de la escritura.* Barcelona: Paidós.

Shapin, S. (2008). *The Scientific Life: a moral history of a late modern vocation.* Chicago: The University of Chicago Press.

Steelman, T. A., & McDonnell, J. J. (2017). *Look for the leaders.* Nature. https://doi.org/10.1038/nj7664-483a

Tagpacker. (n.d.). Tagpacker. Retrieved 7 September 2020, from https://tagpacker.com/user/crai.universitat.de.barcelona.guia.general.i.de.refer.ncia?t=tesis

UK EQUATOR Centre. (n.d.). *Enhancing the QUAlity and Transparency Of health Research.* Retrieved December 16, 2019, from https://www.equator-network.org/about-us/what-is-a-reporting-guideline/

University of Nottingham. (n.d.). *Studying Effectively.* Retrieved December 17, 2019, from https://www.nottingham.ac.uk/studyingeffectively/reading/infotypes.aspx

Vázquez, G. (2001). *Guía didáctica del discurso académico escrito: ¿cómo se escribe una monografía?* Madrid: Edinumen.

About the authors

Julia Prieß-Buchheit

Professor of Education and Didactics
University of Applied Sciences and Arts
Coburg
Germany
Julia.Priess-Buchheit@hs-coburg.de

Dolors Grillo Bosch

Adjunct lecturer
Chemistry Departament
Faculty of Science
Autonomous University de Barcelona
Catalonia, Spain
dgrillobosch@gmail.com

Arja R. Aro

Professor
EduRes Consulting Ltd.
Finland
arja@edures.consulting

Jordi Mas-Castellà

Associate Professor of Microbiology
Faculty of Biosciences
Autonomous University of Barcelona
Catalonia, Spain
jordi.mas25@gmail.com

This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824488.