

Short Communication

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Thinking up an original scientific research project



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Abstract: Writing a research proposal is not a simple task if we wish—and we do usually wish!—to succeed in putting our project into practice. Three different developing stages should indeed be clearly borne in mind from the very beginning. The first stage requires you (the applicant) “*To have your own idea*”, thus demanding novelty and originality in the way of thinking; the second has the goal “*To get your idea funded*”, thus entailing project feasibility and persuasion in the way in which the idea is presented; and the third is “*To run the project*”, thus requiring resources and local implementation. The first step—i.e., to think out of the box, to be different, to be unique—is the most difficult task, the challenging point in the elaboration process. The importance of reading scientific literature, being aware of competitors and developing original thoughts will be discussed. And communication—from brain to brain, from yours to proposal reviewers’ mind—will unavoidably emerge as the *vousoir*, the wedge-shaped or tapered stone used to construct the whole project. In this context, the three pillars of the Aristotle’s Rhetorical Triangle will be discussed: *ethos* (credibility), *logos* (reasoning) and *pathos* (empathy). It will end with a basic, central principle as “*Have the brain full up with the whole story before writing any single word on any blank piece of paper*”.

Keywords: Aristotle’s rhetorical triangle; communication; scientific research project.

Öz: Bir araştırma önerisi yazmak, projemizi uygulamaya koymayı başarmak istiyorsak-ki genellikle isteriz- basit bir iş değildir. Başından itibaren üç farklı gelişme aşamasını dikkate almalıyız. İlk aşama, “sizin kendi fikrinize sahip olmanızı” gerektirir, bu durum yenilikçi ve özgün bir bakış açısını ifade eder. İkinci aşama “fikrinizi finanse etmek”

amacına yöneliktir, bu nedenle fikrin sunulduğu şekilde proje fizibilitesi ve ikna yeteneği gerektirir. Ve üçüncüsü, “proje yürütmek”, dolayısıyla kaynaklar ve yerel uygulama gerektirir. İlk adım-yani kutunun dışında düşünmek, farklı olmak, benzersiz olmak- proje sürecinin detaylandırılmasındaki en zorlu noktadır. Bu çalıştayda; bilimsel literatür okumanın, diğer araştırmacıların farkında olmanın ve özgün düşünceler geliştirmenin önemi tartışılacaktır. İletişimin -beyinden beyine, sizin zihninizden projeyi değerlendirenlerin zihnine- tüm projeyi inşa etmek için kullanılan sivri bir taş gibi kaçınılmaz olduğu ortaya çıkacaktır. Bu bağlamda, Aristoteles’in Sözbilim Üçgeni’nin üç ayağı tartışılacaktır: *ethos* (güvenilirlik), *logos* (akıl yürütme) ve *pathos* (empati). Bu yazı, “Herhangi bir boş kağıt parçasına tek bir kelime yazmadan önce beyni tüm hikayeyle doldurun” gibi temel, merkezi bir ilkeyle sona erecektir.

Anahtar kelimeler: Aristoteles’in sözbilim (retorik) üçgeni; iletişim; bilimsel araştırma projesi.

Good afternoon everyone in the audience attending the *IUBMB & FEBS Workshop on Research and Career Skills for Young Scientists* (Izmir, Turkey – 7 September 2018). I has been invited by Prof. Gül Gunner-Akdogan as a speaker to talk here today on ‘How to write a scientific research proposal’ ... and, I guess, with the hope to get the project funded!

This is a workshop aimed at teaching young scientists to give oral presentations, to elaborate applications, to write research projects, etc. In preparing this talk, I was trying to get some new information on proposal writing by searching in Google using the following four terms: how, write, research and proposal. And this produced a lot of information (Figure 1). It seems that everybody has actually a magic wand and knows how to write a research proposal, and even how to get it funded. So could I say anything new about writing a scientific research proposal? What do you expect from me?

I would like to approach the question in a different way, to be provocative and give some ideas and reflections about what a research proposal is. Later in the group discussion we will go over some practical skills for developing

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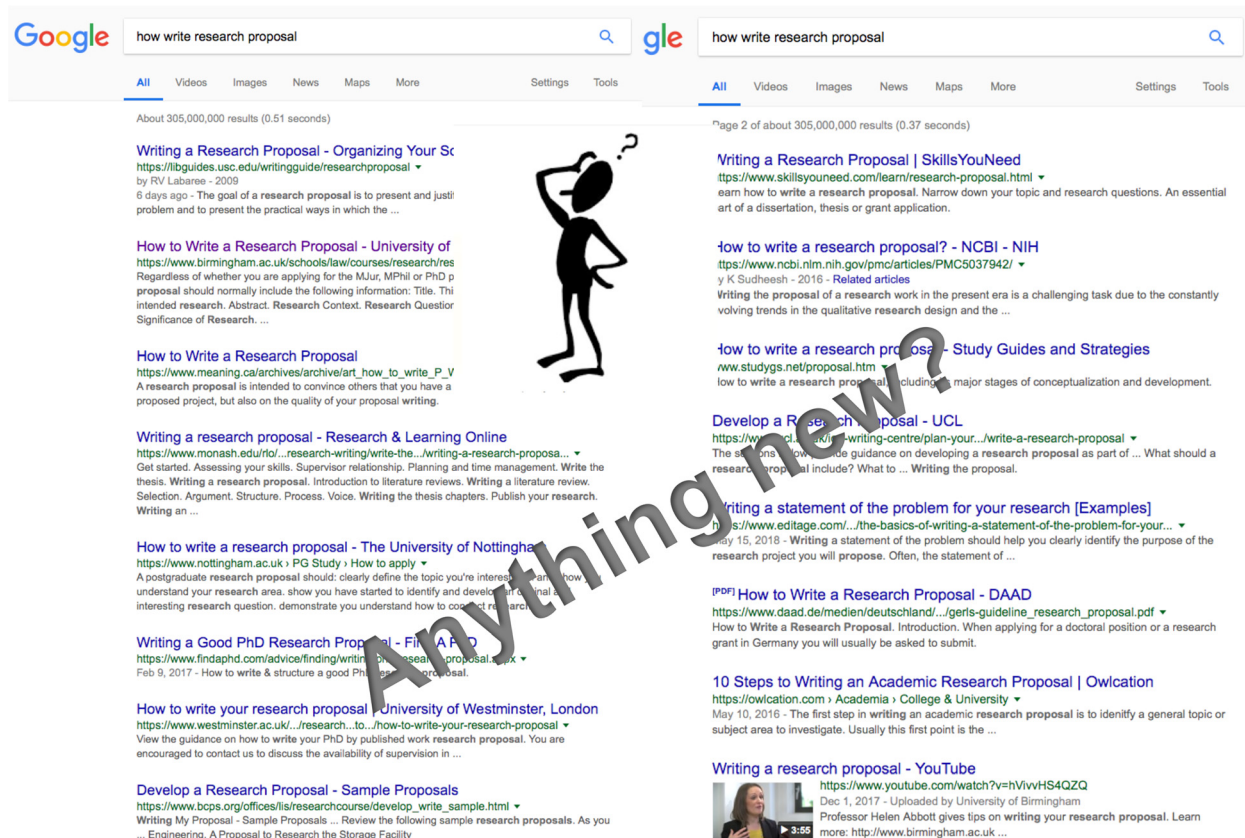


Figure 1: Information produced by Google when simultaneously looking for the following words: how, write, research and proposal.

the proposal. But before that, it is important to consider what a research proposal is, or should be. This is a crucial question, so the title of this presentation should rather change to ‘Thinking up an original scientific research project’.

As principal investigators, it is our responsibility to write research projects and proposals. The first question we should thus ask ourselves is: Do we feel like a *scientist*, or like a *worker in science*? There is an important difference. Firstly, what is a scientist? The term ‘scientist’ was coined by the English philosopher and historian William Whewell in the nineteenth century, in 1835, when he announced that a scientist is like an ‘artist’, using their imagination and mind. However, a worker in science is different, they are like workers in any other field or industry (e.g. car industry, technology or communications). How you view yourself is critical; are you a scientist, are you an artist? Or are you just a worker in science?

And do you feel like a scientist, or like an engineer? This is another important distinction, as the major driving force for the scientist is *curiosity* while the principal motivation for the engineer is *utility*. They serve completely

different roles. The scientist is a *Discoverer*, they are revealing what is hidden in nature, and they are just seeing what is unseen. Thus the scientist is not creating anything but generating new knowledge. The engineer, in contrast, is an *Inventor*, they are using their knowledge to make tools which make our lives easier and healthier. Therefore, the engineer uses existing knowledge to make goods and is thus different to the scientist.

Research (R) means discovery. *Development* (D) is innovation. According to this, we can distinguish different types of projects in terms of the relative R&D weighting, thereby ranging from basic science to oriented research, applied science and problem-solving projects (Figure 2). In a scientific research project the results are completely unpredictable, completely unforeseen, but in a technological development project the end is already known at starting. A research and development diagram, a Pareto front, can therefore be built considering our gain in knowledge vs. the feasibility of foreseeing specific results (Figure 3). We can thus move along the Pareto curve between the two axes. If we are successful with a scientific research proposal, with unforeseen results, it is possible to obtain a high gain in

Types of R&D Projects

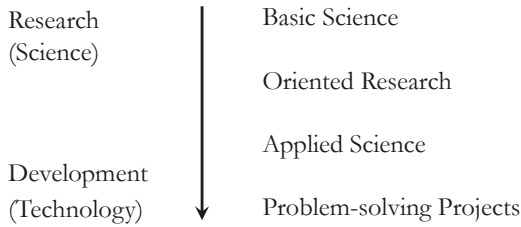


Figure 2: Types of scientific and/or technological projects ranked in terms of the relative R&D weighting, where R and D stand respectively for Research and Development.

knowledge. In the case of success with a technological project, the results are included from the beginning (e.g. the engineer is going to build a bridge), the outcome is foreseen and the gain in knowledge is low. Moving along the Pareto line, it is possible to consider where we are in terms of research and development, and thus we must be clear about what we want to do and what is the purpose of our project.

I believe all of us here feel like we are scientists. Not workers in science. Nor engineers. So when we are going to write a research proposal we must feel like a scientist, this is key from the very beginning. Otherwise, if we think of ourselves as a worker in science or even as an engineer the gain in knowledge is limited.

Accordingly, you should try to propose a scientific research proposal as a scientist. And what are the developing stages in this process? Three steps should clearly be distinguished: first, to have your own idea (originality, novelty); second, to get it funded (to get support for the project); and third, to run the project (Figure 4). According to this scheme the most challenging step is the first one

The R&D Diagram for Choosing a Project
The Pareto Front

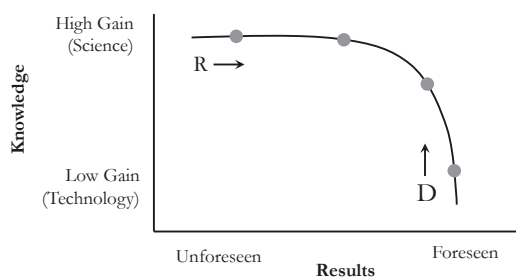


Figure 3: Research and development diagram, a Pareto front, considering our gain in knowledge vs. the feasibility of foreseeing specific results.

(having an original idea); thus, running the project is not the most difficult step, in fact, it is the easiest part. The most difficult step is to have your own idea. The second stage is also quite hard: you have your idea, but you must convince the reviewers that they should adopt it and approve the proposal. For the last step, to run the project, you just need to find the resources, the equipment and facilities, the people ... and to run experiments; all this is difficult, for sure, but not the most difficult one. The level of difficulty is decreasing throughout the three steps, while the amount of paperwork increases (science is being suffocated by bureaucracy!) Overall, it is important to have the steps of the project clear.

We thus agree that the most challenging step is to have our own original idea, that is, to think out of the box. There is a famous quote from Albert Szent-Gyorgyi (a Hungarian Nobel laureate): ‘*Research is to see what everybody else has seen, and to think what nobody else has thought*’. Therefore, you must feel like you are discovering things in nature that nobody could see before. But what does it mean, to think outside the box? There is an exercise I found on the Internet; try to draw four connected straight lines, without taking your pencil off the page, to link all nine dots placed in three lines and three rows (Figure 5). It is simple with five lines; it is very easy, but you are inside the box. To solve the problem and link the nine dots with just four lines you need to go out of the box. Everybody here was thinking about how to connect the dots inside the box, but you need to think out of it with a different perspective. This is difficult, I admit it, to have your own idea, to think in a different way.

The discovery of the Americas by Christopher Columbus is an excellent example of a “scientific” research project. Columbus had an idea (an original thought): to find an alternative route to India. Asia was very important to Europe because of trade in goods such as silk and spices, but there were a lot of difficulties crossing by land from one place to another, with gangs of muggers operating in the area. So, why not travel to Asia from the west instead of from the east. This was Columbus’s original idea. The second step in the research project was to get the

Developing Stages in a Research Project

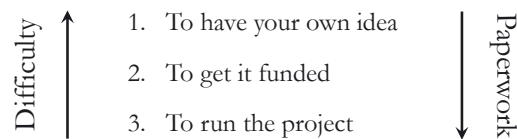


Figure 4: Stages in the process of developing a scientific research proposal. Difficulty and paperwork are inversely proportional.

Think out of the box

Draw 4 connected straight lines to link all 9 dots

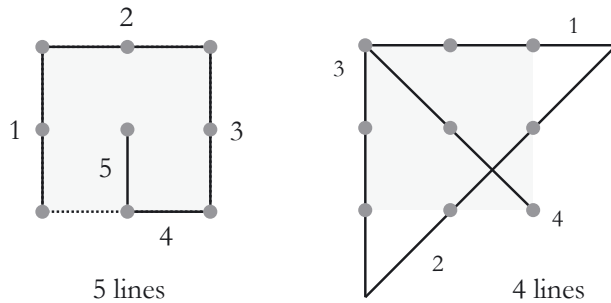


Figure 5: Exercise to show your mind how to think outside the box. Try to draw four connected straight lines, without taking your pencil off the page, to link all nine dots placed in three lines and three rows. You can easily do it with five lines, staying within the square (left); the only way to solve the problem with four lines is going outside the square (right).

expedition funded, and he was able to convince the Spanish Catholic kings – after being rejected by the Portuguese king – to support the project. And the third step was to develop the project (also very difficult, no doubt), which was to run a fleet of three ships across the ocean to an unknown place.

Serendipity is an important part of science. When we are writing a development project, everything is predicted from the very beginning. With a research project, however, you never know what is going to happen. Columbus was trying to reach Asia but instead found a new continent (the Americas). This was a new discovery, completely unpredicted. This is science! According to Columbus: *You can never cross the ocean unless you have the courage to lose sight of the shore*. In some way, you must explore new ideas, new fields, and new worlds. This is a message to clearly take in science.

Another important factor in the success of Columbus was communication. Communication means to transmit an idea from one brain to another. So you should make other people share and be hosting in their mind the original idea you created in yours, i.e. you should get that other people adopt your idea and think in the same way as you. This is also a difficult and challenging task. In the case of a grant application, you must convince the reviewers that your proposal is really original, brilliant and deserves to be accepted and supported. This is communication, and it is also vitally important when writing a research grant.

The diagram of Aristotle's classic rhetorical triangle consists of three elements, namely *ethos*, *logos* and *pathos* (Figure 6). They are the three pillars of oral communication,

but they can be applied in much the same way to written communication as well. *Ethos* is credibility, e.g. your authority and knowledge of the topic. *Logos* is reasoning, e.g. the reasons to support your working hypothesis and ideas. And *Pathos* is empathy, e.g. your ability to connect with the reviewer of your proposal, to communicate that you are an authority in the field and have solid arguments. However, the last point is usually ignored in grant applications yet it is even more crucial than the two others. So don't forget to use empathy – and not only credibility and reasoning – to convince the reviewer of how outstanding your proposal is!

Félix Goñi was talking before me about getting an article published and how to write a manuscript. He was saying you need a story, and I am telling you the same, you need a story. You need to get your brain full before writing a single thing on paper. You must build all the ideas in your brain before you start to write anything down. You are like a novelist writing a novel, the writer has the whole story in their head. Don't start to write until you have completed the whole story (Figure 7).

For that reason, it is essential that you fill up your brain. This means reading the literature, being aware of competitors, and developing your own thoughts. So, before writing, you must think a lot, read a lot, you must be aware of what other people in any other place in the world are doing, because otherwise, if you are not aware, you can repeat what others have done. There are 7.6 billion people in the world, it is very hard to be original, to be different, but you must try to do it. To do that you need to be very well informed, well prepared as to what others are researching in different labs. Therefore, you must read! I insist on this point. Young scientists are normally working in the lab and are not aware of what is being written in the scientific literature, however it is very important to stay up-to-date with relevant literature.

Communication – From brain to brain

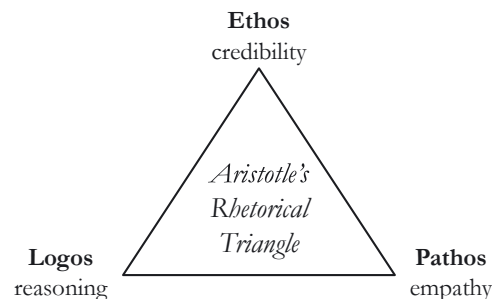


Figure 6: The three pillars of communication are based on Aristotle's classic rhetorical triangle: *ethos* (authority), *logos* (reasoning) and *pathos* (empathy).

Full Brain – Blank Paper

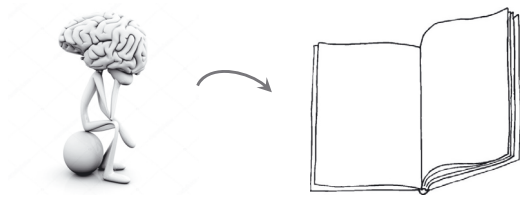


Figure 7: Writing a project proposal. The scientist should be like a novelist writing a novel, who has the whole story in their head before writing a single thing on paper.

In the end, the message is simple: try to be unique, try to be different and ultimately be yourself. Because everybody is different, even though we are all equal in rights. Therefore, we must be different in the way we think, the only way to get support for our project. Don't forget, when you are submitting your proposal, that your main aim is to get your project funded and that there are probably many others doing the same you are trying to do. This is why it is so important to be unique.

And how can we move ahead? This is a usual problem. Let's assume we are here, at a certain place in the present, and want to know where to go. We can take a step forward, to the future, by turning 360° around ourselves as we have no reference. To solve the problem and know where to go, we must think about how to proceed to the next step. We thus need a reference, and the reference is always the past. Once we have a reference point (the past), we have three points (the past, the present and the future), making it easier to draw and move in a straight line. Now we know in which direction to travel! It is critical when writing a research proposal, not only to be different and original, but

also to be aware of what is behind us and where we are going next.

I should stop here and leave practical aspects for the Discussion Group. There are many basic knacks on how to design and structure a research proposal that we could further comment with those of you who are interested. So we will go over practical skills for elaborating and writing a cogent grant application. The attendees will learn about structuring the proposal (basic scheme and complementary aspects), designing the research strategy and methodologies, scheduling aims and tasks, budgeting the costs, writing the abstract, choosing the title and keywords, etc.

Thank you.

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