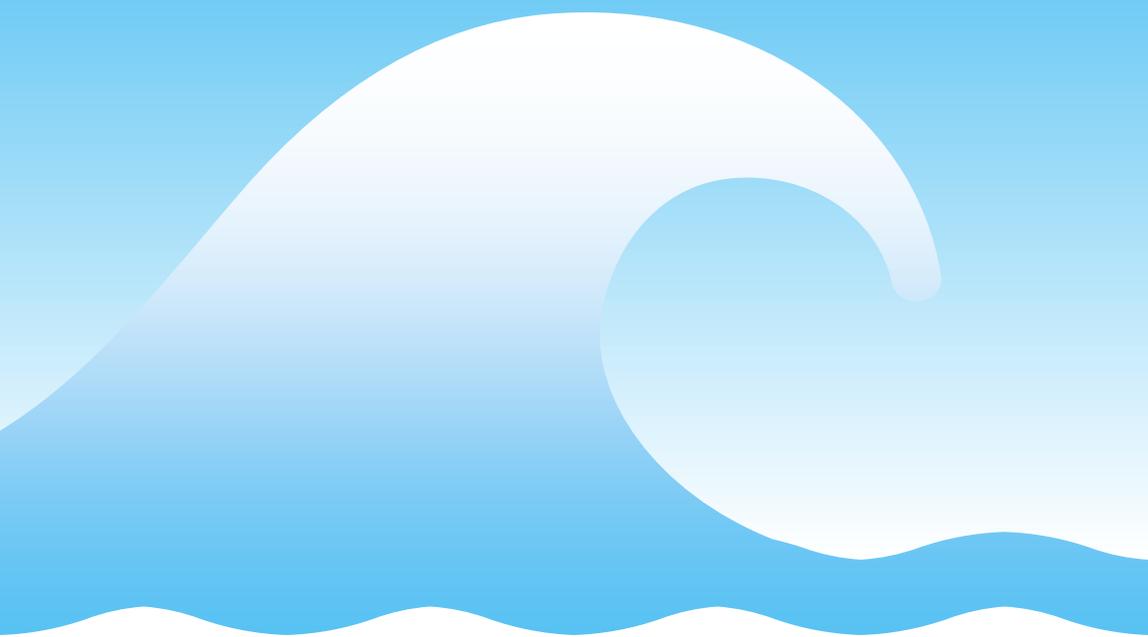


# BLOG



**Nowelties**

European Joint Doctorate



# NOWELTIES

## BLOG

### ARTICLES

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# Introduction



Welcome,

This book collects all the Blog articles from the 14 early-stage researchers (ESRs) of the NOWELTIES ITN project, posted on the project website ([www.nowelties.eu](http://www.nowelties.eu)).

The Blog activity ran from November 2019 until July 2022, generating 106 entries. On the project's social media accounts, among Twitter (@nowelties), LinkedIn (@NOWELTIES-ITN), and YouTube (@Nowelties ITN), the Blog entries reached 130,000+ impressions.

As indicated in the Grant Agreement (Art. 38.1, Horizon2020 Annotated Model Grant Agreement), outreach plays a crucial role in EU-funded projects for the following reasons:

- Research has an impact on our life
- Accountability - taxpayer's money
- Shows the position of the EU in society
- Relates to EU political priorities and goals
- Increases awareness about the specific research domain

With such objectives in mind, the NOWELTIES project aimed to create a Blog able to fulfill them.

During the first project meeting at the University of Santiago de Compostela (Spain) on October 7<sup>th</sup>, 2019, the Blog manager was selected by the ESRs and confirmed by the Supervisory boards. The Blog manager had a steering function in the organization and content selection of the Blog.

The entries were either individual (by one ESR) or co-operative (by two ESRs); they were published on the project website and its social accounts every Friday. The format consisted of text with a picture or short videos. Since the target audience was the general public and potential stakeholders, a plain and non-scientific language was adopted.

The topics covered the following themes:

- ESRs' journeys
- ESRs' personal stories

- ESRs' values and motivations
- Water and environmental issues
- ESRs' research explained in non-scientific language

Moreover, to improve the unfolding of the activity, the Blog manager timely and anonymously conducted internal feedback surveys among ESRs. The aim was to facilitate the overall Blog management, improve the Blog experience, assess the critical elements for engagement, identify rooms for improvement, and define new topics and formats.

The book is structured in nine Chapters, representing the subsequent Blog rounds performed, presented in chronological order. Enjoy the read!

*Michele Ponzelli (Blog manager and ESR12) created the cover of this book, wrote the Introduction section, and curated the formatting of this book.*

# Chapter One



# How I became a Water Researcher

**Michele Ponzelli** - ESR12

*05/11/2019*



I am Michele, and I was born in Jesi, a small town in the central area of Italy. I am a 28-year-old man, but I am also an environmental engineer, or as you can read from my NOWELTIES profile, I am an ESR 12 that means early-stage researcher: a first-time researcher.

Many people think that we engineers, so neat and attentive to detail, can use the same precision in programming every step of our lives, but it is not always so.

To understand who I am, I think it is important to explain what brought me to Girona.

Nine years ago, I chose the engineering faculty because I really wanted to understand how things work, how to improve them, and this gave me the feeling of being able to control what I had around me.

Over time, I got closer to the theme of the environment and of water, two themes that have merged during my university career and they guided me.

I became aware of my purpose, the reason why, every day, I devote myself to the study of physical, chemical, and biological treatments to purify wastewater.

Bringing water back to its original condition meant not only carrying out an experiment, but also thinking about the future, about my loved ones, about the people I could help with my research.

My “thirst” for knowledge was not satisfied: I decided to travel and to share ideas, to understand how others were dealing with the same theme.

For this reason, I have decided to undertake more than one university degree, both in Europe and North America.

This last destination should have been the final one, but at the end of my experience, I felt that I had not done enough for my own continent.

I realized that to improve water treatment technologies there is a need for commitment, cooperation, development, and dissemination.

These are the words that guided my return to Europe, and that allow me, today, to tell you, my story.

Water is one of the most precious resources that we have; I will never stop to say so.

The blue color of water is the first thing we notice when we think about our planet. However, it is not just a beautiful view to observe. Water is part of all our daily actions, and above all, water keeps all of us alive.

What we - ESRs - will try to do in this blog is to explain to you about our everyday work as researchers: processes, objectives, challenges, and achievements.

I am convinced that the European Union has given us a great mission and one of our researchers' duties is to share what we are doing with the people.

## From Zagreb to Girona for Love... of Chemistry

**Barbara Topolovec - ESR5**

*15/11/2019*



Hi, I'm Barbara and I was born in Zagreb, beautiful capital in the continental part of Croatia. I am 29 years old and a chemical engineer. On the [NOWELTIES](#) page, you can find me as ESR 5.

I think it all started in high school, where I met my first love: chemistry. Chemistry taught me that any complex structure can be known if broken down into many small parts. So, I thought that this theory could apply to all life's problems and environmental challenges. Even if I come from a small European country, I always felt I had to think big so that, as a European citizen, I could give concrete help to the development of society. For this reason, I chose the engineering faculty, which gave me an entire "ocean" of knowledge from different branches of chemistry and engineering. I must admit that during my studies I had the opportunity to define my ideas on what really interested me, and I found my purpose: to improve the lives of others

by purifying water. I still remember my graduation day, when I was happy with the cap on my head, convinced that it would only be the beginning of my career and my personal development.

And now I am here to write the beginning of a challenging and exciting journey. As a woman I feel that I have a double responsibility: the one as a researcher and the one as a woman. Yes, because I would like to be an example for all those girls who are afraid of launching themselves into the world of science. One of my wishes is that a large community of scientists can be created, ready to contribute actively so that even women can become points of reference in the field of scientific research.

# To Be...Dr or Not to Be, That Is the Question

**Nikoletta Tsiarta** - ESR14

*22/11/2019*



We were asked to write a few words about ourselves and somehow explain in short why we ended up doing a PhD in wastewater treatment technologies. Let me first start by saying that I am not an engineer but my passion for science, especially with anything related to water, led me to the wastewater treatment sector.

I am Nikoletta Tsiarta and my water journey begins in Cyprus, a small island in the Mediterranean Sea. I started my undergraduate studies on Environmental Science and Technology although my dream after finishing high school was to enter the medical school. The first days were tough. I remember myself thinking of dropping out the university and searching of alternatives to join any medical school. It was that moment of your life that you need to decide what you want to be and what kind of impact you want to leave on this world. It was difficult and frustrating.

It took me some time to realize it but after following all these classes related to every aspect of the environment; ecology, aquatic chemistry, hydrology, toxicology, waste management,

renewable energy, environmental biotechnology, water treatment, water quality analysis, engineering principles and many others, I felt passionate about the idea of making this world a better place. Not only for us, but also for the next generations. And improving the water quality immediately caught my interest since the world is mainly water and we are made of it!

Eager to explore both water sciences and the world, I took every opportunity to combine them. Willingness, enthusiasm, hardworking, networking, Erasmus scholarships, and work experience are some of the reasons that I am now part of the NOWELTIES project working as an Early Stage Researcher at the Catalan Institute for Water Research in Girona. During my postgraduate studies, I mainly focused on the aquatic ecosystems function and the effects that global change pose on them; from lakes to marine ecosystems. The discharges of several compounds from human activity (fertilizers, detergents, pharmaceutical, microplastics, etc.) and the climate change effects put a huge pressure on the sustainability of fresh- and marine habitats.

It is of great importance to keep our aquatic environment in a good ecological status. Anything we use in our daily life comes back to us through the environment and water is the most common transporter. Consequently, I took the decision to move from an ecological point of view to micropollutants' treatment using ozone as part of advanced oxidation methods in combination with ceramic membranes, because I believe that these two fields are strongly correlated to each other. Treating the wastewater with an environmentally friendly way so it can go back to the environment as clean as possible should be one of our priorities. If you cannot control a problem from its source, then try to solve it before causing more troubles. This is exactly why I decided to continue my studies in the wastewater treatment field.

Concluding, from my experience so far, I realized that it is not only the hard work and your passion for something that will move you forward but also having people by your side that support you and believe in you. My advice is no matter what your chosen pathway is, make sure that you will be surrounded by this kind of people. Today when I look back, I believe that day back in 2011 I took the right decision. I consciously chose to follow a career in water sciences and who knows? One day I will be the doctor (Dr) I was always dreaming of (the white

coat I already have it!). Any journey we choose will be never easy, but it is on our hands to make it interesting. Never give up and be positive, that's my motto. Having a twin also helps!!

## Resilient as Bacteria

Silvana Ines Quiton Tapia - ESRI

29/11/2019



Hello everybody, my name is Silvana Quiton doing topic n°1 “Understanding biotransformation mechanisms of OMPs during anoxic biological wastewater treatment” and it is my turn to write a few lines here at the Nowelties Blog.

Let me start by saying that this is my first time writing a blog, but I am all in for engaging in science and online communication of researchers and other professionals in academia (thanks twitter for the hashtags #PhDchat #PhDlife) So here I go!

I believe we, Early Stage Researchers, have chosen to do a PhD for our passion of science. The rich diversity of our backgrounds is very reassuring. And I think this blog series is showing just that, how a diverse group of young scientists are immersed in a similar path that culminates with a same goal, increasing our knowledge about water treatment so we can make our world a better place (our PhD title is just an extra bonus).

I always knew I wanted to work with wastewater. I studied environmental engineering in my hometown Cochabamba, Bolivia. For my bachelor thesis, I worked with constructed wetlands as a biological technology to treat wastewater.

Later, my first work experience was in leachate treatment plant in the municipal landfill of La Paz. My work consisted in attending a combination of biological technologies for the removal of pollutants. I remember being so intrigued on the ability of microorganisms to degrade such a tremendous amount of pollution load. The three following years I kept on working in water treatment related fields.

However, a couple of years later, I felt the urge to keep learning more about the underlying removal mechanisms of wastewater.

Fortunately, that ambition came true when I was a recipient of the scholarship for postgraduate studies. My learning quest took me to do a master at Wageningen University, where I followed the environmental technology track driven by my passion to learn how to treat wastewater.

Following my master thesis, I did a research internship at the IHE-Delft Water Institute, where I worked as an independent researcher using an innovative biological treatment technology called Algamox.

The successful culmination of master studies left me even more eager to continue my quest for deepen my knowledge on biological wastewater treatments. Both work and academic experiences showed me that microorganisms are tougher than I thought. Those little fellows don't cease to surprise me, and they are continuously helping us to remove contaminants from our water.

So now, I'm currently immersed in unraveling the way denitrifying bacteria biodegrade micropollutants as an Early Stage Researcher in Novelities.

So far, my academic journey thought me that science it is not always easy, but we could always learn from bacteria, they adapt to the extreme conditions and can still thrive ... what a resilient life form! I feel so lucky to be working with those badass organisms.

# A Black Sheep for A Greener Environment

**Ana Paulina López Gordillo - ESR2**

*09/12/2019*



Hello! My name is Ana Paulina, Early Stage Researcher 2 in NOWELTIES project.

I have always liked the natural sciences, experiments with microscopes and chemical reactions in the laboratory. However, when asked what I wanted to do when I grew up, I was not able to say “The scientist” or “The researcher”. I was born in Mexico City, where I followed a conventional education system, and where careers such as communication, business or administration are preferred choices.

Despite of this, I felt that my scientific profile could be formed and shaped according to my personality, values and principles.

So, I became a laboratory biologist with a clear goal: to help to implement solutions before environmental degradation reaches the point of no return. There is no need to wait to see the effects of contaminants on human health in order to focus on the environment.

That is why I decided to follow an environmental path, and my first approach to water contamination started when I focused my degree thesis on how pollutants discharged into rivers can cause leukemia and the death of neighboring inhabitants.

After graduating, I decided to continue working as a research assistant in environmental toxicology. At that time, I realized that the pace of scientific research clashes with those of environmental regulations, which take a long time to implement.

This inspired me to continue my training with a master's degree in environmental sanitation in Belgium, where I chose a specialization in water treatment using wetlands and microorganisms. This knowledge would allow me to contribute with environmental solutions in a faster pace.

Before joining Nowelties, I was involved in a company that promotes the closure of the industrial wastewater cycle. This opportunity was very satisfying; however, I realized that my education was not complete in order to contribute fully for the resolution of scientific problems and to adjust them to case studies.

Therefore, I became an ESR and intended to complete my scientific knowledge in water treatment by merging my two different profiles: environmental and biological.

Now, my biggest dream is to be able to see how the impact of my research can provide real help in solving pollution problems.

I understood that being the black sheep has a great advantage: being able to choose your own direction.

# Why My Love for Life Drove Me from 6 to 5

**Edwin Antonio Chingate Barbosa - ESR3**

*13/12/2019*



Hi! my name is Edwin, I'm from Colombia, the 6th country with more fresh water in the world [1]. Almost three months ago I started my PhD in Germany in water treatment. Germany has been very interesting for me because here, people care a lot about water. At the point, that this is the 5th country with more research in topics related to water [2]. That's the reason for me to be here. I'm an early-stage researcher in Nowelties project and my goal is to understand the mechanisms behind the microbial degradation of contaminants such as pharmaceuticals in water. At this moment of my life, I just traveled from the other side of the world for love and to keep growing as a researcher and as a person.

When I was a child I was wondered by nature. I loved to watch Animal Planet on TV and feel delighted with the wonders on the Earth. Also, since then I am eager to understand stuff around me. I tried to make predictions of what could happen and figure out the mechanisms behind that. It has always been a big challenge for me to apply this approach to living systems, but as I grew up and learned more, I noticed that life by itself is not very different to other phenomena in nature.

Because of my passion in science, I chose not to do one but two bachelors. The first one was in Chemical Engineering. Even when the focus of this career is not on the same scale as microorganisms, the principles that I learned can be used to understand the microbial metabolism and its behavior. And as I still wanted to go deep in more related to life topics such as biochemistry and molecular biology, my second bachelor was in Chemistry. Thanks to this formation now I can understand a lot of phenomena in the world around me and contribute to the development of a better planet.

Although most of the knowledge I acquired through both majors can be applied in biology, in the end, I felt that there was a lot more to learn. So, I decided to start a master in bioinformatics in order to go deeply into biological sciences. My master's main focus was in systems biology, metabolic modeling and metabolic interactions in microbial communities. After all of this, I'm aware of the key role of microorganisms in every ecosystem and that without them a world as we know it wouldn't be possible, so it's very important for us to understand the way they live.

Water is key for life, without water there is no life. Society must care more about the fate of wastewater as water resources become scarce. In the near future, potable water supply for cities around the world will come from wastewater treatment plants. Wastewater treatment is one of the biggest challenges in our modern society and microorganisms play an important role in most of the technologies developed for this aim.

After the path that I have been following in recent years, my advice to everyone is to fall in love with a topic. I have experienced that this love keep growing, just as I am living this experience right now. So I think that it was natural for me to continue my formation with a PhD, even though I am pretty sure that I am never gonna stop my learning process. It is not

about my professional development because I do portrait myself as a full-time scientist. It is rather about my own life and personal growth. This looking for happiness is going very well as I am very happy with this new adventure called Ph.D.

### **References**

[1] Miaschi, John. "Which Country Has the Most Fresh Water?" WorldAtlas, Sept. 24, 2018, [worldatlas.com/articles/countries-with-the-most-freshwater-resources.html](http://worldatlas.com/articles/countries-with-the-most-freshwater-resources.html).

[2] Data from Scopus

# To Be Like Water

**Amit Kumar** - ESR4

*20/12/2019*



Hello, everyone, I am Amit Kumar (ESR-4). I was born in New Delhi, the capital of India, but I grew up in a small village called Rasulpur.

I am a joint PhD student of the University of Belgrade and the University of Girona, through the Nowelties project.

Like the other ESRs, I deal with water purification.

Specifically, I plan to use atmospheric plasma discharge to remove organic micropollutants from wastewater.

This is an environmentally friendly technology (it does not require the use of chemicals) for wastewater treatment.

What brought me so far from the land where I was born?

Being able to solve complex problems using limited resources.

Hence the passion for water and research.

It all started after I graduated in Mechanical Engineering from APJ Abdul Kalam Technological University, Lucknow, India.

The courses I attended made me passionate about environmental engineering, chemistry, along with wastewater management.

And to do this, I knew I needed to increase my technical knowledge.

For this reason, I continued my training by obtaining a master's degree at the Indian Institute of Science (IISc).

My undergraduate and master's background gave me the theoretical knowledge and experience to carry on research in the field of wastewater treatment, but if there is one thing that this path has taught me, it is that this field is booming and you are never too prepared.

Water is the most important natural resource a vital area can have and maintaining its quality is as complex as it is important.

We researchers are a bit like water: we change shape and go around things, finding new paths that no one else had ever thought of.

# From a Toy Microscope to an Electron Microscope

**Nebojša Ilić** - ESR13

*10/01/2020*



Writing your story down, what defines you, in a few sentences is no easy task but it is definitely an interesting way to take a break from reading scientific articles and planning experiments.

My name is Nebojša Ilić, and I am a chemical engineer from Serbia.

I am pursuing a joint PhD in environmental engineering at the Technical University of Munich and the University of Santiago de Compostela.

In my opinion, being an engineer is not just a diploma, it is a character trait and a part of your personality. Even as a child I used to run around the house fiddling with anything I could get my hands on, always curious how something works and collecting small broken appliances to see how they work.

The first gift I ever asked for was a microscope. I used it to study everyday things, such as rainwater, particles of sand, leaf structure etc.

This passion transferred to elementary school, where I worked on small projects with friends and our Crafts teacher, making a very basic RC car, an elevating bridge model and so on.

Over the years, I have developed a very intense passion towards science, but the idea to apply for a chemistry related field came after accidentally synthesizing an ester in the chemistry lab in high school. I was amazed how something that smells so wonderful can come from such common ingredients.

The love towards water and the environment has always been a part of who I am and it only kept growing through study exchanges and research projects in other countries and through collaborations with some great people along the way.

Observing the world for the perfect system that it is and studying the essential role of water in this system has since been my passion. The complex patterns that emerge from simple everyday events. Organisms working with one another in a symbiosis. The world around us is a big playground and applying state of the art science to improve the quality of the most precious resource on the planet is a dream come true.

That is how I went from a toy microscope to a scanning electron microscope, and finally as a fellow of the NOWELTIES project (ESR 13) from Belgrade to Munich, to try and push the science forward and help our already strained ecosystem.

The goal? To remove those annoying perfluorinated compounds from water.

I think it is by now clear how passionate I am about this topic, and finding your passion is in my opinion the most important factor for success.

# Only the Unexpected Makes You Happy

**Danilo Bertagna Silva** - ESR6

*17/01/2020*



Hello! My name is Danilo, ESR #6 from the NOWELTIES program. My goal is to design a lab-scale UV-LED photoreactor on laboratory scale to degrade organic micropollutants via TiO<sub>2</sub> photocatalysis and evaluate the factors that might affect this process.

I was born in the state of Sao Paulo, Brazil. When I was about 4 years old, my dream was to become a supermarket cashier (they wore rollerblades – it looked so cool!).

I then changed my mind a couple of times: astronaut, footballer, journalist, psychologist, physicist; until, finally, I chose to become a chemical engineer.

During high school I liked chemistry and physics equally, so I thought that chemical engineering would have been a good idea, because I would have had the opportunity to work in many different sectors: oil, polymers, food, metals, water, pharmaceuticals, management, energy, computers, quality control, laboratories...

Towards the end of my graduation, when I started looking for internships and jobs, I realized the difficulty that a young engineer can encounter when he wants to gain credibility with people who make important decisions in large companies.

The crisis that hit Brazil in 2015 destroyed much of the national economic system. Especially in the field of industry, the positions for engineers have fallen dramatically.

In this scenario, my prospects were less and less predictable. I was very lucky to get an Erasmus Mundus scholarship for a master's degree in Spain and Portugal in 2016, where I studied environmental sciences and advanced oxidation processes in water treatment.

There, I realized that the interest in the environment is very strong in Europe and consequently there are many more job opportunities.

After the Master, I became aware of the Nowelties program and I did not hesitate to take this opportunity. The experience I am living through is not only a way to continue my studies but an opportunity to make my colleagues understand that science is not something far from society, it is not abstraction and the choices related to it have a strong impact on everyday life.

The world can never become a better place if knowledge remains in the hands of a few experienced people.

It is important to spread, create awareness, convince people that change is possible. We, researchers, must become “agents of change”.

I like to travel and discover new stories, cultures and languages. I feel excited to live in a new country and a new city where I don't know anyone and slowly start a new life; to see how the environment changes me and how it alters my perspective.

My research takes place in Zagreb (Croatia), and so far, I can say that I have never felt so happy with my life before and every day when I wake up, I think about doing my best to enjoy this opportunity.

It's true that “Only the unexpected makes you happy.”

## Along the Sava River

**Barbara Kalebić - ESR7**

*24/01/2020*

Hi, I'm Barbara, another Barbara in the NOWELTIES project, and from Zagreb too! However, I'm an environmental engineer, and ESR #7.

As a child I had doubts about my future: I didn't know whether to become a chemist or an artist.

I wanted to contribute to my society and improve it, so I decided to combine my imagination with technical skills that would give me concrete tools to change things: they would not be just traces on canvas.

This thought led me to study environmental engineering in my hometown at the Faculty of Chemical Engineering and Technology. For both of my two theses (bachelor and master) I worked with the removal of pharmaceutical products from water through advanced oxidation processes. I explored photocatalytic processes with modified synthetic zeolite as a carrier for photocatalysts and various types of advanced and catalytic ozonation methods.

After my graduation, I wanted to learn even more and improve my knowledge and my skills in this field.

While many of the NOWELTIES' ESRs had to go very far from their homeland, I was fortunate to stay close to home.

I just had to follow the Sava River, and downstream I reached Belgrade, the city where I started my new scientific adventure.



Apart from the Sava River, in my opinion, Zagreb and Belgrade are linked by a strong interest and a great ambition to change the environment, and to be one of those people who will contribute to this goal is a source of great pride for me.

So, instead of studying colors and contrasts, today I am striving to contribute to solving water problems, and creating a brighter future for water purification processes.

In this way, I hope to make a mark that can be, not only contemplated or observed but used by those who need it the most.

## Even a Small Waterfall Makes Noise

**Camilo Sánchez Tobón - ESR8**

*31/01/2020*



Hi, I am Camilo (ESR-8), and I come from Colombia, a country rich in biodiversity where water is the most abundant natural resource.

I was born and raised in the countryside, in a small town surrounded by mountains and waterfalls.

There I had the opportunity to enjoy the wonderful nature and to see how important water is for the development of the community, from coffee harvesting to energy production.

However, only a small part of the wastewater is treated, which has led to serious contamination of freshwater bodies and affected the environment.

That is why, since I was a teenager, my dream has been to ensure safe water for everyone. This has encouraged me to focus my studies on different routes to get a complete picture of water treatment.

During my undergraduate studies in chemical engineering, I joined a research group where I learned about advanced oxidation processes (AOP) that use solar energy for water disinfection.

Later, I traveled to Germany and Poland to continue my master's studies in process engineering and environmental protection, gathering knowledge in biological and membrane technologies, as well as in beer drinking tests.

The idea of a triple E (Efficient, Economical and Environmentally friendly) water treatment system prompted me in the fascinating Zagreb to join the NOWELTIES ITN project.

My study concerns a microwave-assisted green synthesis of Au/TiO<sub>2</sub>/graphene oxide nano-hybrids for visible-light-induced photocatalysis. The main goal is to develop a material that can treat water using solar energy.

But technical and scientific knowledge are not the only things I learned during this journey.

In fact, I realized that in my triple “E” system two elements were added: Experience and Emotions.

Part of this journey includes all the extraordinary people I have met, such as my beloved wife.

Getting in touch with different cultures and ways of thinking, makes you appreciate the respect, the diversity and the variety of ways of approaching life. The others are the real reason why we are driven to act.

I am not sure where this journey will end, but my desire is not only to achieve professional goals but also to inspire people with the knowledge I am gaining.

I strongly believe that only by talking to people and sharing with them the work that we researchers do every day can we really preserve our water and the environment.

# Life Is an Experiment - You Are the Result

**Sabrina de Boer - ESR9**

*07/02/2020*



My name is Sabrina de Boer or, speaking in numbers, ESR 9.

I'm 26 years old, and grew up on Norderney, a German island in the North Sea.

Now, I am a PhD researcher in Santiago de Compostela since September 2019, working on the removal of  $\leq 5$  antibiotics from wastewater by enzymes (and possibly photocatalysts) immobilized on magnetic nanoparticles (diameter about 0.000001 cm).

Throughout my youth, I have had the opportunity to travel around Europe with my family.

I could stare out of the car/train/plane window for hours, fascinated by our colorful environment, by all the things that surround us every day.

I remember when science teachers at school told us that the complexity of things, processes and structures, goes beyond what we can see with our own eyes.

So, I became curious about what lies behind the visible and I decided to study chemistry.

I moved away from home, to Frankfurt, known for its modern skyscrapers and large airport, but loved for its hidden originality.

Spending long days in the lab and some tough nights in studying theoretical chemistry was really not that bad thanks to my study partners who soon became my friends.

I realized that working together with people who support you helps you to understand what your path is.

During my studies, I could not really relate to the research topics proposed by my faculty, so I did my master's thesis at the DECHEMA research institute in Frankfurt.

Although my thesis was not directly related to environmental restoration, the knowledge I gained there was very useful for my current work.

Only after completing my internship at the chair of environmental analysis of my university I realized that I could connect my work with real environmental issues.

In particular, I became aware of a potentially carcinogenic substance present in surface and drinking water.

Unfortunately, many other compounds have been present in wastewater and subsequently in drinking water for decades, but they have only recently been detected by advanced analytical technologies.

I cannot believe that action against such obvious contamination of our drinking water is being taken so slowly.

Therefore, I want to help protect our water from this flood of harmful substances that are emerging from our current way of life.

Writing this brief summary of what I have done so far, reveals to me that you can always find purpose and sense in your decisions you took. Otherwise you wouldn't be where you are now.

You are the set of your choices, of the directions you followed in a precise moment of your life.

Every choice is like the beginning of an experiment: you never know the outcome and it is not necessarily true that whatever direction you take this will help you achieve your original goal.

There may be changes along the way, but the important thing is that you can justify to yourself why you are changing.

My motivation is to work with inspiring people who are driven by the achievement of their ideals, to create solutions for cleaner water for us and future generations.

## Enjoy the Show

**Francis dela Rosa - ESR10**

*14/02/2020*

Hello! I am Francis M. dela Rosa (ESR 10). I am from the Philippines and I love to see people smiling and laughing at my jokes. I could look like a serious person when there is no smile on my face, but believe me that is my standard facial expression. Trust me, I will not bite you, just call me and I'll be very happy to help you.

Here at the University of Zagreb (Croatia), my colleagues called me “Franjo”, which is the translation for Francis in Croatian. My post-doc friend gave me a surname “Ružić”, from the word Ruža (rose in English). So now, I have a second full name which is “Franjo Ružić”. Amazing hahaha!



If you want to know something about me is that I love basketball. Since when I was a teenager, my idols are Michael Jordan and Kobe Bryant. Indeed, I adapt their mentality from their court to my own court, the chemical laboratory. Of course, I will not shoot the glassware and equipment in the trash-can like I'm going for a buzzer-beater crucial game (my supervisor will spank me if I do that. Just kidding). For instance, in Kobe Bryant's “Mamba Mentality”, the idea is to have an intense focus on what you really want in life. This means that you need

to overcome obstacles that may interfere in your pathway and stay focus on obtaining what you really want. My focus is to contribute to science. Only that. People may tell me, “hey that is not just life is all about.....” Yes, I know. Of course, I will change my priorities in the future but not during these three years of my PhD time. Now, my focus is here.

Technically speaking, I really like the field of heterogeneous photocatalysis. So, what I did last January of 2019 was to search for the keyword “Photocatalytic Degradation” every day on the Euraxess portal. I was not sure if something would pop-out or if there was an existing EU project during that time but “SUDBINA” (destiny in Croatian) happens and “NOWELTIES” where there. And the focus mentality was spot-on, again.

Some of my friends may ask me “what makes you curious about this topic? Why are you so dedicated”? Well, it’s for you to find out in my next blog contribution....

Join me and the other ESR’s for our moment.

Let us all ENJOY THE SHOW!!!

# Is This Water Clean? Look Closer

**Marina Gutierrez Pulpeiro - ESR11**

*21/02/2020*

Hi! I am Marina, ESR#11 from Nowelties program between the University of Ferrara and the University of Zagreb. Let's see how I arrived here.

The first years of my life were influenced by the water of the river next to home. We lived on a farm in Chile and the river was both the basis of our prosperity and a small-catastrophe-maker from time to time. I remember how vegetables were growing in spring and the floods in autumn. I remember the feeling of my skin burning after swimming in the river once. "Something contaminated it upstream" was said, and we didn't have any other option than waiting.

I moved to Galicia without knowing that was the rainiest region in Spain and I discovered here how much water can influence people's lives. Do you know that they have more than 70 words to describe only the rain? It was difficult to adapt but nice to discover the feeling that everything was alive, growing and renewing without effort. Sadly, coming back here on holidays has not been the same for the last few years due to climate change.

When I decided to study biotechnology in Girona, a very Mediterranean province of Spain, I realized water scarcity can be a real issue in some parts of the world. I moved there with the purpose of helping people with medical research, but my mind changed to help the



environment. We were nothing if we didn't have a place to live. I was concerned, motivated, obsessed. I joined a master's degree in water science, and I realized there were many problems to face and many ways to deal with them.

Let's confess that it was not easy to decide how to contribute to the improvement of the quality of water bodies. I studied and tried everything I could from both ecological and technology perspectives and I realized that, as a human being, I couldn't stop generating residues around, even without pretending it.

We advance as a society, but we pay a price for what we produce. So, why not focus on trying to avoid this contamination?

My Ph.D. is about to remove micro-contaminants (the really tiny ones!) from wastewater using membrane bioreactors and activated carbon. It took me years to be conscious that water sets the pace in any region of the world but hey, now I can't stop thinking about it.



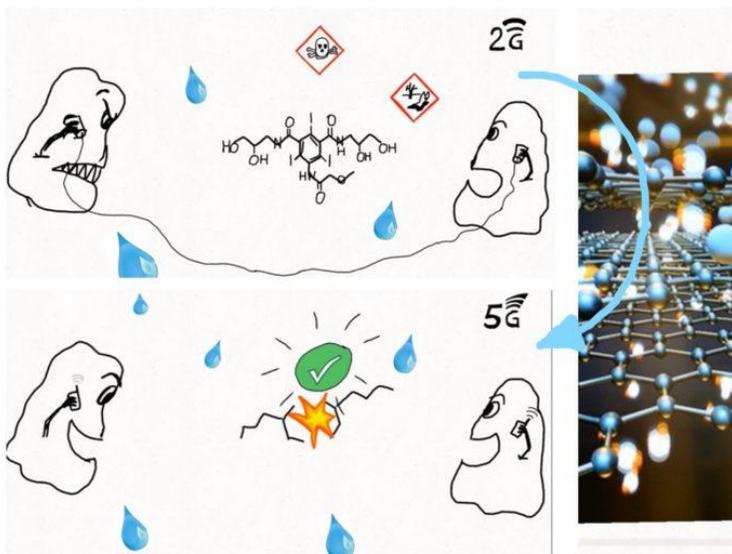
# Chapter Two



# Graphene: The Microbes' 5G Network

Michele Ponzelli - ESR12

28/02/2020



We live in a constantly connected world, where the exchange of information is getting faster and faster, and technology is rapidly evolving. We can barely remember when there was no internet connection or when we had no cell phones at all.

As in many other fields, in scientific research, there is a growing need to speed up the connection in order to solve increasingly complex problems.

Sewage water treatment is one of them. Particularly, my research focuses on removing pharmaceutical products that enter the water cycle through their use and disposal. The discharged pharmaceutical products that enter the water bodies might harm the ecosystem and the human health. In fact, these compounds contain active substances capable of inducing, positive or negative, functional modifications in living organisms.

Even if these compounds are generally present at low concentrations and they unlikely pose a risk to human health, their massive use and the involuntary exposure over long periods might have adverse effects.

Generally, in a wastewater treatment facility, one of the most advantageous way to remove contaminants happens through microorganisms' metabolism. However, pharmaceuticals seem to do not look appealing to the microorganisms' tastes, so these chemicals pass through the treatment facilities completely undisturbed, or partially removed (there is not enough time to remove them at 100%).

Then, in this specific case, how can the research press the accelerator and shift from 2G to 5G connection?

The solution may be in a material never seen before.

It is the thinnest material in the world (only one atom thick), it can transport electric current faster than the renowned copper, and it can withstand a weight 200 times higher than steel, but at the same time ensuring a high degree of flexibility. It is the wonder material. It is graphene.

You may have already heard about something similar, i.e. graphite, which is what the black point of your pencil made of. However, the main difference between them is the number of layers. Graphene is a one-layer of carbon atoms arranged in a hexagonal honeycomb structure; graphite is a million layers of graphene instead.

But how can graphene help microorganisms in eliminating these dangerous pharmaceuticals?

Graphene simply brings in communication the microorganisms present in water with one another.

In fact, one can think of microorganisms as people who want to share messages but have very slow connections to be able to communicate successfully.

On the contrary, the presence of graphene enables microorganisms to increase their connection speed and consequently increase the amount of information that they can exchange, i.e. the number of electrons.

The higher the quality of the connection, the higher the number of electrons that they exchange, thus, the faster the degradation rate of the pharmaceutical products.

Therefore, graphene allows the microorganisms to switch from a 2G connection to a 5G connection.

Anyway, communication is not only important for microorganisms but also for scientists, because it allows us to share our work with the society. Effective communication transforms science from that boring and sometimes too complex matter into an everyday language. It transforms the way we observe our planet, making us feel not simply guests of nature, but conscious inhabitants and informed citizens.

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# ‘PFAS’ - The Forever Chemicals

Nebojša Ilić - ESR13

06/03/2020



Graphics source: hiclipart.com; cleanpng.com; fotolia.com; mdmpublishing.com

I would like to start this blog article by talking about awareness.

Awareness is easily taken for granted and we are predisposed to think that everyone is equally informed and has the same knowledge as us (scientists). That is however not the case. We live in a time where false information is easily distributed and every person has a responsibility to question the reliability of this information and to try to ensure that it comes from a proven source.

I continuously make an effort to be an environmentally aware person. Especially now, as a part of the NOWELTIES project, am I becoming more and more familiar with the problems we are facing. With many pollutants accumulating in water in small concentrations, I became motivated to read and inform myself as much as possible. And as you read this, I am still reading more into this topic and I learn something new about the adverse effects on the environment and our health every day. Micropollutants are a problem that needs immediate action! Therefore I am doing my part in this battle by, on one side, developing methods for

removal of per- and polyfluoroalkyl Substances (PFAS) from water, and from the other side by using every opportunity I have to share knowledge and awareness.

This blog article is another opportunity to contribute to public awareness, and I would therefore like to share a few facts about the aforementioned PFAS.

PFAS are a large group of compounds that are used daily and regularly in the world around us. They have been around in the industry since the 1960s and have been the basis for many technological advancements we are enjoying today.

To further emphasize this, here are a few examples. That jacket that water just seems to run off? It has probably been treated with a form of PFAS. Firefighters also rely on this compound to put out strong fires because the foam that PFAS form blocks oxygen and is resistant to high temperatures. There are of course many other uses: one form of PFAS is used as a pesticide in Latin America, another as a supporting material in Teflon production, third as a treatment layer for the baking paper we use every day in the kitchen (the same type of paper used for microwave popcorn packaging!). There are over 4000 different registered PFAS after all!

Unfortunately, just as they were a basis for many technological advancements, they were also a basis for many malpractices when it comes to environmental protection. The same properties that make them this wonder material for industry also make them incredibly resistant pollutants! That is why they got their famous nickname “The forever chemicals” after all. Moreover, we need to be aware that the negative effects these compounds have on health are still far from fully explored.

Well, how do we deal with pollutants that are super resistant to everything we currently use to treat water? This is what many scientists around the world, me included, are set to find out!

In the meantime, if after reading this text you are wondering how to help, I would say that everything begins and ends with our commitment. For example, when you need to buy a waterproof jacket, you may want to look for an eco-friendly model that does not employ PFAS (usually specified on the label). Or if you feel like popcorn, pop the corn yourself, rather than buying the microwave version!

What about you, do you know something important or interesting regarding the environment? Is it important information that will help protect the world around us? Then share it! It is our responsibility as curious people to find out as much as we can, and it is our duty to share what we know with the people around us.

If you want to find out more about PFAS and what is being done about them, the European Environment Agency website is a good place to start.

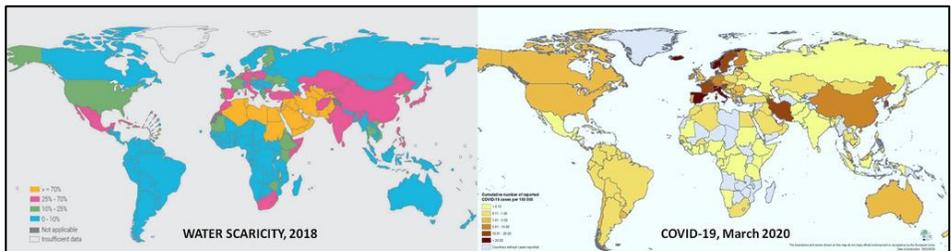
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# C.O.V.I.D.: Catalytic Ozonation for Virus Disinfection – Why Not?

Nikoletta Tsiarta - ESR14

20/03/2020



Hello, my #stayhome readers. It's been four months since our first digital contact, and I am happy to share my thoughts with you again. Taking into account the current situation, who said COVID could only refer to a disease?

COVID, a word that has unexpectedly changed our daily routine. No one was prepared for what this virus outbreak would bring. No one took it seriously in the first place. No one expected that this virus would spread that fast, and no one believed that one-day people would get fined just for walking outdoors without a specific reason. However, everyone realized that only collectively, we can fight this invisible battle and bring our life into equilibrium again (or maybe in a new, better equilibrium).

I am sure you have all heard about COVID-19. It is the hot topic of all websites, newspapers, magazines, social media. But all this information was given to us only when the World Health Organization (WHO) has declared it as a Global Health Emergency. It is always like this. We only deal with something when it becomes a problem in our daily life.

On the other hand, who heard about C.O.V.I.D.? Well, let me introduce you to my world of science. As mentioned in my previous blog article, our project main objective is to propose

innovative technologies for wastewater treatment. To produce clean water from the water that has been already used in our houses, businesses or industries.

Catalytic Ozonation for Virus Disinfection (C.O.V.I.D) can be the cure for another possible future battle, the one of water scarcity. Many countries worldwide, including most EU countries located in the Mediterranean region, face extremely high-water stress problems [1], meaning that in the future people will not have access to freshwater. WHO has several times arisen concerns since contaminated water and poor sanitation are linked to the transmission of diseases.

Let me present you some facts and predictions I gathered to make a comparison of COVID-19 outbreak to water scarcity [2,3]. The maps on the top also show the countries affected by each occasion. Do you see the connection?

COVID – 19	Water scarcity
<b>February 1<sup>st</sup>, 2020:</b> 14,5 thousand cases worldwide <b>WHO declares Global Health emergency</b>	<b>2007:</b> 700 million people in 43 countries are affected.
<b>March 1<sup>st</sup>, 2020:</b> 88,5 thousand cases	<b>2025:</b> 1.8 billion people will be living in countries or regions with absolute water scarcity, 2/3 of the world's population could be living under water-stressed conditions.
<b>March 18<sup>th</sup>, 2020:</b> approx. 220 thousand cases in 176 countries out of 195	<b>2030:</b> 50% of the world's population will be living in areas of high water stress and water scarcity 24 - 700 million people will be displaced.
<b>2020:</b> 9,285 people have died so far	<b>2020:</b> 181 315 deaths are caused this year by water-related diseases
<b>2020+:</b> Modelers Struggle to Predict the Future of the COVID-19 Pandemic	<b>2050:</b> > 5 billion people could suffer water shortages

On both occasions, the numbers are getting higher and higher by the time. Regarding water scarcity, the numbers are incredibly higher than those of COVID-19. But since it is not currently affecting our lifestyle we ignore it. It is of high importance to consider all these numbers and act on time. Many experts on wastewater treatment, are now introducing the concept of Water Reuse, urging governments and local authorities that this will be the only sustainable solution for dealing with the lack of water in the upcoming years.

Water Reuses means the use of treated wastewater, or “reclaimed” water, for beneficial purposes such as drinking, irrigation, or industrial applications [4] with the aim to keep the ecosystem and public health unaffected. And, here is where Catalytic Ozonation for Virus Disinfection (C.O.VI.D.) steps in.

My research focuses on the design of a technology that combines catalytic ozonation and membrane filtration to treat wastewater and eventually pose it back to the environment by minimizing any adverse effects. Following the concept of Water Reuse many research projects are now trying to find the best technology and provide guidelines for treating effectively all these contaminants found in wastewater.

Ozone is well known for its protecting layer around the earth’s atmosphere. However, it can be used as a disinfectant in the final line of a wastewater treatment plant (WWTP); the method is called ozonation. It gets mixed with secondary effluent water and it simply reacts with every single particle present in it, including bacteria and viruses [5]. Interestingly, ozone is 50 times more effective at disinfection compared to the most popular disinfectant – chlorine.

And why Catalytic?

Because catalytic ozonation utilizes catalysts. Catalysts are substances that increase the rate of a chemical reaction, let’s say like COVID-19 uses people to increase its transmission rates. So by using a catalyst, we aim to increase the efficiency of the technology and provide water of better quality.

Now going back to COVID-19, why do you think governments and local authorities have taken all these drastic measures?

Because we were unprepared. When humans ingest medicines/pharmaceuticals, up to 90% of active ingredients are excreted back into the environment and COVID-19 has increased the number of pharmaceuticals in WWTPs effluents.

If another disease outbreak arises while countries are suffering from extreme water scarcity events, then only a well-planned water reuse system will be able to prevent economic and health system collapse scenarios. Countries should develop comprehensive water treatment and reuse standards, providing directions, encouraging and financing wastewater reuse programs like they are all trying to do now against the virus outbreak.

Let’s be prepared this time!

You may think water issues are somebody else’s problem. But in a few years, it will be yours too.

Protecting yourself means protecting others and respecting the environment means respecting yourself.

And as Erasmus said, “Prevention is always better than cure”!

Hasta luego amigos/as and enjoy the small things you have missed due to the non-stop “running”!

#stayhome #bepositive #acttogether #beready #betterdaysarecoming

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# Revealing the Wastewater Black- Box

Silvana Ines Quiton Tapia - ESR1

26/03/2020

We all know the famous phrase of Antoine de Saint-Exupéry “What is essential is invisible to the eye”. In my research, this quote is literally true.

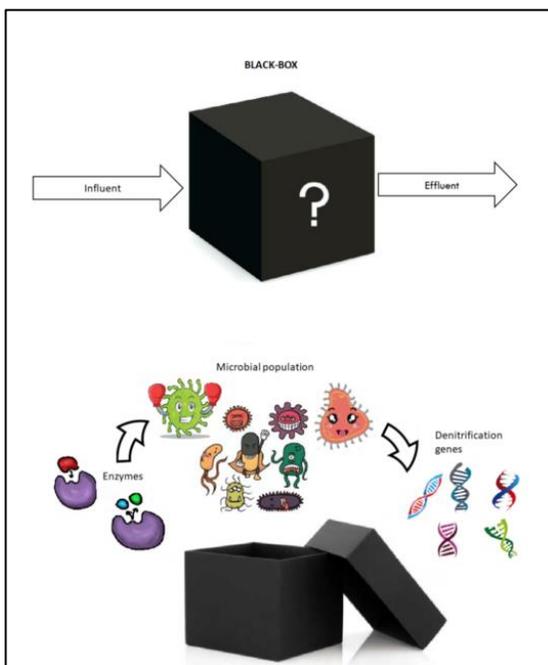
My work consists in understanding biotransformation occurring in wastewater, that is how microorganisms convert all sorts of substances present into their own food.

But how do they do it? And why is it relevant for us understanding it?

The microbial strategy of turning toxic compounds into fuel is considered a very important removal

mechanism. This is particularly the case for organic micropollutants (OMP), for which biotransformation is considered one of the main mechanisms responsible for their natural attenuation. Since Nature is so wise and has much more experience in overcoming problems, we want to learn from it how we can control and enhance the removal of these toxic compounds from water. The engineering of these natural removal process is known as biological treatment systems.

Biological systems have been and are a relevant wastewater treatment typology. However, biological treatments have been studied following a “Black-box” approach: only considering inputs and outputs. But in this way, we disregard what happens in between, namely the different removal mechanisms that these treatments encompass. Scientists observed that some organic



micropollutants were being removed in conventional biological systems, but they did not know exactly how that happens.

In the last few years, there has been a paradigm shift in wastewater treatment research: scientists are now studying removal mechanisms independently in order to dissect what's happening inside the Black-box. In fact, recent research has pointed out that the redox conditions have a major effect on the biotransformation of OMPs.

Redox what?

Based on the type of process, biological systems can be aerobic (with oxygen present), anaerobic (no oxygen) and anoxic (oxygen in form of nitrogen species). These are called redox conditions, because they involve biochemical reactions that determine the microbial population, which influences the biotransformation pathway.

The biodegradation pathway is the route that microorganisms use to break down OMPs. In anoxic conditions, microorganisms follow a denitrification route which consists in a series of reactions to consume nitrogen. The anoxic route is one of the least studied among the redox conditions but potentially relevant due to the participation of enzymes, as they could act as reactor catalysts to drive and/or speed up the biotransformation of OMPs.

In the lab, I have my own black-box (a biological reactor), but I can find out what is hiding from us by simply “taking pictures”. That means carrying out different chemical and microbiological analysis to open the black-box little by little, and clearly identify the microscopic actors that are involved in nature's complex game of detoxification.

This is why my work is zooming in microorganisms, enzymes, metabolites and even genes that so that we finally understand the black-box nature.

### **Pictures source**

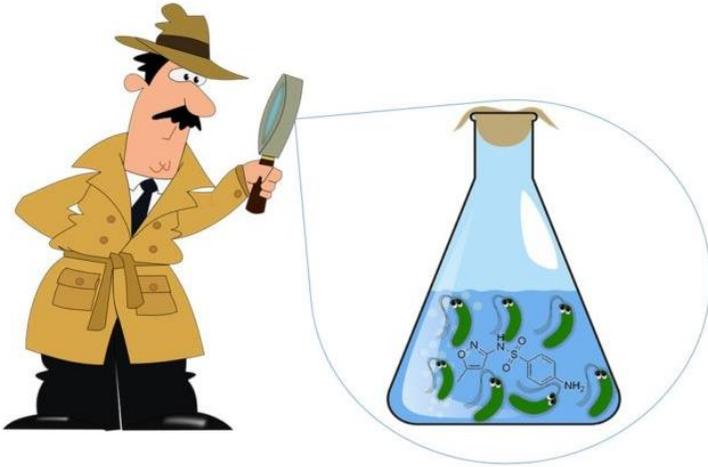
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# Bacteria Are My Employees

Ana Paulina López Gordillo - ESR2

03/04/2020



As part of the Nowelties project, my main goal is to understand and enhance microorganisms' potential to treat wastewater.

Why am I so interested in knowing more about this?

Most of the existing wastewater treatment plants include microorganisms because these marvelous bacteria, fungi, and protozoa use substances present in wastewater (that we consider contaminants) to grow, replicate, and continue with their life cycle. So, there is a win-win, we obtain cleaner water and they get constant "food". However, some contaminants that are discharged in water due to human activities are not treated efficiently...and this is the case of many organic micropollutants (OMPs).

If we only understand why OMPs are resistant to biodegradation, we could try to provide what microorganisms need.

I like to think as if bacteria were employees, we need to provide them a nice working environment, some tools, and perhaps understand their limits and "preferences". In this way,

OMPs removal can be improved, for example by promoting a more diverse and old microbial community.

Particularly, I am focused on discovering why some OMPs persist in water even after improving the operational conditions of a biological treatment. One idea is that micropollutants could not be reached or detected by bacteria because they are adsorbed to other materials, and/or their concentrations in water are not enough to be up taken by microorganisms; in other words, OMPs are not bioavailable. And then, if bacteria cannot “eat” them, OMPs won’t be degraded.

- But is there a limit from where bacteria can start detecting and degrading them?
- How can we define this limit?
- Is this limit the same among different microorganisms?
- And what happens with diverse sorts of micropollutants?

These are some of the questions that I wish to answer with my research during the coming years.

Many times the answers are difficult to find. However, I will start my investigation with simple scenarios such as considering one type of bacteria at a time, exposing it to one OMP only, providing suitable environmental conditions...In summary, I will try to keep bacteria joyful and look for any detection limit.

Nevertheless, as these ideal conditions aren’t occurring in the environment, my research will expand to more realistic systems afterward.

Overall, I am glad to take part in unraveling the so-called black-box of microbial wastewater treatment.

### **Pictures source**

[www.pixabay.com](http://www.pixabay.com)

# Ph.D. in Three Steps: Fall, Get up, and Keep Going

Edwin Antonio Chingate Barbosa - ESR3

17/04/2020



Even though it's not new to me, and we all keep doing it all the time, that phrase is sticking in my mind, especially during this period of my life called Ph.D. studies. As science by itself requires persistence, I'm aware that everyone in the world of science should bear it in mind, and I'm pretty sure that this is a good time for me to training my "get up and keep going."

Of course, I'm dying to write about my research just as some of my colleagues already did. Still, I think that if you want to know more about my work and the way I do it, it would be useful to tell you something more about me. Because, as for the artist, the work of the scientist reflects its character.

Even though I love my work, sometimes I noticed that I should move faster, but then I realize that it's too much for me and that I won't be able to do it. Often it goes as easy as it

came, but other times it requires more reflection upon it. I keep learning just as much about myself as about my research.

Finding the way to “get up” involves planning, understanding the situation, and discussions with others. Once I organized my ideas, I’m able to “keep going” since I own more in-depth knowledge about my research. I come up with a better plan for what I have to do, I know more about myself, and I’m more prepared for the next time because it always comes back.

It helps to think about the authors of the papers that I read. Before they fully understood the phenomena, they performed several experiments, and they undertook many pathways to solving those intriguing and complicated questions. It’s this series of challenges that make them humans just like you and me, and they finally succeed because every time they failed, they got up and moved on.

Frustration is a significant part of the research; you always have to try more than once to understand or develop something new. It’s a feeling that you’ll learn to deal with. I would say that “fall, get up and keep going” is a natural cycle. Every time you’ll face more significant challenges, you’ll feel even better after overcoming it.

Also, it is helpful to be aware that this cycle is present in other stages of our life as well. From having no money, being lost in the middle of nowhere, discussing with family, having a broken heart, or falling from the bike. Those are some examples of things that may have looked like something too big for us. Still, in the end, we overcame those challenges, and we became wiser than before. As getting more

knowledge is critical for research, this cycle seems to work, of course! Only if everyone keeps getting up.

As I have a lot of experience falling from my bike, I’m gonna use this as an example.

For both science and cycling, even though I have fallen many times, I still feel a strong passion for it. This experience usually begins as a regular journey, sometimes it happens when I’m enjoying it too much.

Something that I didn’t expect suddenly appears, without perceiving where it was coming from or why at that very moment. It could be ice on the road or an obstacle that I didn’t see

before. Then, everything happens too fast. I don't have time for any reaction, that I find myself on the ground hurting.

While suffering, I don't know what to do, I just want to stay there and see if everything gets fixed by itself. But of course, it never goes this way.

I have to think about all the possibilities: does the bike still work? Can I even go home by myself? Should I ask for someone else help?

In the end, I have to deal with the pain and fix the bicycle. Later on, I realize that I can restart, maybe more slowly, but it's something that I can work out and I haven't found anything yet that defeats me.

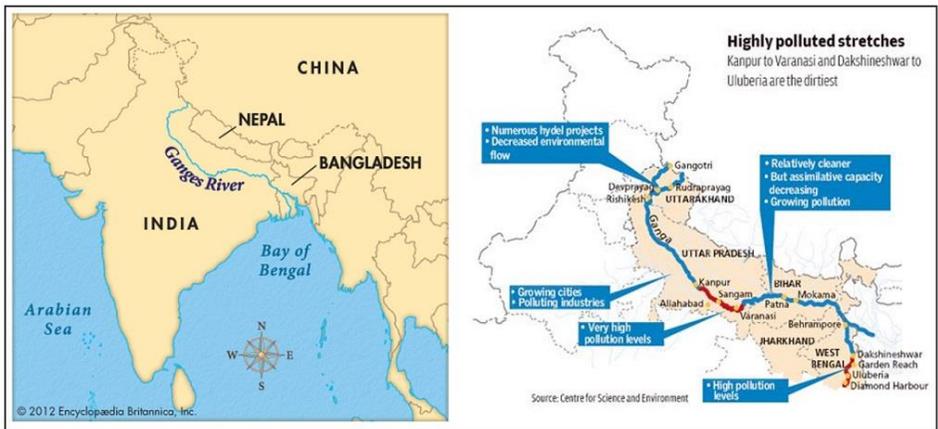
I know this idea is not something that makes me unique. It's just the fact that it's significant for me. A lot of people "fall, get up and keep going" with their lives. In my case, these kinds of feelings are partly responsible for loving my chosen path. If it were easy for me, I would get bored, and I won't do it. Stronger the fall, more satisfaction after getting up, and more experience gained for the keep going.

As we are all facing enormous challenges because of SARS-CoV-2, this is a good time for talking about this topic. A lot of people are living hard times, some already lost someone close to them, and others are experiencing economic problems. This is a hard fall, but humankind will find a way to get up, and things will keep going even better than before. I hope that with my words, I encouraged you to "get up and keep going."

# A Solution for Cleaning Water: Cold Plasma

Amit Kumar - ESR4

24/04/2020



I am from India, where 37 % of India’s population lives in the Ganga River basin. The Ganga is a holy river in India, with a total length of 2,525 km. This river is an essential source of water for a vast area, and it provides more than one-third of India’s surface water. About 47 % of irrigation in India depends on the Ganga basin alone. It also provides water for drinking purposes to about 40 % of India’s population.

Unfortunately, the Ganga River is getting polluted with hazardous chemicals each day, and it is in trouble. Industrial waste, human waste, and the ones generated as a result of religious practices are the leading causes of river pollution. According to a report by the WHO, domestic wastewater and industrial sewage that contaminate the Ganga have been estimated at about  $1.4 \times 10^6$  m<sup>3</sup>/day and  $0.26 \times 10^6$  m<sup>3</sup>/day, respectively, which are almost equivalent to emptying 140,000 and 26,000 milk trucks every day!

Several organic micropollutants, such as dyes, pharmaceuticals, surfactants, and pesticides, have been found in trace amounts in groundwater and surface water samples from the nearby

regions of the Ganga River basin. These pollutants can cause cancers, physical abnormalities, harm to aquatic life, and also affect the lower productivity of agricultural land.

Organic micropollutants are very resistant to degradation, and they cannot be removed from water by conventional water treatment processes/plants.

However, a new treatment technique could play a significant role in the degradation of those trace non-biodegradable organic micropollutants. It is named cold plasma, and it can make water reusable for drinking and/or irrigation.

But what is cold plasma? And how can it be used?

Cold plasma is an advanced oxidation technique that leads to the formation of various types of oxidizing agents, such as hydroxyl radical ( $\text{HO}\cdot$ ), atomic oxygen ( $\text{O}$ ), hydrogen peroxide ( $\text{H}_2\text{O}_2$ ), and ozone ( $\text{O}_3$ ).

These oxidizing agents are capable of eliminating a large number of organic micropollutants from water and killing microorganisms (e.g., bacteria, viruses, etc.) present in water. While conventional disinfection involves the use of chlorine that is a hazardous chemical, treating water with cold plasma is an environmentally friendly way to obtain safe drinking water. Additionally, since cold plasma operates at room temperature and atmospheric pressure is more sustainable than its similar hot plasma.

Several organizations, both national and international, are already working to clean up the mighty Ganga River now severely contaminated by industries, cities, and agriculture. This is of great importance because hundreds of millions of people and a vast range of wildlife rely on it.

The sacred river the Ganges is crucial for India: culturally, economically, and environmentally. This river means life, and this life has been endangered for years.

When, at the end of my Ph.D. studies, I will return to my hometown to my family and friends, I don't want to go back empty-handed.

I want to return with a solution to this enormous pollution problem that afflicts my loved ones and my country in general: a solution that will ensure a healthier future for them. Armed with an acute knowledge and specific skills, I want to contribute to developing long-lasting technologies to clean up the Ganges River.

My work on cold plasma treatment could apply to the Ganga River problem because it could be developed into a simple, valuable, and easy to use technology. So it would be an attractive option for every country regardless of its financial status, expertise, and experience.

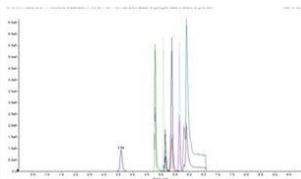
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# Revealing the Unseen

Barbara Topolovec - ESR5

04/05/2020



I was in the lab, with my eyes fixed on my sample.

At first, nothing happened, but after a few minutes, I saw them: red, yellow, and some blue spots. I repeated two more times the same experiment; my brain couldn't believe what my eyes had noticed.

Back then, I was working with a technique called thin-layer chromatography. That was my first time when I discovered the “art of chromatography”.

It feels like it was yesterday, but science has moved on, and today I work with more sophisticated methods.

But how does this relate to my project?

The main objective of my project is to understand the transformation of specific micropollutants during plasma treatment. To do this, I rely on the most advanced tool in analytical chemistry: the liquid chromatography-mass spectrometry (LC-MS).

Since my fellow Amit already explained what plasma treatment is, I will only focus on that powerful tool used in analytical chemistry.

Chromatography is one of the most versatile analytical techniques nowadays because it enables us to separate, identify, and quantify almost all the compounds that are present in any liquid sample, even at meager amounts. Thus, it can reveal the “unseen“.

What started in the early 1900s as a simple separation of leaf pigments, today it exists in various forms. Thanks to the new inventions and improvements in the field of chromatography, followed by related applications such as mass spectrometry, we identified a whole spectrum of new contaminants present in the environment.

These new “friends” present in water at low concentrations are referred to as emerging contaminants (ECs). Moreover, these are continually evolving and therefore represent a great challenge for environmental monitoring.

In this case, my main objective is to obtain the first information about the transformation and removal processes occurring during plasma treatment. That means identifying the intermediate and final transformation products (TPs).

At this point, you may be wondering: what are these emerging contaminants that I am talking about?

Well, have you ever heard about PFAS?

Per- and polyfluoroalkyl substances, or simply PFAS, are the most environmentally persistent contaminants, and they are present a wide range of consumer products such as pots, pizza boxes, and stain repellents. There are several ways people can be exposed to these chemicals, and one of these is through the water.

Today, I still have my eyes fixed on my samples. Although circumstances we all face together these days have postponed my laboratory work, I am still able to analyze and reveal the unseen from my home office.

I am very far from that thin-layer chromatography, and I just started

### **Pictures source**

- <https://www.pinterest.com/pin/540713499004974025/>
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## Why My PhD Matters - But It's Not Enough

Danilo Bertagna Silva - ESR6

08/05/2020



All of the fellows in NOWELTIES are working hard on cutting-edge technologies of water treatment. Specifically, in my case, I should study the applicability of UV-LED photocatalysis for the degradation of organic micropollutants and develop optimized photoreactor designs to further reduce energy expenses. By doing that, it would be possible to degrade toxic substances which currently are not removed in conventional wastewater treatment plants - and the whole process would be more efficient, sustainable, and cheaper for society.

As it is clearly stated on our website, the program is funded by the European Union Framework Programme for Research. Sounds great, doesn't it? And it is. The possibility to work with R&D in a relevant field with all the required resources is exciting. EU initiatives such as NOWELTIES and many other projects are necessary at this moment, and I feel honoured to participate. However, since I decided to enter the academic world, I noticed that in order to not lose sight of the bigger picture, we must realize that almost all of our problems have barriers more significant than science and technology.

Contaminants of emerging concern have been reported to cause harm to ecosystems, and their effects in human health are still largely uncertain due to the chronic character of the continuous micro doses we are exposed over long periods of time. Scientists and engineers all over the world are continuously (and successfully) finding ways of degrading these substances - chemically, physically, and/or biologically - every day more efficiently. Having said that, there is an alarming mismatch between science and legislation. Laws and regulations about emerging pollutants are still globally scarce - and limited to highly developed countries. Even in European Union, where other efforts have been made such as the Surface Water Watch List under the EU Water Framework Directive (WFD), only this year a new draft of the regulation of minimal requirements for water reuse (currently waiting for approval in the EU parliament) mentions these contaminants officially.

The reasons for that mismatch are easy to find. "Contaminants of emerging concern" embrace, among other classes of chemicals, pesticides, and pharmaceuticals. The agribusiness and the pharmaceutical industry are formed by huge conglomerates whose profits' leftovers contaminate our water, soil, and air. While the agribusiness concentrates private property and sets the tone of our society's cost of living, the pharmaceutical industry keeps us "healthy" and helps us cope with facing our daily routine - in a rhythm that keeps accelerating indefinitely, in despite of the deterioration of our personal relationships and quality of living standards brought about by the commodification of everything.

The quest for efficiency and sustainability has become a sort of "holy grail" of science, repeated to exhaustion in academic publications, political speeches, and private enterprises "our mission" marketing statements. While highly qualified professionals and students are working with renewable energy, trying to make solar panels and wind turbines better and "applicable", increasing their efficiency inch by inch, designing new green products, developing and evaluating life cycle assessments for all aspects of our production chain (in a constant state of struggle, fighting against budget cuts), the fossil fuel industry continues as strong as ever, heavily influencing politicians all over the world to avoid stricter environmental legislations. Additionally, many of its stakeholders fund research on renewable energy to control its framework of action and applications, or use it for marketing strategies.

If we put the rest of the world in this discussion, the situation gets much more critical. In my country (Brazil), wastewater treatment legislations are anything, but rigorous, limited to a few considerations on pH, suspended solids, turbidity, nutrients, and total organic matter – and the inspection of their compliance is sparse and corrupted. Furthermore, half of the country’s population does not have access to basic sanitation infrastructures and sewage collection. Dozens of pesticides forbidden in Europe due to their severe toxic effects and still used in Brazil on a large scale, like atrazine and glyphosate. In that scenario, to discuss state-of-art technologies to degrade contaminants of emerging concern seems naïve or hypocritical.

Our current crisis triggered by the COVID-19 is a crystal-clear example of how our problem is not a technological one. Cheap and straightforward products – like alcohol, soap, masks, and gloves – are enough to reduce the reach of this disease significantly. However, our production chain is unable to provide these most essential items to everyone who needs it, and governments hesitate to listen to scientists and to adopt measures that go against their economic interests to save lives.

I’d like to raise a few questions I’ve been thinking about since I started this PhD to all the professionals in the field of water treatment technologies:

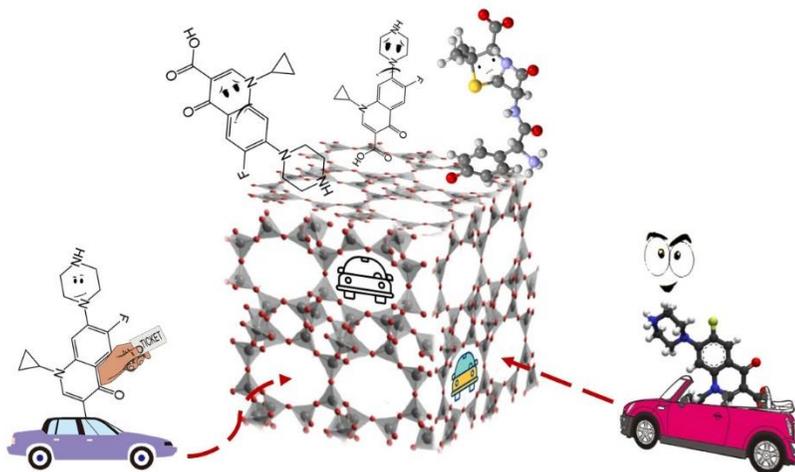
- Why some regions of the globe have stricter environmental legislations and significant investments in science, education, and technology while others “can’t afford” that?
- How efficient and cheap our technology has to be so we could finally stop drinking poisoned water?
- To what purpose do industrial activities poison our water in the first place?
- Who profits from water pollution, and why should they?

If the ultimate goal of science is to improve the material conditions of our society, answering these questions and facing these issues are urgent. No personal growth is possible for a scientist if s/he remains unaware or indifferent to what happens away from the lab.

# Finding the Parking Slot for Harmful Antibiotic

Barbara Kalebić - ESR7

15/05/2020



Every day, we are faced with the significant progress of humanity, achieving a better quality of life with more straightforward, safer, and longer living. As a consequence, science has to deal with many new and more complex problems that require an urgent finding of innovative and effective solutions.

One of these problems is global water pollution caused by emerging contaminants. Among these contaminants, the antibiotics - pharmaceuticals that, if discharged in the environment, may cause harmful effects on the ecosystem - are one of the most concern these days. They may pose a serious risk to living organisms by enhancing bacterial drug resistance. In fact, due to their continuously increasing consumption, they usually end up in the aquatic environment without any treatment; thus, they can reach drinking water supplies.

The focus of my research is finding a solution for removing one of these antibiotics from water: ciprofloxacin (CIP).

Although decomposition of organic contaminants is the most common removal mechanism, it is not the only option. The adsorption process on natural solids has proven to be an effective alternative for removal due to its simple operation in which no potentially toxic by-products are formed. Also, it is economically and environmentally feasible with a wide range of adsorbent materials available today.

Zeolite (more specifically, clinoptilolite) is one of them, and I use it in my research. Zeolite is a fantastic mineral abundant in nature with a microporous structure consisting of highly ordered, pores and cavities with molecular dimension. For its unique microstructures, zeolites generally have excellent adsorption properties.

But how does CIP get adsorbed on zeolite?

Imagine that your car is the antibiotic (CIP), and the parking lot is the zeolite surface.

Visually, the zeolite micropores structure can be thought of as a multi-storey car park with a lot of parking spaces of different sizes available.

Furthermore, you are driving your car in a metropolis like Belgrade. Like other world's metropolises, Belgrade lacks parking spaces due to the fast-growing number of vehicles, so it is necessary to expand the areas where parking is allowed.

Similarly, CIP molecules rapidly saturate all the available free adsorption sites making it necessary to modify the zeolite surface by increasing its specific surface area.

The adsorption of CIP molecules on the zeolite "parking" surface is thus similar to parking the cars. The only difference between the parking lot and zeolite is that adsorption is strongly influenced by electrostatic interactions between CIP molecules and zeolite surface. Since the CIP molecule is a zwitterion, which means that it can be a neutral, positive, or negative molecule, it is crucial to make a good optimization of the adsorption process.

To modify the zeolite's surface, various techniques have been developed today.

In my research, I will be studying the coating of zeolite's surface with different materials, such as metal oxides, graphene oxide, or biopolymer chitosan. Also, I will explore a plasma treatment for the zeolite surface to increase its efficiency in "capturing" the CIP molecules.

For now, I still don't have problems with finding free parking spaces because I don't own any car here in Belgrade. On the other hand, I am now intensively dealing with "parking" the

antibiotic on the zeolite surface and its consequent removal from aquatic water systems, and much more...

# Taking Advantage of an Unlimited Source: The Sun

**Camilo Sánchez Tobón - ESR8**

*22/05/2020*



Have you ever noticed how some objects change their properties when they are left under the Sun?

For example, when a newspaper is exposed to sunlight for several days, it becomes yellowish. This remarkable process is called photodecomposition, which means that a substance is degraded by exposure to the light.

All the energy that arrives at the Earth from the Sun is coming in the form of radiation.

This radiation is mainly composed of infrared (49%), visible (42%), and ultraviolet (8%) light. The infrared radiation is the least energetic, and it is absorbed by the water and CO<sub>2</sub> to become heat, that is why more CO<sub>2</sub> emissions increase the temperature on the Earth (Global warming). Visible light is more potent than infrared but less than ultraviolet. It is mainly used by plants in the photosynthesis process (conversion of CO<sub>2</sub> to oxygen) as well as it is responsible that we can see everything colorful. Meanwhile, the ultraviolet light is the most

energetic one, and it induces photodecomposition of many things, including our skin (sunburns and skin cancer). That is why many objects have UV protection, and it is recommended that we use sunscreen.

The photodecomposition phenomenon is the base of my purification system that I am applying for removing organic micropollutants (OMPs) from water. As other technologies used for purifying air and water based on the decomposition processes, they are usually boosted using some compounds called “catalysts”. They take the ultraviolet light and make the oxidation of the substances (pollutants) present in air and water more efficient and faster. One of this catalyst is titanium dioxide (TiO<sub>2</sub>). This fantastic compound is used in several industries, such as cosmetics, paints and coatings, solar panels, as well as in air and water treatment, because of its non-toxicity, low cost, and chemical stability. Although TiO<sub>2</sub> works very well in the removal of many contaminants that are discharged to the water bodies (rivers, lakes, oceans, etc.), TiO<sub>2</sub> receives only ultraviolet radiation and not all radiations mentioned before. Thus, it is necessary to modify the TiO<sub>2</sub> to absorb visible light too. In this way, we could take advantage completely of our unlimited source of energy, the Sun.

Mainly, my project focus on a new methodology for the synthesis of a photocatalyst based on TiO<sub>2</sub>/graphene oxide for the removal of organic micropollutants (OMPs). As my fellow Michele said, graphene could improve communication between microorganisms. In my case, it could enhance the light absorption of my catalyst. Additionally, for the synthesis of the materials, I am applying a microwave oven, like the one we use at home, but with additional features that allow me to control the process more accurately. We believe this new synthesis methodology might produce materials with a higher purity in a shorter time (just minutes), reducing the consumption of production energy significantly.

My research is part of the NOWELTIES project for developing innovative technologies for water treatment. We are working all together, sharing experiences and knowledge, building a great scientific network. From this, we are trying to find out efficient, economically, and environmentally friendly solutions to the problems related to water, that could improve the well-being of society.

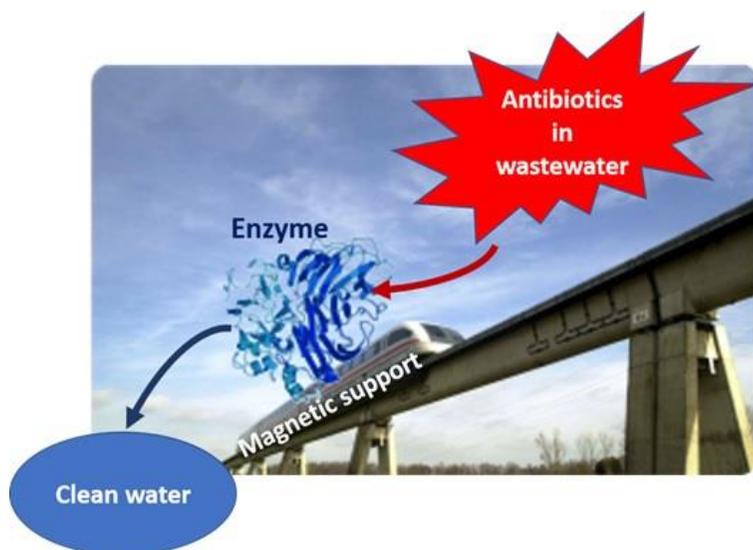
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## Staying on Track

Sabrina de Boer - ESR9

29/05/2020



The development of the magnetic levitation (maglev) train in Germany could be denounced as a failure. Billions were invested in creating a faster and more efficient way of transportation. In the end, it was not applied in Europe. Not because it was not efficient, but because it was not competitive enough with the existing means of transportation. The decision to stop the development was also provoked by a terrible accident on the test track. Even though it was not caused by a technical failure, trust in the innovative technology was lost.

You might ask, what has a high-speed magnetic train to do with new water treatment technologies?

In a broader sense, I also work with magnetic vehicles. I use tiny particles that can be attracted by a magnet as a support for special catalysts: Enzymes. These complex structures are the base for vital functions, from metabolism to sensing, and are present in all living organisms. Enzymes derived from mushrooms can degrade wood towards essential nutrients. Scientists

found out that they are also able to degrade harmful substances from wastewater. For example, antibiotics.

Antibiotics save thousands of lives each year, but having done the job in our body, they remain active, are flushed down the toilet, and reach the treatment plant. In their current state, wastewater treatment plants cannot retain these substances completely. Consequently, antibiotics enter rivers where they can cause toxic effects to water organisms and promote the development of antibiotic-resistant bacteria, which are increasingly affecting human health.[1] Since the abolition of antibiotics is not an option, wastewater treatment is the most substantial barrier to keep medicines in their field of action.

By introducing an enzymatic treatment stage, it could transform antibiotics in non-toxic products with no residual activity. Also, enzymes will be attached to magnetic particles to prevent their release, or to keep them “on track”. This means that while the uncontaminated water can be smoothly discharged to the river, the enzymes will remain inside the treatment plant to be used multiple times.

The enzymes work at ambient temperatures without the need to add harmful chemicals, so the risk that the implementation of the technology will be involved in a fatal accident is low. Still, I have to prove that my magnetic helpers do not have negative effects on the environment in the case they go “off track” and find their way to the river.

I am also optimizing the manufacturing process, using less harmful chemicals. Because we have always been alerted that by solving a problem, we do not create another. And if we do, find a solution to this problem too. In the case of wastewater treatment technologies, every additional stage in the treatment train will have an impact on the environment, even if we try to minimize it. We have to discuss at very different levels if the benefit pays off the impact.

Today, there is only one high-speed maglev track in operation in China. Recently, the switches were set to construct the first large distance track.[2] The different political, economic, and social frameworks make the technology favorable, while it was not the case in Europe.

The same can become real for enzymatic technology. First, we have to do an excellent job of proving our technology efficient and applicable. But it does not end here. We also need to

convince society to take the financial risk to build up a new treatment process to make the best use of our precious water resources.

**Picture source**

<https://www.tagesspiegel.de/images/teststrecke-des-transrapid-in-lathen/24057610/1-format43.jpg>

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# IQ, EQ, and AQ: The Three Ingredients for a PhD

**Francis dela Rosa** – ESR10

05/06/2020

Hi readers!

It's my blog contribution time again.

Camilo (ESR 8), Sabrina (ESR 9), and I (ESR 10) have similar topics that are related to photocatalysis, and they both already gave great explanations in their blog contributions. The main difference among our studies is only synthetic techniques, catalysts, and pollutants to be degraded for our studies. In this blog I will focus on my personal development and my feeling in a new country.



## *For personal development*

Most people think that PhD is only about IQ (Intelligence Quotient). Well, you indeed need to be prepared to obtain a PhD degree. Still, in my opinion, other factors can contribute to one's success. Here in Zagreb at the Faculty of Chemical Engineering and Technology (FKIT), I can literally say that my EQ (Emotional Quotient) is amazingly upgraded. For instance, my self-management and awareness are improved by having an advanced and detailed schedule for daily lab tasks. I now manage my emotions when something goes wrong in my experiments. I always keep in my mind that tomorrow is another day, and I just need to try and try until I succeed.

Moreover, my social awareness and relationship management are magnificently enriched here in FKIT. Every day, I work with new people inside and outside our department (from

Electrochemistry, Reaction Engineering, Analytical Chemistry, and Inorganic Chemistry Department and more to come I think hehehehe). I feel that I am so lucky and blessed that I can always seek help from them. Well, I do agree that doing a PhD is an individual project, but collaboration is also essential for research success.

My AQ (Adaptability Quotient) is also tested and improved during the past months. Yeah, we all know COVID-19, and we had an earthquake here in Croatia last March. Imagine, I am far away from my home country (Philippines), alone, and these uncertain events happen in the middle of my PhD Studies. Well, I survived and learned more on how to focus on my work. I become stronger. As they say, "What doesn't kill you makes you stronger."

### *Feeling in new city/environment*

Here in Croatia I got a chance to know and work with more people as days gone by. I enjoy eating Ćevapi, Sarma, Kobasica, Kulen, Štrukli, and Orada fish. I also appreciate their Rakija. Believe me, Croatian Cuisine is delicious. As a matter of fact, I gain weight, and 4 out of my 6 pants are now tight. So, I think it's time now to make a diet. Time to eat their Palenta and avoid rice.

You may be wondering why I chose the picture above for this blog contribution. Well, these are all my beautiful colleagues, and together we will achieve our goals for our PhD Studies. They are the living evidence on how I build and improve my IQ, EQ, and AQ along the way.

(Note, we are still not complete in this picture. Insert: Marin K, Marin P, Sara C, Hrvoje, Zvonco, Neda, Prof. Ana, and Prof. Zlata. I think we need to have a department group picture soon.)

It is A WHOLE NEW WORLD indeed...

# Facing the Boundaries of Facts and Opinions

Marina Gutierrez Pulpeiro - ESR11

12/06/2020



*“Contrary to the fashion in most prefaces, I will not add that “all mistakes and shortcomings are entirely my responsibility.” That is sheer bourgeois subjectivism. Responsibility in matters of these sorts is always collective, especially with regard to the remedying of shortcomings.”*

Walter Rodney, *How Europe Underdeveloped Africa* (1972)

“Science is not about opinion but facts” is a quote that I have heard so many times in my life. Facts can be interpreted as the results obtained from the already well known scientific method, made with the objective of limiting as much as possible cognitive biases of observation through experimentation and peer-review.

But, please, don’t get me wrong, we all want to challenge those facts. Science is in the service of society: it creates knowledge, works to improve lives, and fights misinformation. Although

science is a way to provide facts to reality, what we do with those facts is clearly political. Determining whether pollution affects people is a matter of science, but deciding what to do in response to the data is political.

How do we balance the relationship between corporations and citizens? What do we do with our resources? How much weight is given to environmental awareness in our progress? Deciding how to allocate fundings and what type of science is valuable or not, are more political rather than scientific questions.

As consumers expect brands to have not just functional benefits but a social purpose, in crisis times, they expect science to give guidance through fast and transparent information about what is going on. Lately, when outbreaks of new diseases and preventable illnesses are risen up, scientists are on the horn of a dilemma. They have to express their opinion on the facts: there's a lack of basic research and there's not enough time in fighting disinformation.

The misinformation had evident consequences: global and local governments act differently, people become skeptical about the seriousness of the virus. All this did not help to contain the outbreak. Also, a possible vaccine is believed to be ineffective or unsafe. However, we should not forget that it also depends on the capacity of each country to ensure the supply of preventive measures such as face masks, and vaccines, when needed.

As scientists, it seems that our work is becoming a long-term race, at a changing pace and with a multitude of obstacles to overcome. During these times, we need to think and work and obtain results without the required meditation, without taking into account the imperative need to contrast all the current information to give a final conclusion. On the other side, most of the current research has suddenly stopped due to lockdown, and scientists have started to take the perspective of their careers.

When the NOWELTIES project started, the premise was clear. We would work together to find out how to remove emerging contaminants from water. That is, in fact, a political statement: we are facing a problem caused by our acts, and we don't know how to deal with it. Those contaminants are not perceptible to the eyes, we don't even precisely know which are the consequences of their occurrence in the environment.

But what happens if you need to take part, to express an opinion, and to make a stance of what is currently going in society? Where can you find your space for expressing yourself?

Frequently, scientists keep in silence to social issues beyond science in order to continue their research because there isn't a safe place for expressing ideas. Political opinions on social issues are not considered adequate in the working space. Meanwhile, protesting in your spare put in risk your career, as if the scientific method while working on research couldn't be enough to limit your cognitive biases.

The knowledge created through science serves to governments and international institutions to make decisions. On the other hand, scientists are citizens with the right to express their opinions. We, therefore, should think that academia will difficulty be completely apolitical.

This 2020 seems a year where boundaries start to dilute. The pressure of society to obtain fast and transparent information has risen up, while misinformation also increases. The boundaries of workspace and privacy have jumbled due to lockdown. Inequalities affecting gender, ethnicity, and social class are on everyone's agenda.

**Picture source**

“Destellos” of Juan Genovés, 2019.

# Chapter Three



# Why a PhD Makes Me Feel Helpful

**Michele Ponzelli** - ESR12

*19/06/2022*



If at the end of my master's degree, they had asked me if I would prefer to continue my studies, I would have answered with a sharp no.

I felt that I had studied enough, and I wanted to finally put into practice what I had seen so far only in books. And yet, it did not turn out that way. I earned another master's degree in North America and then embarked on the double PhD path in which I am now.

But then, you may be wondering, what made me change my mind?

Why should I go back to studying rather than trying a career in a company?

Especially during this period of uncertainty, in Italy, the so-called Neet (i.e., young people between 20 and 34 years old who neither work nor study) register a record percentage of 27.8%, the worst country in the EU.

In my home country, doing a PhD is not seen as a step that will secure you a fixed position or a coveted position, quite the opposite. For the industry, your skills will always be too high, and they will prefer to rely on a master student, rather than raise the compensation of the position offered. People will judge you as someone who hasn't found a job. And once you completed it, you will find it hard to find a position while pursuing an academic career is almost impossible.

So why did I choose a PhD? What really motivated me?

I wanted to invest in myself.

After so many years of study, I realized that the only things you really have left are the skills and knowledge that only education can offer you.

An example?

Think of the ability to speak a new language. The knowledge of a different language opens up a whole world of new opportunities for you. Getting to know and understand different cultures closely and thinking differently, starting from the simple formulation of a sentence. This allows you to see the world from another point of view, adding something to your cultural background.

Knowing more words is not only useful to travel but to understand the world. The philosopher Ludwig Wittgenstein said, "*The limits of my language mean the limits of my world*".

Starting a PhD for me was a bit like being born again. Being curious to learn, typical of children who realize they have a world to explore in front of them, but they don't know what fear is.

Recently, after nine months of PhD, I discovered another reason why I'm convinced that doing a PhD is an unparalleled experience.

When we become adults, we are at a crossroads.

Is it better to choose a well-paid and unsatisfactory job, or to risk and embark on a less rewarding but highly gratifying work or study experience?

We do not immediately understand which is the right choice, we know it only after we have made the choice.

Beginnings, in any direction, are full of euphoria. Then, however, the excitement goes down, and normality takes over: at that moment, you understand if the decision you have made is the “right” one.

In this way, if you have chosen a job just for financial compensation, you will discover that this is only a palliative. The real engine that moves us, what makes us stand up every day, is feeling useful: being part of something that can contribute to change society.

If the reason for the position you cover is in line with your inner purpose, you are in the right place.

But how do you figure it out?

First of all, we must be clear with ourselves: we have to look deep inside ourselves and understand what we really want. Then, once onboard, we have to ask ourselves: if I had the chance, would I go back?

But what is the real benefit of choosing a doctorate?

It provides you with a method of approaching problems that you can adapt to your everyday life. It allows you to refine your critical attitude, to look at things from different points of view, to not be hasty, to confront yourself, to understand the value of time.

For example, taking a civil engineering course not only teaches you how to design a street or house but helps you understand how your work can improve society. Writing a scientific article expands your glossary, allows you to build complicated periods, and articulate your thinking and research in the field, while smoothly linking them.

Likewise, a communication course not only teaches you marketing but also involves your relationships, your leadership, your values and principles.

To understand what is right to do in our lives, we need to identify our purpose. Each choice is unique, and the decisions made by others must remain an example rather than a path to follow.

When we make a choice for the future, we must always bear in mind that our job should not only give us economic stability. First and foremost, it must enable us to be useful to our community.

**Picture source**

<https://unsplash.com/photos/AndE50aaHn4>

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[https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Statistics on young people neither in employment nor in education or training](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Statistics_on_young_people_neither_in_employment_nor_in_education_or_training)

# Removing the Needle from a Haystack: A Magnet for PFAS Removal

Nebojša Ilić - ESR13

26/06/2020



Hello again! In my previous blog post, I introduced you to a family of chemicals (PFAS) that have been around since the 1960s and proven to be harmful in the late 1990s. These “forever chemicals” have been accumulating in the water bodies all around us continuously for decades. They are resistant to biodegradation and slip through most conventional water treatment technologies and eventually end up in our glass of water. Even though the concentrations vary from country to country, we can say with certainty that they are present absolutely everywhere.

So how do you conceptualize a solution to remove these chemicals from water sources if they are so resistant?

Well, nature functions in an elegant and unaggressive manner. The world around us is alive thanks to a lot of different chemical reactions that together make up a complex network. A network where each member of the ecosystem has a specific role to play. This is why man-

made materials are sometimes not “recognizable” by nature. There has simply not been enough time to adapt. Fun fact: it took 60 million years for bacteria to start degrading trees!

PFAS, due to their chemical nature, fall under the category of these resistant compounds. There have been recent developments in getting nature to clean up our mess. We are still a long way from applicable solutions though.

That’s why if we want to remove PFAS from water, we should start by considering the following:

1. Almost no compound is immune to high temperatures;
2. Every chemical has properties that we can use to our advantage.

With this in mind, I have set out on two different paths to try and design a system for PFAS removal.

The first approach uses ultrasound in a very crafty manner, and has been one of the more promising treatment methods in the last years.

The ultrasound creates very tiny bubbles in water due to pressure differences that the sound waves create. These bubbles eventually collapse and form very high temperatures in many small areas of water. They are so tiny that even though the temperatures at these collapse sites achieve up to 3500°C, the water itself is just a few degrees warmer at the end of the treatment than it was at the beginning.

The advantages of using this method are that it is a straightforward process and requires no chemicals or specific materials. The drawback is a very high energy consumption when running this process. Therefore, if we aim for a practical application in the future, we need to make it more efficient and price-competitive. We are trying to achieve this both through reactor design and through process optimization by looking in-depth into the mechanism behind the process.

The second path involves the use of a fascinating nanomaterial.

Based on previous experience and theoretical modelling, we are trying to come up with a new “version” of an exciting (nano)material (called MOF) that has been in the focus of chemists in the last years.

So why this material?

Due to how this nanomaterial is made, we can adjust its properties to work in our favor. Ideally, we want it to be resistant to water and incredibly stable. That way we can use it for a long time unlike commonly used materials which are replaced often.

By modifying the material properties, we can also achieve selective removal of PFAS from water. This is done by changing the chemical structure of the material's surface to match the features of the chemical we want to remove.

This removal process is called adsorption, and the best part is - it occurs spontaneously without any need for energy! Plus, it allows us to remove contaminants at super low concentrations, which is for PFAS extremely relevant. You probably know the basics of how this process works from Barbara's post about parking antibiotics in zeolites.

In other words, we are taking a big magnet with us to use in the search for the needle in our haystack.

The fight against PFAS is certainly not an easy task. Regardless, my goal is to dedicate time and energy into pursuing these two research directions that show a lot of promise. I am excited to work on a project that is a true representation of the possibilities how research can improve the world around us.

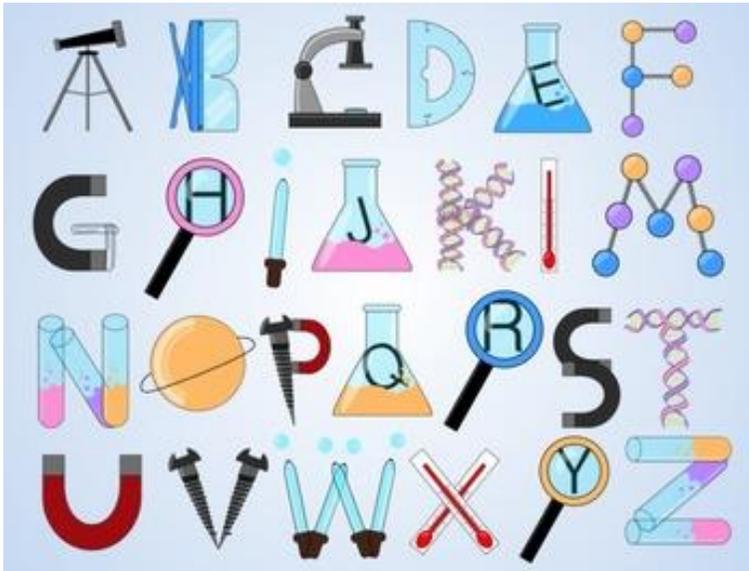
**Picture source**

[medium.com/hackernoon](https://medium.com/hackernoon)

# The Scientist's Alphabet

Nikoletta Tsiarta - ESR14

03/07/2020



Each language has its alphabet, and this is what shapes the words and, consequently, the sentences, the paragraphs, and in general, the way of expressing ourselves.

Words are essential to make ourselves understood. We, as scientists, need to find the right ones to communicate the results of our research to the public in a comprehensive and catching way.

This time I wrote an article about a typical day of a scientist. I decided to describe the scientist's life entertainingly using the alphabet letters in a certain way. In Greek, it is called "acrostikho", or acrostic in English, i.e., a poem where the first letters of the sentences form the alphabet. Let's begin...

A day starts with a cup of coffee/tea and checking your emails.

Be ready to organize your day and have a talk with colleagues.

Collect your energy and get in the lab.

Don't let the chaos around to distract you; it's just the beginning of the day!

Experiments are waiting to be done.

Focus on the tasks of the day, but don't forget...

Gloves, lab coat, goggles are necessary. Safety first.

Head to the equipment and turn it on.

It will take a while before everything is ready.

Just be patient and keep working.

Keep in mind that the working surface should be clean.

Leave the materials on the bench and start mixing the solutions.

Make sure you follow the right protocol.

Notes are essential to keep track of your work.

Organize your time wisely; otherwise, the lab can replace your home!

Protect yourself from any accidents. The lab can be a dangerous place.

Quitting is not an option!

Results time...analyze your samples and proceed with the data.

Sometimes you fail, but it is vital to get up and try again.

Try to better understand the problem and approach it with a different method.

Use the literature to get more information and formulate your research questions.

Visualize your manuscript before start writing it. It helps!

Work hard without overdoing it.

Xanax can be helpful, but maintain the balance: it is extremely recommended.

You are almost there. Lab life is difficult but worthy.

Zoom zaam, the day is finished, and yet there more to come!

Having all said, I conclude that an alphabet is not enough to express the life of the scientist.

There is so much more!

Maybe putting all the alphabets together will better reveal the blessings and curses of scientific life!

Until then, make sure to keep the positive ones and build on them.

**Picture source**

<https://www.teacherspayteachers.com/Product/Alphabet-Clip-Art-Science-themed-1420794>

# Teamwork: Navigate the Downs and Facilitate the Ups

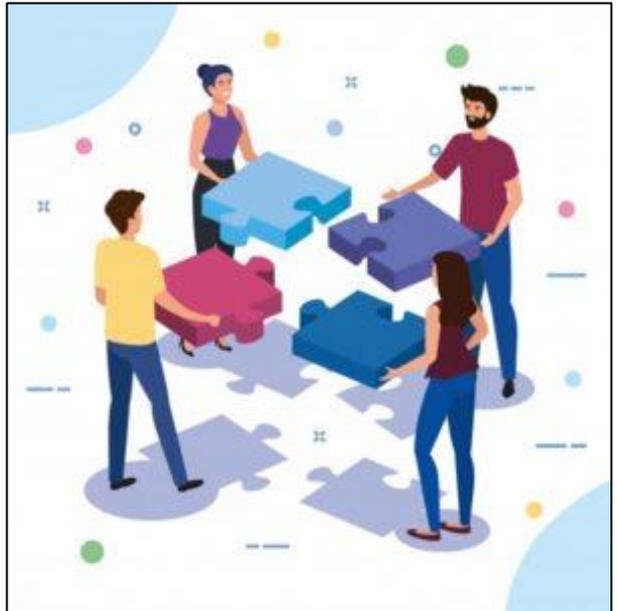
**Silvana Ines Quiton Tapia** - ESR1

10/07/2020

It has been suggested that the Homo Sapiens secret of success is large-scale cooperation (Harari, 2019). From humanity early beginnings till now, we have created very sophisticated networks of cooperation in our modern life.

*Scientific community is based on cooperation*

Cooperation within the scientific community is a long time recipe for success due to the multiple



advantages it provides. Team up with other researchers is a common practice to get more publications, write more robust grant proposals, exchange expertise, and learn from each other. Still, it also has to overcome some challenges: the uneven strength of partners, gender discrimination, and exclusionary behavior (Wang and Kong, 2019). Many believe that the future of science is based on improving cooperation by learning how to work more effectively with each other. In fact, one of the main goals of our project is to foster research cooperation among different research groups through our joint PhD.

Being part of the scientific community means sharing the same values and the same principles. As an early-stage researcher, I also must comply with the code of ethics and follow a scientific method to do my research. This will ultimately be published in a peer-review publication. The conduct of the peer-review process is a quality check for research that allows

you to share your research with a broader audience. Thus, we can trust other people's work. And trust is a critical component in science. Especially important when it comes to teamwork.

*Teamwork makes science better but there is some science in teamwork*

So we know collaboration is a clear advantage, but how can we improve this aspect? In my opinion, there is no single recipe for making collaboration work. Still, there are indeed some effective approaches, and some pitfalls to avoid.

One of the articles that inspired me to write this blog was based on insightful lessons from years of research on teamwork (Coleman, 2018). What draws my attention from this study is that establishing some common ground, providing psychological safety and having cooperative goals, while “needing” constructive conflict helped teams to thrive. The importance of teamwork and behavior psychology really resonates with me. After all, we are emotional human beings, and emotional intelligence is a crucial skill in teamwork (as Francis said on his blog).

*Teamwork to the rescue*

It is no surprise that a PhD journey is full of ups and downs. Working in teams can definitely help navigate the downs and facilitate the ups. And while finding our individual path is essential, having cooperative goals and learning how to work together is critical.

In USC, I am part of a group called Biogroup, but instead of seeing it just as a group, I consider it a research team. Inside the team, we have different people dedicated to various tasks, from administrative to technical lab staff. And they are all there in helping us to reach our daily goals more smoothly. As explained in my previous blog, I'm currently working with RNA extraction, something completely new for me. Still, luckily for me, I have both a microbiologist that guides me and the experience of a lab colleague, I can always ask for tips and tricks. These very handfuls of insights provided for our lab colleagues are paramount, and they saved me a lot of time. The same happens when I'm trying new experiments in the lab. For example, when developing a new method to quantify my antibiotics, we also received handy comments by analytical experts from ICRA, partners of the Nowelties consortia.

*Cooperation for the greater good*

If I look back to my experience so far, I realize that I couldn't have done it without the help and collaboration of different actors. This blog is dedicated to all the people that I have the luck to interact with on a daily base. In fact, they are continuously encouraging me to fulfill my goals. Working together to achieve greater good is just what is expected of science. For us, within the Nowelties team, we are entrusted with the challenging task of finding sustainable solutions for water treatment, but luckily we are not alone.

**Picture source**

[https://www.freepik.com/free-vector/teamwork-people-with-puzzle-pieces\\_5686193.htm](https://www.freepik.com/free-vector/teamwork-people-with-puzzle-pieces_5686193.htm)

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# Ready, Set, Move!

Ana Paulina López Gordillo - ESR2

17/07/2020



ESR formation involves international mobility in different ways, from short trips to conferences to longer stays during mobility periods. When stepping in a PhD journey, one should be prepared to travel when the time arrives. For us, the 14 ESR, our full PhD journey will consist of living in different new cities.

But what does this mean?

This means flexibility: we should get ready to do scientific research while obtaining travel and resident permits, which most of the time is a time-consuming process. However, there is an advantage too: this experience is a good warming up for everyone pursuing an academic career after the doctorate, which commonly includes changing your residence or traveling.

*New city, new research group, new life*

Arriving in a new city and embarking a new project are significant changes. There are many aspects to discuss from such a life change; however, I will only focus on the scientific and environmental perspective that I experienced.

As a scientist, the integration into a new laboratory and a new work environment is as well a plus. New introductory courses, working rules and working area organization are some of the novelties. Getting acquainted becomes more exciting and in a different level of difficulty when the activities and surrounding material are in a new language than yours: Safety Data Sheets, reagents, announces, invoices, meetings, etc. You can feel discovering a new sub-world in a new city. Fortunately, most of the colleagues at the Universities can communicate in English to smooth our integration in the research group.

Although learning the local language is not a requirement to graduate, it definitely grants us independence and better social integration. The locals will give a warmer welcome!

*What about environmental nuance?*

Each country has its own rules regarding environmental topics, such as garbage separation, energy alternatives, and preferred transport. This can become confusing for us as newcomers since a deviation of the rules can lead to expensive fines! Thus, getting informed and adapt to each host city is the key to a successful settlement. Any general recommendations for this?

- Investigate calendars for trash collection and existing sorting system in colored bags.
- If your country has a good cycling infrastructure, maybe give it a try. Sometimes you can be faster by bike!
- An application for buses and trains on your mobile may not harm.
- Renewable sources are often available for electricity and warming.
- Read on restrictions in green areas around you.
- Potable water from the tap can ease your life.

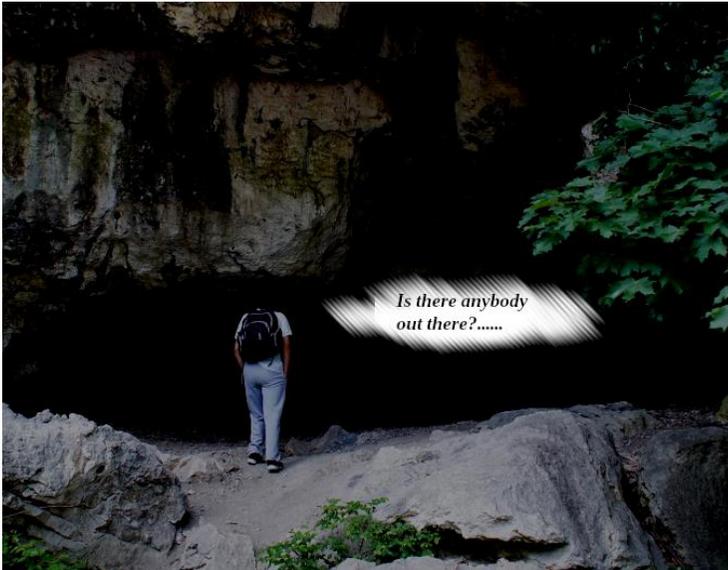
**Pictures source**

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# Journey to the Darkness

Edwin Antonio Chingate Barbosa - ESR3

24/07/2020



It's been a long trip for me. Now, even though I feel exhausted, I'm ready to start a new challenge. This is how my life is going...

I heard that *She* ran away and now is hiding in the deepest cave. I understand that feeling - they built her an armor for fighting with the Everywhere Demons, but *She* didn't manage to control herself and escaped. Probably, I'd do the same if someone pushes me that hard.

I think that *She* needs a friend to relate, not a boss, and I've got the feeling that I could be that one. That's the reason for my journey! That's my destiny! I can feel her confusion as I'm getting closer.

From time to time, when I get lost, I get the advice of the *Happy Tree*. Last time he mentioned that if I'm able to see all her faces, *She* could take to the battlefield for fighting the *Everywhere Demons*.

Finally, I'm here, in front of the cave. I can't see anything in the darkness, but I know that this is her house. It's time to knock the door:

- Is there anybody there?
- Go away! I can kill you, and I will if you're not careful. I won't let you use my powers to solve your problems. I just want to live a quiet life in freedom, and to enjoy as much nature as I deserve. You wouldn't understand who I am.
- I don't wanna use you! I admire you and I want to understand you. If you feel you're going into battle after this, that's up to you. I just wanna help you.
- Even if you have good intentions. The door is closed and all of me can't go out. But, I'll let you take a small piece of me with you. As soon you prove that you can take care of me, the door will be open.

My human nature is so limited. Even with a part of her with me, it's so hard to accept that *She* is everywhere. I just need some quiet place for letting this piece to grow and look for answers.

- Wherever *She* is, wherever you should be. *She* doesn't need armor or a mask. She just needs time.

Again! *Happy Tree's* advice could be as confusing as useful. What does time mean to a being who's been here before humans?

...

Now it's been several months since we became partners. I realized that the longer we stay in the same place, the bigger and stronger *She* gets.

Only now I understand the message from the *Tree*. She has as many faces as places are in the earth, and with time, *She* will make a house there. That could mean that if I chose the correct place for her, *She* would be able to face the demons. Now my question is how I choose the right place? Should I try countless places?

Maybe it would be easier to start with the place where the *Everywhere Demons* were born. They were human creation and the raw material is still there. We could go there and see what would happen if *She* faces them. I think that they would be curious about each other and they will cooperate instead of fighting.

That's in an old temple and I'm not too far. Not after this journey.

Now I'm standing in front of a huge door that I don't know how to open it.

"KNOW THYSELF" is engraved in large letters on the door. I don't know if that's about her or me. But I must find a way to open it.

By adding some water, I can see some carving signals on the door. It's difficult to read it, it would be better to clean it. Four possible pathways that *She* could follow just appeared. That's all I got and the only thing left is to try...

### Short message

The powerful being (*She*) is a metaphor of the bacterial community, and the battlefields are the environments where that community can express enzymes for trace organic chemicals (TOrcs) degradation. In fact, TOrcs represent the *Everywhere Demons*, and this is my journey looking for getting insight into the hidden world of microbial metabolism for TOrcs removal.

At this point in my project, I'm performing microbial adaptation to different substrates in order to evaluate the degradation of TOrcs in the future. But as you may be noticed from my short story, this is just the beginning...

# My PhD Life in Serbia

**Amit Kumar** - ESR4

*31/07/2020*

Hello everyone!

In this blog, I am going to share some of my personal views about being a PhD student here in Serbia.

Let me start from the beginning, I obtained my previous degrees from universities in India. While pursuing my postgraduate studies, I always hoped that at some point, I would go abroad to pursue my PhD rather than in my home country. From my perspective, the general benefits of studying in another country include experiencing different cultures, histories, expanding your world view toward other nations, etc.



So, I looked for PhD programs in Europe and I was excited when I found an interesting PhD position within the Nowelties project at the Institute of Physics Belgrade (IPB). They were offering a PhD position on plasma applications, similar to what I was doing during my master's studies and my research assistant period.

Before arriving in Serbia, I was a bit anxious about how I would fit in such a different academic environment and in a different country. Since it was my first time traveling to Europe for an extended period of stay, it was difficult to leave my home and go to a foreign place. However, I knew about Serbia for scientific discoveries, sports as well as one of the famous tourist destinations in Europe. I was enthusiastic because I was going to explore another country that I never visited, meeting new people, and the PhD would have provided me opportunities to evolve in the global research environment.

After arriving here, it took me months to settle completely. I had a lot of things to do, such as apply for the work permit, enrollment at the university, dealing with bureaucracy, etc. But, everything went very smoothly, people from my laboratory and institute helped me a lot, so I didn't face crucial problems to figure out the things.

So far, my experience has been positive doing a PhD here in Belgrade. Now I am about to finish the first year. My working conditions are quite flexible, people are very cooperative and help each other. The best thing I have noticed about the work culture at my institute is the lack of competition among PhD researchers. There is also nobody sitting and making judgments about an individual's work life. It's a little difficult to truly convey my experience, but I can tell you that it's the best decision I made to come here.

Belgrade is the capital city of Serbia. It is an incredibly charming city: people are very friendly, open towards foreigners, extremely sociable, and almost every local I met is exceptionally welcoming. There are plenty of opportunities to enjoy local and international cuisine all around the city. Belgrade is renowned as one of the cities with the best nightlife in the world. On the other hand, there are no problems related to communication, I am fascinated by how most of the people here speak English. Now, I have a lot of amazing friends, and it will be tough for me to leave this country.

Additionally, I am spending my spare time here doing sports activities. Cricket, the most popular sport in India, is the least popular sport here in Serbia. Still, I did manage to find a few cricket clubs. I am enjoying it, and currently, I am playing cricket for a club called "Mirjevo Cricket Club".

Furthermore, I would like to mention that the lockdown in Belgrade due to COVID19, it was a very tough time for everyone. Despite this, my colleagues were organizing online meetings to ensure that no one gets depressed or bored, and I am really grateful for that.

Overall, I am glad that I decided to pursue my PhD in Serbia. My biggest advice to prospective researchers from other countries who wants to consider studying in Serbia is to be determined. You will be surprised and happy with the hospitality of the people in Serbia.

## My 1st year of PhD

Barbara Topolovec - ESR5

28/08/2020



*“1095 days of adventure begins”*

This is what my sister told me when I took that plane and flew away to another country. And as I’m writing this, I realize that it happened one year ago—one year. You may know that moment when you meet an old acquaintance after a long time you haven’t seen each other, and there is that question: “Hey, what’s new?” and usually the answer is “Nothing much.”. This time, when someone asks me that question, I have a little bit more than just “nothing much” to say.

I am a person who likes to be prepared. After I found out what my project would be, I decided to do a little research. Found a few articles and researched several topics related to my dissertation. And about Girona, the soon to be my city, I discovered it while walking through the streets, from a distance, using Google. But when I landed in Barcelona and arrived in Girona something hit me. It was like that all the people, and everything around me was

different and that I didn't belong there. It took me some time to adapt to a new situation, a different city, and a new culture. Although, when comparing today, Croatia and Spain, they are not that different. Still, it felt like I landed on another planet. Shortly, the work started, and finally, I was on familiar turf – the laboratory, and everything seemed to be easier.

Getting to know a very diverse group of people working on the same goal (clean water) was a fascinating part, and it still is. When I arrived at ICRA, the institute where I am working, I realized how I was not fully aware of the diversity not just of the people, but also of the technology and topics related to wastewater treatment. To be able to learn so much more not only from the book but from my colleagues as well.

Learning a new language is always challenging. Try to think on one, talk in second, and understand people speaking on the third. Now, after one year, it is easier, but I can find myself overwhelmed from time to time. And don't think that you will learn only one language. You will know how to say “cheers” at least on 5 different languages.

The best part of this adventure is what is going on after the job is finished—experiencing the city and everything that offers with colleagues and new friends from work. And I need to tell you – the food is great! Although now I know that the food is excellent, in the first month nothing had tasted like food, except for the paella which was made by my colleague. Come to think of it, that was the “switch on” when I started to love their food. The wine, on the other hand, was delicious from the beginning.

And suddenly, while I was embracing my work and new life, it hit all of us. One of the biggest challenges and the one you would've least expected. The global pandemic of COVID-19, which in the case of Spain, meant complete lockdown. My work changed drastically since involved not just going to the institute, but also traveling. Home seemed to be farther away than ever. But even in those days, I had a chance to learn a lot. A lot about myself. Those changes: new city, new environment, different situations, and every problem you face, they change you, and you grow. In this one year, I have grown more than in a few years back home. And many of your problems start to look pretty small.

And one thing I have learned: everything is easier when you have your colleagues, your “PhD crew” no matter how different you are. In the end, you learned that we are all similar.

And the adventure continues...

**Picture source**

<https://ar.pinterest.com/pin/214343263492197034/>

# How to Place Christmas Lights in a Pool Full of Contaminants?

Danilo Bertagna Silva - ESR6

04/09/2020



Hello again!

Today I want to tell you more about my research role in the NOWELTIES project. I'm carrying out the development of ultra-violet light-emitting diodes photoreactor design.

"Ultra-violet light-emitting diodes photoreactor design"... this sounds fancy, but let me break it down to you:

Ultra-violet: this was explained in Camilo's blog. Ultra-violet is the highest energy constituent of light and it is beyond what our eyes can see. These rays can be very dangerous and are responsible for causing skin cancer, for instance. On the other hand, they are frequently used for sanitation because they can kill bacteria and other pathogens.

Light-emitting diodes: these are the famous LEDs we've been using as a replacement for incandescent light bulbs in the past decades. Scientists discovered that some unique materials emit light when an electric current passes through them, and a lot of energy can be saved that way.

Photoreactor: since most people only hear the word "reactor" when Chernobyl is mentioned, it always sounds like something complicated and dangerous. However, a reactor is nothing more than a defined space where a chemical reaction is happening. It can have any shape. It can be a shoe box, an oven, a pipe, a huge tank, a bucket, a petri dish... the prefix "photo" simply means that the reaction needs light to happen.

Design answers these questions: what's the size of the reactor? What is it made of? How quickly should we add or remove things from it? Should we heat it up or cool it down?

Considering that light is involved, imagine the challenges of someone in charge of illuminating a large swimming pool would have: how much energy should we spend on the lights? How are these lights distributed around the space? Which direction are they facing? Do they need to be on all the time? Should they be submerged or not? Should all lights be of the same colour? And so on and so on...

So this is the point where everything blends together. Although LEDs have been commercially available to illuminate our houses for a while, only very recently, scientists developed LEDs that emit light in the ultra-violet spectrum efficiently. Environmental and chemical engineers were waiting eagerly for this moment because now we can replace mercury lamps, the traditional sources of UV light in the industry, by UV-LEDs.

Why should we bother to do that?

Unlike LEDs, mercury lamps are built from fragile quartz material, demand high voltages, have a short lifetime, and pose a risk of mercury release, a highly toxic substance. Above all that, the most crucial difference between mercury lamps and LEDs for photoreactor design is their dimensions. LEDs can be considered as the typical Christmas lights package: small points that can be arranged in infinite arrays, with each individual source facing any direction in a 3D space. Mercury lamps are much more inflexible: they are cylindrical, and their dimensions vary from centimetres to a few metres. Obviously, the photoreactor design possibilities using

LEDs are much larger. And more efficient designs can represent huge shortcuts for more sustainable, energy-efficient processes of water treatment.

Imagine that poor guy, responsible for the swimming pool, having to decide how to illuminate it with Christmas lights, instead of using just one large cylinder? That's me!!!

The situation gets much more complicated when we consider all the other variables involved in water treatment. Is the liquid in the pool pure water? River water? Domestic wastewater? How does each pollutant present in the pool react when you double the light intensity? Is it worth to spend more energy on it? Can we add something in the pool to make degradation faster? Should we impregnate the pool walls with a catalyst? Is there a risk of creating even more dangerous substances in our process?

These are the questions I have to find the answers to during my PhD.

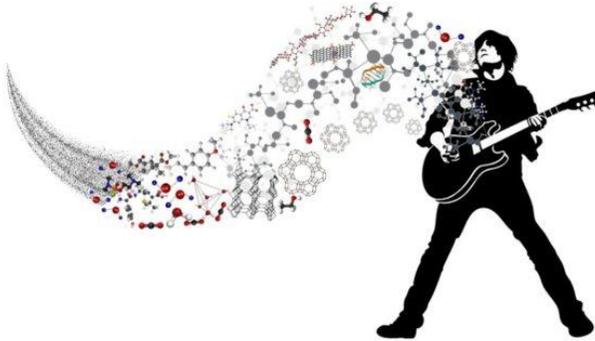
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# How to Rock a PhD

Barbara Kalebić - ESR7

14/09/2020



*“Everybody thought I was a bit of an eccentric for wanting to be out there looking at the stars, but I still do.”*

These are the words of a famous PhD astrophysicist who is the least known for his contribution to science. After the lead guitarist of the rock band Queen, Brian May (or should I say Dr. May) won the hearts of fans around the world, he took one step further in his academic achievements as well. May’s superb guitar skills, enviable musical career, and PhD at the age of 60 made him become one of the “big brains in heavy music”.

Being in a band takes dedication, tireless practice, and determination. Obtaining a PhD takes even more. To keep a balance during your PhD journey, you must keep moving forward constantly, always striving for new experiences and knowledge. It is important to find your rhythm; to tune your instrument!

In addition to persistence and practice, PhD as well as the music, requires a talent. A special talent that is not perceptible as a sense of humor or guitar skills, but becomes apparent over the years. And that is revealed over the years. Not everyone can, for example, spend 8 hours

in front of a digester holding fingers crossed to get explainable and satisfying results or leave family and hometown in pursuit of science. You also need a particular talent to fit in a new work and living environment, as well as to express the importance of your work to people around the world.

As in the world of music and fame, the key is to present your work in an interesting and accessible way to your targeted audience. Every audience is always looking for more and more, so you need to update them on time, be up to date and feed these hungry scientific mouths.

A good part of getting a doctoral degree in a foreign country is that you are never alone, as much as you sometimes seem to be. You have your band behind you, with enough support from every member. Playing together makes it easier for everyone to achieve their individual goals.

Furthermore, great things take time, as we can see from May's example, so it is essential not to give up after the first failure. Giving up makes us even more disappointed when we realize that we are never going to finish what we started a long time ago.

To sum up, the main ingredients you need to rock a doctoral degree are:

- a melody that is easy for you to follow,
- a band you trust,
- a small but enough support,
- more gigs mean more experience for the final big concert,
- desire to never stop learning,
- hard work and discipline, and
- surplus of luck (it is certainly not out of the question)!

So, don't hesitate because there are "new horizons to explore"!

# Is Water Accessible to Everyone?

Camilo Sánchez Tobón - ESR8

*25/09/2020*



Do you know how many days could a human being surviving without water or food?

According to several scientific studies, a person could survive up to two months without food, just drinking water. However, the survival probabilities are highly reduced to few days when any drop of water is not drunk. The reason is that the human body is mainly composed of water (around 60%).

The purpose for which I started this blog article with the above question is that I would like to emphasize how important the water is. I want to make you aware of how the lack of safe drinking water and sanitation systems in many regions contribute to broadening social inequality.

Water is essential for life. It is so crucial that in 2010 the United Nations General Assembly, through Resolution 64/292, declared the water as a human right. Although many efforts have been made over the last years, still around 785 million people do not have access to drinking

water, and 2 billion people drink contaminated water, according to the World Health Organization.

In the case of my home country (Colombia), over the past decades, the coverage of sanitation and water supply services increased by 82% and 94%, respectively. However, this reality only applies to urban regions and the main cities. For rural areas and small towns either they do not have safe drinking water or not have access to water. In contrast, we are one of the water-wealthiest countries, and most of the freshwater for the cities come from rural areas.

In rural communities, which are mainly dedicated to agriculture (one of the most water-consuming sector), additional to lack of safe water for their activities, some groups (legal and illegal) threaten them to control the water distribution to use for private consumption in mining or hydropower plants. Even in some cases, the communities are forced to leave the land, and their leaders are killed just by claiming the right to the water.

In other less critical scenarios, although the water access infrastructure is included within the National Development Plans, the corruption and private interests hinder the complete development of the projects. In the end, the communities must walk long distances to collect some water, and then apply rudimentary treatments. Besides, due to the absence of sanitation systems and environmental education, in these remote territories, usually, the wastewater is discharged into rivers and creeks, promoting water pollution for downstream communities. These repetitive cycles make that water access get worse over time, increasing social inequality in rural communities. If we look at other developing countries, we will find out that the circumstances do not change too much.

Although the outlook does not seem easy, we should not give up and continue working in new water technologies, as we do in the Nowelties team, to provide access to safe water for everyone. However, reducing social inequality and improving the health of communities requires not just the use of specific water treatment, also requires a considerable commitment from Governments and stakeholders to ensure an integral implementation of sanitation and drinking water systems.

**Picture source**

<https://enaccion.bankia.com/articulo/falta-agua-potable-pobreza-mas-grande-existe/>

# Mobility in Times of Paralysis

Sabrina de Boer - ESR9

02/10/2020

The Marie Skłodowska Curie fellowship for early-stage researchers awarded by the European Commission is a unique opportunity to work on a PhD project in a strong scientific community. But there is more to it: Research stays (mobility) allow the fellows to serve as promoters for international research networks, which are an important tool for specialized groups to keep up the pace of modern science.<sup>1</sup>

For us as fellows, mobility during our PhD projects means even more: It means leaving everything but some

oversized suitcases behind. Say goodbye to our lab mates and friends we shared many laughs and tears with. Decide which samples we will hide in our luggage, fearing leakage and customs, and which ones we instead send by post, fearing that the package will be lost forever.

Europe is not the same as it was one year ago when I arrived in Santiago de Compostela (Spain) to start my PhD. Facing the situation of Covid-19, the member states of the European Union had no time or resources to act in collaboration. Instead, states had very diverging opinions on how to manage the crisis. A global pandemic was decided to be tackled nationally, with all its implications.

For many international early-stage researchers, this meant not only to be out of the lab for months but also to be forced to fit into foreign societies, which had to redefine themselves



daily. The opportunity to perform research stays during our PhD suddenly became an outdated and odd idea regarding the new situation. Nevertheless, we were encouraged to schedule our previsionsed research stays, sticking to the original plan as close as possible.

For me, it was now time for me to move to Switzerland to perform a 4-month research stay at the FHNW in Basel. Here, I was going to study the efficiency of my previously prepared magnetic biocatalysts to degrade several antibiotics. Directly afterwards, I would move to my second research stay at RWTH Aachen (Germany). The procedure to find an accommodation, get all the paperwork done while trying to end all experiments on time is always a little improvised. But now, even more, things had to be considered when leaving for a secondment. The entry requirements of European countries kept changing daily, and Switzerland is not even a member of the EU! I knew that I had to stay in quarantine in my new home during the first ten days after my arrival, without being able to go to the grocery store. Fortunately, I had already found a flat, and even more important, kind people who could provide me food in these first days. However, I kept checking the swiss regulations regularly. Few days before my departure, I discovered this small sentence: “People from “Countries of Risk” may not enter Switzerland.” Some distressed minutes began for me since I was convinced that Spain falls in that category (In Germany, it does). Luckily, in Switzerland, Spain is classified as a “Country with elevated Risk of Contagion” since it is part of the Schengen Area. So, I was allowed to enter. The last weekend in Spain, I passed packing, both my suitcases as well as my stomach. The abundance of food in Galicia is impossible to be reached by any other region in the world. The farewell was numbed by facemasks and distance requirements, but I knew that in one year, I will be back. A direct, underprized, and underbooked flight brought me to my new destination. A flight where many thoughts came to my mind, memories, dreams, and fears. Memories of people that made my year in Santiago de Compostela exceptional and who taught me a lot. Dreams of how I will be able to go on in my project at the new research group. And fears about possibly missing documents, failure, and rejection. The good thing about planes is that they can not go backwards.

Actually, nobody of us can move backwards. We must face the world as it is. But we can try our best to understand it. Doing that, we are able to change it instead of fearing it. I am very

grateful that even in this difficult situation the whole world is facing, I can start a new chapter of my thesis in a different country. Because I am convinced that only united and interconnected we can solve challenges that affect us globally and strive for new ways to ensure water resources will also play its role to assure human health in the long term.

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# Consistent to Be Resilient

Francis dela Rosa - ESR10

09/10/2020

Hi readers!

It's my blog contribution time again.

This year (2020) brings tough times for all people all over the world. In my previous blogs, I talked about focus, mamba mentality, EQ, and AQ. This time, I want to add two crucial factors, which I think are essential to achieve our goals as researchers. These are *resiliency* and *consistency*.

## *Resiliency*

The Oxford dictionary describes resiliency as “The capacity to recover quickly from difficulties/toughness.”. Indeed, studying abroad is really overwhelming and life-changing. People always see the privilege of studying abroad: meeting new people, having fun with your colleagues, discovering new places and cultures. But this is just one side of the coin: you also have to deal with “homesickness”. I miss my friends and family but thanks to my warm and energetic colleagues, it's easier to be away from home. Fortunately, I felt it for only two times: November 2019 and last month (September 2020). Thanks to my warm and energetic colleagues, I don't feel too much to be away from home. What I want to say is: you really need to be mentally prepared before deciding to study abroad.

In my case, I am performing mental exercise since 2015: going to different places on my own, eating alone, going to church alone, and watching a film alone. Don't get me wrong here: I like to go out with friends, but there are times that I practice such solitariness. In these



moments, I simulate that I am in a different country with no acquaintance. I believe that these exercises made me more challenging throughout these years. I am not telling you to do these crazy things, but I am just explaining how I prepared myself. I would like to emphasize this: “Don’t be afraid of studying abroad, but be prepared”. Lastly, as we all know, COVID-19 affects almost everything, but still, I am resilient. I am confident that I will achieve my goals because of the training that I made.

Note that we can’t be resilient at one time. We also need to be consistent.

### *Consistency*

The Oxford dictionary definition describes consistency as “Acting or doing the same way over time, especially to be fair or accurate.” We all experienced problems throughout our lifetime but I believe that being consistent to be resilient is an effective way to achieve our dreams.

For all of my colleagues in FKIT, fellow ESR’s, and aspiring researchers, I believe that we will all be like Diamonds as the quotation says:

“Diamonds are formed under pressure, but never forget they are not formed overnight”-

Anonymous

More Power to us all!

### **Picture source**

<https://www.deviantart.com/leoniolcone/art/Resilient-Knight-840729713>

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# Treating Wastewater Using Just Carbon

**Marina Gutierrez Pulpeiro - ESR11**

*19/10/2020*



What do I do in my PhD?

Where there is an infrastructure for wastewater treatment, its performance can be enhanced by adding a specific material. I am that person who looks forward to obtaining clean water by adding activated carbon to a tank. That's it.

When we talk about our experience of humanity's impact, we realize it is visual and sensorial. Charts, graphs, and pictures are regularly deployed to give visual form to climate change phenomena: melting ice caps, the effects of rising water levels, areas of deforestation.

However, an omnipresent material as carbon can help us to solve a problem, we don't see at first sight.

Over the last few decades, the occurrence of micropollutants has become a worldwide issue in aquatic environments. There is an extensive use of chemicals from the anthropogenic and natural origin of which the conventional wastewater treatment facilities are not designed to

remove. Complex mixtures at low concentrations of these trace substances lead to the creation of advanced treatment processes, which can deal with their removal before discharge into surface waters. In this way, activated carbon is a unique material. Its remarkable adsorption capacity makes it suitable for the separation and purification of chemicals and thus useful for a vast group of industries. In recent years, its use has addressed new scopes, playing an interesting role involving water purification.

Activated carbon is just charcoal with a particular characteristic: the space (porosity) enclosed between its carbon atoms is what makes it active. That is, we have a material partially “empty”. We do have carbon atoms, but they are distributed in a very particular way at the nanoscale level.

Charcoals are as old as history itself. Their use to relieve digestion problems was already known by Hippocrates, and in recent times their use is related to fireworks and barbecues. Their commercial applications have been expanded over the last centuries so far that have achieved new inconceivable uses. Nowadays, charcoal – the bulk material – can be transformed into an innovative one – activated carbon – with promising properties at the nanoscale.

It can be manufactured from hardwoods, coconut shells, fruit stones... which makes it suitable to be produced everywhere. Manufacturers can also create several types of activated carbons, each of them with different properties and specific applications.

So, what can I do with just one material with so many options to explore?

Let's start with the easiest option. Enhance the current facilities for wastewater treatment!

Its great capacity for sorption could help remove one pickiest type of pollution – the microcontaminants in water. They are present at very minimal concentration; they have small size – just a bunch of atoms, and sometimes they are not easily degradable.

But how? Just by adding it in the tank where you were already treating the water. Through a filtration step, you can retain the activated carbon within the tank. Hence, the effluent water is clean and without micropollutants.

We know it works. Previously, scientists transformed banal charcoal to obtain activated carbon. Now we are looking at how to improve micropollutant removal.

Where do we add the activated carbon? How much should we add to the tanks? How much time do we need to wait to have the desired effect? Should we place the activated carbon attached to a surface? Or should it be free in the tank? Which is the relevance of the filter? Should we recirculate the water?

Questions are infinite! But I hope to have some answers at the end of my PhD.

**Picture source**

<https://lifeandsoulmagazine.com/2018/02/03/binchotan-charcoal-a-natural-way-to-purify-tap-water/>

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# Chapter Four



# A Successful Failure

**Michele Ponzelli - ESR12**

*23/10/2020*



Whether you are a researcher or not, you have, at least once in your life, experienced what it means to fail and how it feels like. Fail an experiment, fail an activity, fail to meet a deadline, etc. That feeling of misery, of the world collapsing, of plans breaking, that desire to let everything behind.

How to deal with it?

How to change the sense of anger and frustration into something positive?

This energy must be transformed into something actionable. First of all, do not feel discouraged, do not let frustration take over. But how do you really change your point of view on failure?

*Have you ever found yourself wondering what actually works?*

It works to be yourself. It works to go beyond our prejudices and models imposed by our family or our daily social sphere.

Falling off the bike when we were children is something we all experienced. But why, despite the peeled knee, our morale didn't drop? What gave us the strength to try again and to keep our weight balanced differently while cycling?

Because we imagined the joy, the fulfillment, the freedom that we would have felt in succeeding.

Whizzing in front of the house and feeling that sensation of speed throughout all our body. Feeling, in our own way, adults because we could also ride a bike without the training wheels.

The emotional tension caused by succeeding was much higher than the endless and miserable falls.

### *So how to learn to fail?*

Failure is just our expectation that we have not achieved. It is the disappointment that can either take away our emotional energy or charge us with anger.

When we fail, we can only change our approach because encountering obstacles means we are on the right path.

In research, failure is commonplace: only 10% of the things you had planned will be successful. The remaining 90% is an uncalibrated instrument, a missing pipette, a machine that stops working, an unforeseen weather event, the repetition of the entire experiment from scratch because you missed the first step. Doing research means living with failure, with uncertainty.

Failure will always be something to avoid, but we can learn a lot from it, especially about ourselves. Those who are perfectionists will have a hard life.

Failure will only be non-success if our approach to the event will be so. The event that went wrong and that we consider as our failure is a wake-up call on how we interact with events. Our reaction to the event will determine whether it is a failure or not.

Let's not stop and keep going.

**Picture source**

<https://it.freepik.com/foto/affari>

# Piloting Spaceship “Earth”

**Nebojša Ilić** - ESR13

*06/11/2020*



With all the negative news circulating around due to the COVID-19 crisis, the world has fallen into turmoil lately and it is taking an obvious toll on everyone’s productivity and general well-being. Regardless, the NOWELTIES team is working diligently to overcome the restrictions imposed by COVID in the pursuit of scientific breakthroughs.

Turning outwards for inspiration is a common practice among us at NOWELTIES. The idea to write this article as a break from scientific discussions came to me after reading about a wonderful outcome of a major seagrass restoration project [1]. The grass was planted on a 200-hectare plot offshore in Virginia and has over 20 years grown to over 3600 hectares, making it the most successful project of this kind in the world! This is even more important considering that marine ecosystems like this one have larger carbon storage potential than any terrestrial forest.

Lately, I have been hearing through different discussions that the biggest polluters are large companies, and how our actions are just a drop in the ocean. Therefore, if any major change is to happen, it is not up to us but rather the governments and the companies. While that might or might not be the case, pointing fingers at each other as to how we got here will not get us far. When I say, “how we got here”, I’m talking microplastic everywhere, PFAS being found even in livers of polar bears, islands of plastic the size of Manhattan floating in the ocean, huge oil spills, rapid glacier melting, rainforests burning, species going extinct...

However, instead of focusing on the major environmental issues we are facing, I want to point the spotlight at some outstanding individuals already working hard to restore this planet to its former glory.

To paint a picture of how much actions of one person can leave a mark, I want to bring up the story of Jadav Payeng [2]. Jadav is a forestry worker from India who has singlehandedly preserved a river sandbar from perishing by planting trees since 1979! He was named “Forest man of India” to honor his actions by the then-president. Since then, over a hundred elephants have started using this remarkable forest as a habitat, alongside rhinos, deer, and tigers. If it weren’t for him, this sandbar would have fully eroded instead of being a habitat to all these amazing beings. In this great interview [3] for National Geographic he talks about the challenges he has faced during this project and the benefit it has brought to the region.

Still not convinced how small actions add up? How about this story [4] of how only 14 wolves introduced to Yellowstone national park in 1995 helped completely reverse the degradation of the biome?

For comedic effect, here is how introducing wolves changed the biome: wolves as an apex predator started hunting the native population of deer. As a result, deer started avoiding certain areas of the park, thus allowing the vegetation to flourish - first aspen and willow trees, followed by berry bushes and consequently bugs. These then attracted various bird species alongside beaver, which was extinct in the region. The beaver dams provided an ecosystem attractive to otters and reptiles, while wolves fended off coyotes allowing the critter population to grow (primarily rabbits and mice), who then attracted red foxes, badgers, hawks and bald eagles to the park!

The healthy balance brought significant change to not only the life in Yellowstone, but also significantly affected the way rivers meandered and formed.

There are more uplifting stories like these all around if you know where to look. In fact, just reading that solar energy is now the cheapest energy in history is enough to lift my spirits for the day (take that, coal!) [5].

If you're unsure how to begin your journey, getting acquainted with the United Nations Sustainable Development Goals (SDG) is always a good place to start looking for inspiration [6]. NOWELTIES for example is focusing on SDG6.

We can't all be Mr. Payeng of course, but we are giving it our best here at NOWELTIES. Now it's your turn to join us! As Marshall McLuhan once said: “There are no passengers on spaceship Earth. We are all crew.”

#### **Picture source**

NASA

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# Change Is the Only Constant in Life

Nikoletta Tsiarta - ESR14

13/11/2020



The greatest philosophers were people who spent a lot of time thinking, developing theories and less time living. Most of them were self-taught, and they often would spend most of their life in the same place. But what has this to do with my article today?

Well, recently, I had a conversation with my flatmates, and someone asked: “Do you know what the only constant in our life is?” My flatmate and I started staring at each other, trying to find the right answer and somehow look smart.

“*The change*”, he said. Then, I reflected for a while, and indeed he was right. I immediately search it online, and I found that Heraclitus, a Greek philosopher, was the one who said it first 2500 years ago!

I’d never thought about it before, but yes! As contradictory as it sounds, so right is. On the other hand, in science, a constant is a number that doesn’t change. It’s a number you can use every time you want to do a calculation and give meaning to your results.

Science is part of philosophy. After all, every person devoted to studying and producing results can receive a Ph.D. title, aka Doctor of Philosophy. But, can someone with the title be considered a philosopher? Not sure. Difficult to say.

A Ph.D. title doesn't make you a philosopher. It does make you part of the philosophy, though. We are all, basically, part of the philosophy, and in the NOWELTIES project, we're experiencing at first hand.

Let's take me as an example.

I was born in Cyprus, in a small village with only 500 inhabitants. I spent my elementary education in my village's school with 45 students in total. I then spent my secondary education in a village close by where the school hosted students from 17 different villages (400 in total, almost 10 times higher!). After finishing my studies, I moved to one of the biggest cities in my country to study Environmental Science and Technology. For the experimental part of my bachelor thesis, I travelled to Madrid, all alone. When I graduated, I received an Erasmus grant, and I flew all the way to Amsterdam. After completing my internship, I decided to do my master's in Oceanography and Limnology at the same university. During my studies, I had the chance to spend some time at Curacao studying corals (want to go baaaaack, COVID decides). Later, I spent a few months in Girona doing my master thesis and participating in different international conferences. I was also employed by the same university to work on a project for one year.

When I got the chance, I applied for my current Ph.D. position. And look at me now, I am in Girona doing a Ph.D. in the Engineering field, under this unusual situation we all need to go through, making progress against the pandemic. And, still, I have my secondment pending, and Zagreb is patiently waiting for me.

So many changes and I'm looking forward to more. None of them was easy. Challenge yourself is not an easy job, but it's totally worthy. Don't be afraid. Try to remember how your life was evolved until today. It's amazing, right?

It's also amazing people's resiliency and ability to recover from or adjust easily to change. Living life with gratitude and embracing changes gives us the opportunity for continuous renewal and growth.

No matter the change we experience, how we embrace that change will forever impact our ability to live with the change. We (you and I) should be aware of the changes happening in our life, and their understanding may be the force to push us forward in the right direction.

Everything changes and is in our hands, whether we are prepared to accept it and live with our new self that is born every day.

So, back to philosophy. What is the connection between the ancient philosophers and us people today?

Simple! We turn their theories into practice, and I think we do it pretty well.

Remember that changes are a normal part of life.

We are changing! The whole world is changing!

And this is the magic of life! The evolution! So, let's live and change!

The only thing that remains constant and certain in this life is this: **EVERYTHING CHANGES!**

And for the end, some food for thought: The City – A Poem by Constantine P. Cavafy (my favourite poem “No matter how many places you change, the city will be following you”)

#### **Picture source**

<https://www.travelweek.ca/blog/independent-insights-change-is-good/>

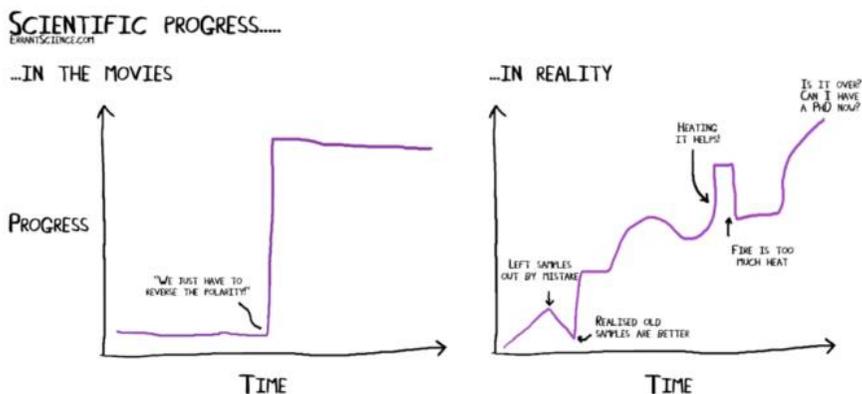
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## 7 Lab Tips to Take Your Research a Step Forward

Silvana Ines Quiton Tapia - ESR1

20/11/2020



Hello readers, I'm Silvana ESR1.

For most of us Nowelties, the first year of PhD has already come to an end. Last month, I started my first experience supervising a master thesis student, and I have to confess that as much as I am teaching him, he is teaching me much more.

This month of supervision has been very therapeutic in many ways. The experience of teaching what I know and explaining my experiments helps me realize all the things I've learnt so far. With my mentee, I'm sharing all the theoretical knowledge, but most importantly, I'm sharing all the tips and tricks of the everyday lab. Some of which can perhaps be useful for others out there. Here I summarize my experience in a practical guide in 7 dos for a first-year PhD.

### 1. Be proud of your work

There will be times your experiments won't go as planned, and there will be times everything will just flow perfectly. Both situations are still teaching you something. Don't get me wrong

though, things going well is not mere chance; it is a sweet reward of your hard work. Take the necessary time to reflect on your work and celebrate your wins. It's definitely a good confidence boost to remember the work you've had done and what you had learnt.

Having confidence in yourself will help you face your next challenge and don't be constrained by the fear of failure.

### *2. Learn to fail*

Scientists deal with failure daily. Failure is an important part of learning. It's ok to fail, but it's better to learn how to fail. The more you fail, the closer you are to succeed. Here I would advice, fail quickly, meaning do not drown. My nowelities colleague (Michele) talked about how to see the silver lining of failure on his blog.

### *3. Write every single thing down*

Write everything down, document everything, take pics if you find it helpful. Your lab journal will be your greatest ally when analysing your results and remembering your experiments on those jam-packed days. I write my lab journal in simple words, I add my thoughts and impressions. You don't need to use scientific jargon, but it needs to be clear enough to recall what you did and why you did it.

### *4. Start simple*

It is very tempting to try to do everything at once but start small, and as you get full control, go forwards. Working in the lab could get chaotic, so I advise my mentee to be mindful of each of the things he 's doing. You'll get better results if you do all things adequately than rushing from one analytic to another. When doing scientific work, it is important to do things thoroughly, remember, "The devil is in the details".

### *5. Take chance on your resources*

Sometimes you won 't have all the resources you have at hand, so you'll have to adapt and get creative to reach your goals. However, your most valuable resource will be time. Take your

time to plan your days efficiently. Find out what routine works for you and stick to it. Everyone doing a PhD can conquer that time management is one of the most critical skills for your success.

*6. Keep questioning your results*

You'll always have new information that can help you better understand what is going on. Use it to complete your view of your experiments. It is often helpful to discuss your results with your colleagues and listen to what they think of them. Sometimes you'll get a new perspective of the matter. But most importantly, keep learning, do not settle.

*7. Enjoy!*

Enjoy the process. This is what I'm telling my mentee and myself daily. Time in the lab is flying. A year of our PhDs have already gone by so quickly! you might miss it if you do not stop for a moment and appreciate all that has taught you. Take the time to remember why you started this journey and where you are heading. My own motivation? Loving what I do!

**Picture source**

<https://twitter.com/ErrantScience/status/827497858899275777/photo/1>

## Overcoming Barriers of Waste and Energy

**Edwin Antonio Chingate Barbosa** - ESR3

*04/12/2020*

My plan for today is to show you the clear link between environmental research, personal development, and gas stealing. But first I wanna talk a little bit about you. I know that you're producing a lot of waste every day! You shower every morning; you flush your toilet at least 5 times a day; you wash your hands frequently; you wash your dishes after your meals; and you're making your laundry once a week, right? That's just wastewater from your house. What about the plastic that you're using or the carbon footprint from your activities? Do you feel bad about yourself? Let me tell you about waste production in my environmental engineering research.



Every Monday, I clean my glassware and accessories for microbial medium storage with 27 L of ultra-pure water. To be sure that it would be appropriate for my microbial medium storage, I autoclave it for two and a half hours. Tuesday afternoon, I use that glassware to prepare 15 L of microbial medium, and I start my experiments.

Activated sludge from the wastewater treatment plant as inoculum, incredible diversity of bacteria that also include potential pathogens. 5 mL for every chemostat and continuous flow can start. 12 pumps, 6 scales and 6 magnetic stirrer plates are working constantly for me to get a picture of bacterial metabolism with my daily samples.

After one week of constant operation, that 15 L of microbial medium becomes waste. Depending on the experiment, they have some toxic substances and a lot of bacteria. The following week, the cycle continues.

In the end, I have some useful data, a lot of wastewater, and confusion in my mind. Am I really working for the environment?

Depressing, right?... instead I would prefer to show you how to steal gas from a car:

Let's go step by step. All that you would need is 1 m length tubing, an unprotected car, and a container for your new acquisition.

1. Open the gas tank.
2. Introduce one extreme of your tubing into the gas tank, and be sure that you reach the bottom.
3. Put your container next to the tank at ground level.
4. Be sure that now your tubing has a curve shape like in Figure 1.
5. Suck out some gas from the other extreme, and you will see gas flowing into your container without any additional effort.
6. Enjoy your gas.



Figure 1. Expected shape for tubing in the crime.

Step 4 describes not just how to start the gas flow in a crime, but almost everything in life. Also, you may notice some similarities between figures 1 and 2. Both start at a certain level, high for gasoline or energy for chemical reactions. Then, that level increase and later decreased even lower than the initial point.

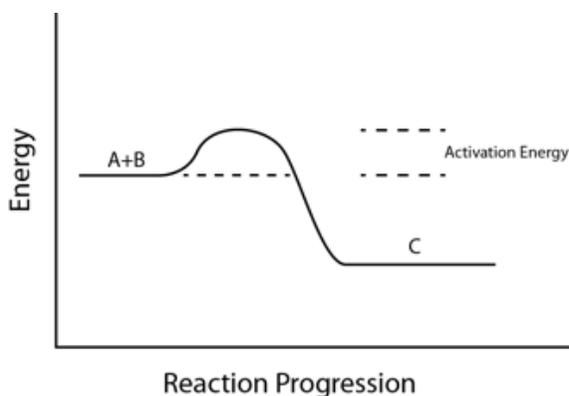


Figure 2. Chemical reaction progress representation.

Everything in life implies effort, and most of the time, the biggest challenge is at the beginning. Climbing that mountain of effort is always challenging, but when you realize that that's the most difficult part, you'll feel everything smoother. A piece of advice for free: if you wanna make your dreams come true, go for it and start now!

In my case, I'm living a dream. My work is a constant challenge, sometimes I don't even know where to start with my tasks, but I have as much space and resources as never before. I can follow my curiosity and solve a puzzle every day. Successful in my research means contributing to trace organic chemicals (TOrcs) removal from our water.

First-year in my Ph.D. wasn't easy, but I know that I would solve this puzzle with my effort. I'm climbing a huge mountain, not just effort but also waste. I'm getting data that help me to understand bacterial metabolism and how do they transform those TOrcs. Deep knowledge in bacterial transformation of TOrcs would drive to improve current solutions and make them accessible for more people.

Just to finish, I have to tell you that we are also treating all of our waste at the chair of urban water systems engineering from TUM.

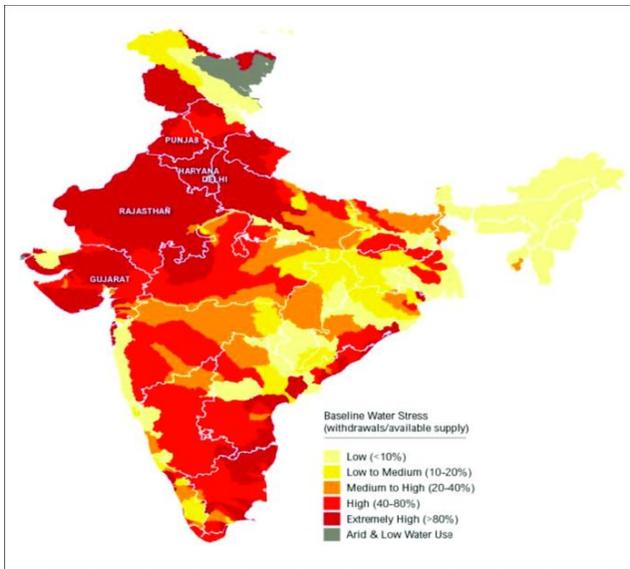
#### Picture source

[https://commons.wikimedia.org/wiki/File:Activation\\_Energy.png](https://commons.wikimedia.org/wiki/File:Activation_Energy.png)

# Global and Local Partnerships to Solve India's Water Crisis

**Amit Kumar** - ESR4

11/12/2020



In this blog, I would like to talk about India's current situation regarding the water crisis and some ongoing projects and partnerships in order to solve the problems.

Currently, India is suffering from one of its major and serious crises, not due to the Covid-19 pandemic, but due to the water crisis. India is the second-largest population in the world and it holds around 17 percent of the world's population. However, it has just only 4 percent of the total potable water.

According to the National Institution for Transforming India (NITI Aayog), about 600 million people face high-to-extreme water stress in India. However, three-quarters of households do not have safe drinking water facilities, and 84 percent of rural households do

not have the accessibility of piped water. The current estimation data reveal that India's demand for water will be double the available water supply by 2030. On the other hand, it is considered ranked 120 among 122 countries in terms of the water quality index.

India is one of the largest users of groundwater in the world. Groundwater consumption has been estimated at about 230 cubic kilometers per year – over 25 percent of the global total. However, groundwater is a source of around 80 percent of drinking water and more than 60 percent for irrigation. Hence, due to groundwater overexploitation, about 60 percent of Indian districts are likely to run out of groundwater over the next 20 years.

However, it has been found that about 70 percent of water bodies in India are highly contaminated with organic, bacterial and other hazardous pollutants. Therefore, about 200,000 people die every year due to a lack of access to clean water.

According to the World Bank report, for the water scarcity in India, several factors are involved, including climate change, unsustainable water systems, rapid urbanization, the expansion of irrigation, rising demand for water from the industrial, domestic, and power sectors.

Several national and international bodies have been working to tackle the situation and implement a sustainable water system in India.

For example, 'Jal Shakti Abhiyan' has been launched in collaboration with the Government of India and state governments. It is a time-bound and mission-mode water conservation campaign focusing on highly water-stressed districts and blocks in India. The Department of Drinking Water and Sanitation of India has launched the 'Jal Jeevan Mission' to provide sustainable drinking water supply in all schools and households across the country by 2024. The Jal Jeevan Mission has already been providing clean water to 20 million families in India. Recently, India's government has announced 'Atal Bhujal Yojana' to improve the groundwater management systems in seven Indian states.

The India-EU Water Partnership (IEWP), through its research and innovation programme 'Horizon 2020' was launched to build up India and the EU's technological, scientific and management capabilities in water issues. There are several projects under it, such as 'PAVITRA GANGA', 'PANIWATER', 'LOTUS', 'PAVITR', etc. These projects' objective

is to tackle the urgent water-related challenges in India's urban and peri-urban sites, including wastewater treatment, improving the quality of drinking water, water resources management, etc. Also, several World Bank projects support India's efforts in the water sector, such as the National Mission for Clean Ganga, the Dam Rehabilitation and Improvement Project, National Hydrology Project, etc. There are several other active bilateral agreements between India and foreign countries working on various water projects, such as Indo French Water Network, Indo German Water Partnership, India British MOU on Water, and so on.

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# The Power of Positive Mindset

Barbara Topolovec - ESR5

18/12/2020

Hello everyone!

I would like to share some thoughts related to personal development and mindset. Let's start with scientific facts, something we all as researchers like.

## *The science behind positive thinking*

A human brain has millions of brain cells called neurons. Each neuron consists of a nucleus, cell body, axon (fiber), and the dendrites (branches) as its main parts. Neurons connect via fibers, which help them transmit messages (electric signal or the impulse) from one neuron to another. Thus, they create a network.

When we choose a positive thought by its nature, this creates a positive impulse, a message in the centre of a neuron. A message travels along branches and triggers the release of the organic compound called serotonin, responsible for the feeling of satisfaction and happiness. Serotonin is also a messenger, which means that it allows a message to continue its path and build a positive thought pattern. That is the moment of the "eureka" effect when we see the problem's solution and get new ideas. Sounds simple? Yes, but keep in mind that the connections via fibers between neurons are not instantly permanent, they are unstable. Therefore, we need to repeat the positive thought, train the brain to think positive, and from time the connections become stable, they create a belief. More connections mean that the brain is more active.

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And what about negative thoughts? The process is the same, but another compound is released – cortisol, responsible for the feeling of sadness and depression. Don't hate it too much! It is released in a moment of fear; it alerts us to be careful. It is good and useful in the moment of escape from danger or struggle. For example, if you ever run into a bear in the woods, you would run thanks to cortisol.

But in this modern life, the problems are different than an encounter with a bear, something our brain can't understand; it doesn't know if it's a problem to run away from or not. Its reactions are the same, all the body energy is redirect to the part of the brain, which is focused on our object of fear, and our body is stressed out.

Why is this important?

We all have goals in our personal as well as professional life. They can be big or small, something we want to achieve in our future or on a daily basis. How are they created in the first place? With our thought, of course.

The mindset to success. What can we do?

The 3 Laws of the mind say:

1. *Every thought creates a chemical and physical change*

Remember how the brain works? Think you can! Choose positive thinking. Train your brain to choose positive thoughts. Consistency is the key! Repeat your plans with positive thinking to affect your subconscious part (part of the brain, which holds memory and automatic actions). The subconscious works as an autopilot. Repeating your dreams and positive thoughts can affect your subconscious and work on your goal, even if you are not aware of that at the moment. To recognize problems we want to avoid is a good thing, but too much focus is not.

2. *You can think only about one thing*

The sentence “I will try to find” confuses the brain. It sees the “will try” part and “will find” part.

So tell yourself, “I will find”.

3. *Our thoughts precede our reality*

I wanted to take this opportunity to share this with you especially because it's this time of the year. 2020 is almost over. We all can't wait for the beginning of the new one because we see it as a fresh start when we are setting new plans. Also, all of us collected a certain amount of frustration, negative thoughts, lack of motivation, and fear, especially this year. I had to face uncertain changes and problems as a PhD researcher and personally as well, in a new environment. My mindset and confidence were challenged a lot.

For all of you, dear readers, I wish to have a fresh start, start with your goals with positive thinking, and, more importantly, to continue with them and create a powerful mindset. Maybe we cannot control what life force brings us, but we can choose how to use this force for our achievements.

As for the picture? This is something a friend of mine has shared with me recently. According to psychology, the first 4 words you found reveals what your subconscious desire. Something you seek? Part of your goals? New year decisions? Find your words, think about them, go to the New Year and own it!

**Picture source**

<https://elizajourneythroughlife.home.blog/2019/08/14/what-are-the-first-4-words-that-you-see/>

# Lost in Translation: A Home for a Researcher

Danilo Bertagna Silva - ESR6

15/01/2021



Internships, exchange programs, mobility periods, training courses, seminars, conferences... this used to be the academic world pre-corona. Students and professors moving around all the time, everywhere, carrying their posters and powerpoint presentations. English being spoken in a multitude of accents. Fancy coffee breaks in nice hotels... all this came to a halt recently and we don't know when it will get back. However, this text is not about what has changed in 2020 but about what remained the same for most of us in the NOWELTIES program.

The overwhelming feeling of getting into an airport and changing your life completely from one day to the other. The excitement and affliction of accepting a new job and having a list of scientific milestones to achieve at a given deadline in someplace you weren't even capable of pointing exactly in a map before. Having to deal with dozens of issues such as getting all your paperwork right, finding a house to rent, and dealing with the available cooking ingredients,

transport system, and a foreign language. Events unfold at maximum speed in front of your eyes and are over before you even had time to get used to them.

Add that to the fact that most of us are in our 20s, just starting our professional lives and understanding how the world works. We are full of energy and uncertainties. Much more than just having a “good job”, we crave socio-emotional security and (self-) acceptance. And this is very difficult to get when you are just temporarily in a place. Craving for good friends and partners is completely normal when arriving in an unknown city, but to be aware that all the new relationships you find have an expiring date can be harsh and even cause psychological damage. I would be lying if I said that this lifestyle hasn’t made me more cynical and numb about personal relationships. Even so, I always advice people to cherish whoever they find across their paths with as much intensity as possible because, in a way, life is temporary, so we might as well make the most of it anywhere we are.

It is a fact that we live in a globalized world, and at any time, someone living in Peru can find a job in Bangladesh via LinkedIn because s/he has the perfect curriculum vitae for the position. But often, the CV does not account for the cultural sensibilities one should acquire to have a fully integrated life in the new place. Values, customs, habits, religion, history and sense of humor can drastically differ. Much has been said nowadays about racism and xenophobia, and I’ve seen it displayed in two different ways: the first, and more obvious, is when the foreigner is completely shut down and ignored from social circles. The second, and more subtle, is when the foreigner participates in social life, but in the role of an exotic attraction, whose customs and ways are considered funny or antiquated for the hosting country. The solution here is to understand that each one of us has a background and a reason to think and act as we do; to know that even with the best intentions of trying to make someone feel comfortable, we can be causing the exact opposite result; to respect each other’s personal space and rhythm. This is a two-way street. The person arriving in the new country should be aware of sensitive topics and language barriers. If care is taken, living abroad can be the most decisive, enriching, and positive experience in one’s life. If things are done wrong, it can result in isolation, frustration, and loneliness.

You could say that I'm used to all that by now. By the time this project ends, I will have lived in 6 different countries and 11 cities for the past 10 years. Honestly, I love this lifestyle, I try to make the most of it and wouldn't like it to be any different. I notice how it shapes me and gives me some advantages compared to my childhood friends who never left my hometown. They have more immediate worries, have seen less of the world, and would definitely suffer a great deal if they tried to do what I do. Nevertheless, they have something I felt that I've lost years ago and am eager to find again someday: a place to call home.

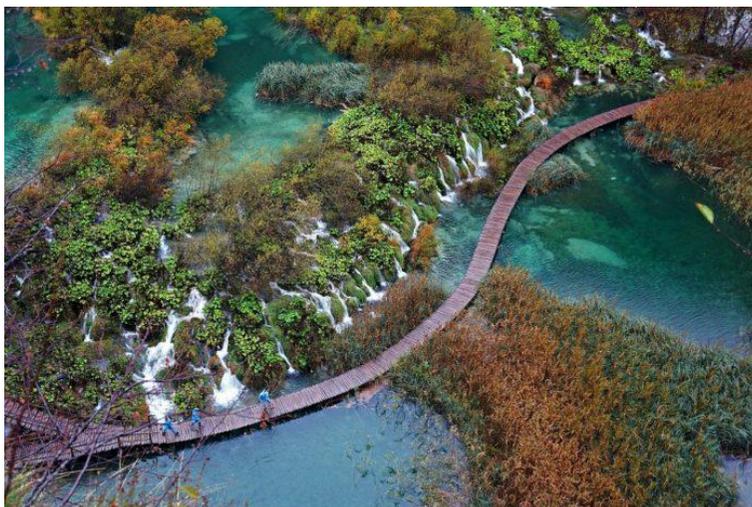
**Picture source**

Screenshot of the film "Lost in Translation" (Sofia Coppola, 2003)

# Water Management in Croatia

**Barbara Kalebić - ESR7**

*22/01/2021*



By protecting water, we protect the environment and human health and ensure the growth of tourism, economy, agriculture, and other activities related to the country's growth and development.

Nearly two-thirds of the world's population faces a serious water shortage problem for at least one month a year. It is estimated that by 2030, these severe shortages could cause a displacement of 700 million people worldwide.

Although the 21st century has brought improvement in the field of water management and some special encouragement for more steps forward, not only in Croatia but around the world, it brings new water worries – new challenges as well. It seems that science and technology must play a vital role in devising the solutions that will be necessary to overcome the problems arising from global water scarcity.

What about Croatia?

Croatia belongs to the group of European countries rich in natural water. It has enough water for its own needs, despite its uneven spatial and temporal distribution. Modest water resources at Croatian's islands and abundance of water in the continental part, requires systematic and sustainable management of water resources, which was established in 1876. Over time, of course, the content and manner of water management changed depending on the political circumstances and the dominant socio-economic problems of a certain period. When entering the European Union in 2013, Croatia became a part of the international community with the highest environmental protection standards in the world.

Compared to the other EU members, Croatia has a poorly developed public drainage system with 46% of connection, and only 28% of collected wastewater has been processed. Therefore, investments have been made to modernize water supply, wastewater collection, and wastewater treatment infrastructure, mostly in urban areas.

A mobile device for wastewater treatment in which drinking water is produced from wastewater offers a fast, reliable, and cost-effective problem-solving service during so-called water crises, and it includes available processes such as reverse osmosis, oxidation, flocculation, electro-flotation, etc.

By using mobile (waste)water purification devices, drinking water can be delivered anywhere and thus solve the problem of areas with clean water scarcity. Additionally, the device purifies wastewater, which contributes to the preservation of clean natural water sources.

To point out, even if Croatia is 5th in Europe and 42nd in the world according to the availability of clean water supplies, these water stocks will not last forever. Maybe there is still enough clean water during your lifetime, but what about your grandchildren? If we continue to recklessly use clean water without restoring it to its original state after use, soon the water as we know it today will no longer be available to us.

As part of the Noweltis project, I believe that I have an excellent opportunity to contribute to the further development of efficient, environmentally friendly and accessible wastewater treatment technologies, and that my work can make people aware of the real water value.

Let us keep water safe today, so we can safely swim in it tomorrow!

**Picture source**

<https://pixabay.com/photos/plitvice-lakes-national-park-croatia-984280/>

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# The Dual Nature of Rivers

Camilo Sánchez Tobón - ESR8

*29/01/2021*



Hello everybody, I want to use this space to talk about one of the available freshwater forms that bring us life but sometimes bring death: the rivers. What kind of emotions do they evoke on you?

In some ancient cultures, the rivers are considered the Earth's veins in which the water flows to bring life. Rivers have been the motor that allowed civilization to develop and grow. It was possible to contact different communities, exchange products, and even cultures, enriching the riverside towns' lives. In many nations today, rivers are still an essential part of the economy. They are medium for product transportation to the seas' main ports.

On the other hand, rivers have been the cause of conflict between nations that claim the right to them. One example of this is what is happening right now in the Nile river, where Ethiopia and Egypt disagree about access to it. Ethiopia is building a huge dam to produce electricity that will improve its economy, while Egypt argues the dam filling will create a severe

drought that could affect their population survival because the Nile river represents 90% of their water supply.

Additionally, because of climate change and lack of planning, the riverside communities are endangered by flooding or drought, threatening their economy and lives. These flooding or drought are counted by dozens in the last year worldwide, becoming more frequent every year. Last year in Paraguay, its whole economy strongly damaged by a heavy drought of its main river; since more than 50% of importation and exportation are done through the river.

In my home country (Colombia), we have around 42 rivers that have built our economy, traditions and cultures. Among them, the Magdalena river is the main Colombian river. It has particular importance for what it represents in our history. It is also considered Colombia's national heritage. This river borns in the Colombian massif and flows around 1500 km before reaching the Caribbean sea. Even, Gabriel Garcia Marquez described it in his book "Love in the Time of Cholera".

Since pre-Columbian times, the river provided food to indigenous people and connected them. In colonization, the Magdalena river was used as a means of transportation from the Caribbean sea to the capital and other cities and allowed Spaniards to explore other territories. The river is still an essential route of product transportation between the riverside towns.

Despite the prosperity and development that it has brought, the Magdalena river also brings some tragedies. Ten years ago, the river flooded more than 35.000 hectares (around 32.000 soccer fields) and dammed about 120.000 inhabitants, devastating thousands of houses and crops. Also, the Magdalena river considered "the biggest cemetery of Colombia" because most of the killed people in the Colombian conflict were thrown to the river.

Fortunately, after signing the peace agreement in 2016, people living along the Magdalena river started to see this moment as an opportunity to have a peaceful life, express their culture and traditions, and heal through the river the scars that conflict has left.

And answering the initial question, the rivers evocate me peace, prosperity, and continuous evolution.

**Picture source**

<https://pixabay.com/photos/river-colombia-sun-summer-ecology-1405645/>

# Mind the Gap of Your Mind

Sabrina de Boer - ESR9

05/02/2021

As you can see from the headline, my intention was to write about the mind. As soon as the idea for this article emerged in my brain, I started to put it into English words. After checking some useful expressions, I realized, once again, that thinking in another language can completely alter your original perspective. I realized that the English term “mind” synthesizes rational and emotional aspects while my mother



language German has strictly distinguished terms for the rational and less rational parts of our mind. From this point of view, it seems logical that the Austrian Sigmund Freud developed the fundamentals of Psychoanalysis more than hundred years ago.

At that stage, I did not want to change the headline, even though I originally wanted to write about plain reason. The part of your brain dealing with the hard facts. Those I deal with every day as a scientist. During my youth, the irrevocability of definitions gave me stability. The reason does not trick you. Reasonable actions will produce reasonable results. You can control everything if you only think it through. Science is true, honest, reliable.

Only recently, I became fully aware that this focus and reliance on the reason is sometimes not enough to confront every obstacle in your life. You are facing people who do not act rationally towards you. You live in a society that is desperately grasping every straw, reasonable or not, to pretend everything will stay as it was. And, of course, it is an ignorant illusion to think that your actions are only guided by your reason.

So, you better start to look at the other side of the mind, I would call soul. The part of feelings, good and bad, intuition and gratitude. Suppose you become aware (the term “mindfulness” is recently advertised as a cure for every problem you might have with yourself and the world) of the power of this part. In that case, it can serve you as a solid fundament equally important as your reason. It can help you neutralize the doubts and drawbacks which might burst into your life and nourish your idealism to reach your real-world goals. Standing on this firm ground, you do not have to be afraid or ashamed of your subconscious fears, desires, and sociocultural imprinting. They are a part of your unique personality you can unconditionally embrace.

Due to the restrictions imposed during the lockdowns, most of us quit doing sports. Of course, we gained some weight, but there is more to it. We lost the connection to our body to a certain extent. Always in the resting state, wobbling around, it has no longer means to attract our attention by growing muscles or a beating heart, but by fatigue, backpain, or even serious diseases. Even though the linkage between your state of mind and measurable biochemical processes was long neglected by western medicine, researchers have only recently tackled this unexplored field. For example, exosomes, small vesicles that can pass the blood-brain barrier, have been found to play crucial roles in diseases like cancer. In fact, fitting my blog’s title, the EU-funded project **MindGAP** aims to study alterations of the exosome community in dependence of the health status and to find biochemical evidence for the benefits of meditation [1].

Freud might cringe upon the dilettante picture I drew above. But I learned that every theory, as irrevocable it may seem, always has room for interpretation and development. And this is particularly true for theories describing yourself.

In order to gain more equilibrium between all these important parts of the mind, I have decided to increasingly mind my body. I had never been very kind to it, especially during long days in the lab. Therefore, I have started yoga this year and remarkably do not want to quit yet, also because I found an inspiring instructor on Youtube (Mady Morrison). She does her classes in German. But even if you don’t speak German yet, maybe you got interested in exploring your mind in another language.

**Picture based on**

<https://www.asanavoga.de/wp-content/uploads/2014/06/yoga-krieger-virabhadrasana.jpg>

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[1] <https://mindgap-fet-open.eu/project>

# Make It Happen

Francis dela Rosa - ESR10

12/02/2021

Hi readers! It's my blog contribution time again. I hope that you all have a happy new year!

*Life is 10 % what happens to you and 90% how you react to it.*

Charles R. Swindoll

Last year (2020) had brought an onslaught for us all. It happened in just one snap. Now, I would like you

to imagine that you are born around the 1900s. During your lifetime, there is a great chance that you experience the effects of World War 1 (1914-1918), the spread of Spanish flu (1918-1920), Great Economic Depression (1929-1933), World War 2 (1939-45) and many more undesirable events. I would say that you are really unlucky and the **PROBABILITY** of being successful in any field of life is really low. However, I believe that the events that **HAPPENED** are 10% of your life overall. (Assuming that you are still alive after these astonishing events...hehe). On the other hand, there are people who managed to survive to make an impact on this world during the 1900's dark years.

Learning from above mentioned past historical events, I believe that we still have a high **PROBABILITY** to be successful in any fields of life. Let us be optimistic. Delays from our experiments, jobs tasks, covid-19, etc., have already **HAPPENED**. Vaccines are already out, and in just a short time, this pandemic will be over. There is still **HOPE**.



Maybe some of you may ask me on how did I manage, learned and adapt about this COVID situation? Well, I suggest you read my previous blogs. Readers should follow and re-read all of these since everything is interconnected with one another.

Despite low **PROBABILITY** setup (due to delays), let us all focus, enhanced our EQ&AQ, and be consistently resilient to achieve our goals.

As the additional quote says:

*It's not about the cards you're dealt, but how you play the hand.* Randy Pausch

I don't want to take this blog entry long. All I want to say is undesirable events already happened. Let us all move on. Let us all stand up and fight for our dreams. Let us all **MAKE IT HAPPEN**

**Picture source**

<http://www.pxleves.com/photography-picture/512f62f376df3/Water-Dice.html>

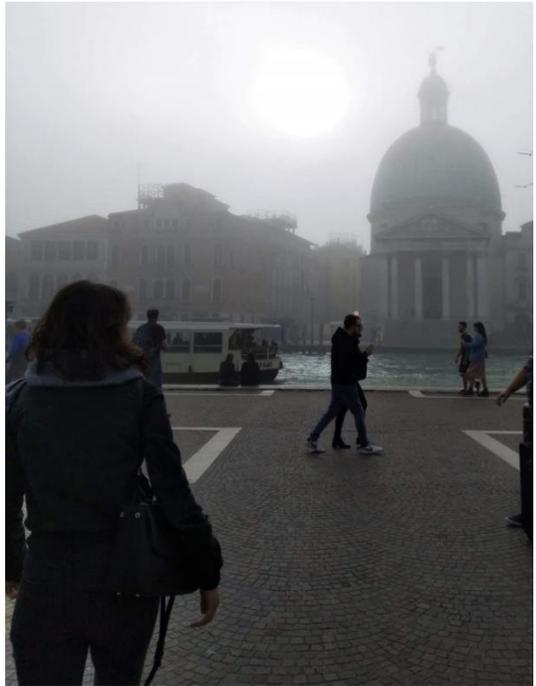
# Science Goes on Even When It Seems Impossible

**Marina Gutierrez Pulpeiro - ESR11**

*19/02/2021*

New experiences always scare us, even when we are sure the decision we have made is correct.

When I started my bachelor's in biotechnology, I did not know how exactly I was supposed to begin my scientific career. However, I was sure I wanted to contribute to society with new knowledge because I need to understand further how things work before deciding. And I was not wrong. Trying to understand the world, asking yourself how you can contribute to the progress, and understand the difficulties to reach the objectives are necessary but difficult steps.



When I applied to the PhD position, I was very excited to become an international PhD student. But once I was accepted, contradictory feelings came to my mind. I was ready to move away from my city but afraid of not adapting to a new country. I was scared for not speaking Italian but willing to learn as much as I could about Italian culture. I liked the research topic, but I did not feel ready to start. It was an opportunity to feel independent, but I felt worried about being lonely.

It turns out PhD is not only challenging from a technical point of view, it comprises all kinds of new experiences. Even when you think you are prepared to step forward, life turns

out with new challenges. Experiments may not work out. Plans may be cancelled. Personal difficulties may show up.

I discovered that not having an answer for a question is an answer itself. It helps to look for new ways to respond, and it gives you clues to change your mind, to think outside the box.

Questions may not always be answered, even if you try very hard. Even when you have not found the answer you would like to, your work can still reference other scientists. And that it is OK because we need to understand we are not alone in this battle. Helping each other is an essential part of progress. In fact, we always hear of the “scientific community” without noticing how important is the word “community”. Research is based on sharing, acceptance, and discussion.

When 2020 hit so hard, we all had to overcome the new situation. Like everyone else, I had to accept the new reality. Planned experiments were impossible to be carried out, and working from home became the new routine. New ideas to still perform research activities emerged, and my contribution was possible thanks to all the efforts we made in the scientific group. All the progress – big or small, depending on the perspective – would not be possible without the people that have been around me these months. The ones that teach me the topics guide me and have the patience when I – still – make mistakes: doing science, speaking a new language, adapting to a new country.

It was then when I understood that challenges should not be seen as a high mountain we need to climb but a combination of small steps and breaks. Science seems a living organism that evolves, adapts, and goes on even at the darkest moments. It is inherently connected to human nature. As for science, personal growth is not a linear path.

I discovered that success is an internal state of mind. I have been challenging myself every day since I started my way into the scientific career. Science needs brave people, and I am happy to do as much as I can every day.

## Loading.... Scientist in Process

Ana Paulina López Gordillo - ESR2

25/02/2021



Hello everybody, I would like to focus on how the PhD at Nowelties has enhanced the quality of my life.

Sixteen months ago, I started the doctoral pathway very excited after meeting all the talented fellows of Nowelties during our training at the University of Santiago de Compostela. I am grateful that we could share experiences and activities in person at least once! From that time onward, everything has been in constant change, as Nikoletta explained in her article. I am convinced that most PhD students face ongoing challenges from day one, and even if it is hard to stay positive all the time, we can choose to grow through this pathway. After all, personal growth may enhance our life quality in the short or long term.

### *Life quality: before vs after*

The life quality of a person is determined by multiple factors which intervene in the blossoming of the individual. As a doctoral student, I would like to briefly describe the impact of my PhD

in 4 different fields that define my life quality: emotional, physical, personal development and social relationships.

#### *Mental health matters*

Before becoming a PhD student, I could see how doctoral candidates struggled with uncertainty, work overload, and lots of stress and anxiety. When reading here and there, I was intimidated by the fact that graduate students present more mental health issues than the general population. After experiencing a grasp of these emotions during the master, I was sure that I did not want to repeat the case during the PhD. In the end I can say that we are likely to face all those emotional challenges through our life with or without doctoral studies. Controlling our reaction (as Francis explains here) and having a positive mindset (as Barbara explains here) are useful to overcome this. Thanks to my doctoral studies, I could access workshops to learn to detect the signs that point to seek for help for myself and others, do active listening to help others, and develop mental strength via mental training. I was amazed to live the power of visualization with a simple stretching exercise. Don't forget to take care of your mind too! This is influencing your physical health (Sabrina wrote about mind caring in her last blog article).

#### *Boost your fitness*

Unfortunately, a PhD will not get you slim nor healthy. So you may wonder how it enhanced my health after these months. I can mention two things: commuting flexibility and the healthcare system. During my bachelor studies, I lived in Mexico City. It is crazy the time that a person can spend commuting when living in a megapolis; the daily journey from my former home to my Institute at UNAM included taking two buses, two subway lines, and walking, summing up  $\sim 2.5$  h transport one way. This meant investing 4-5 h a day to reach your studying/working place...even thinking of it makes me tired. Fortunately, when you start a PhD like Nowelties, you move to a new country to aim to live near your Institute. And I did this! Having the chance to reach your workplace in 30 min by foot or 20 min by bike enhances your physical condition. On top of this, the healthcare system of Germany promotes prevention. It

facilitates regular checkups to detect and treat diseases as soon as possible. This preventive culture has led me to regularly check on my health and tackle diseases early.

### *Shaping a Research Scientist*

My impression of personal development through academic studies is that we are constantly acquiring new knowledge and probably new skills. Before Nowelties, I had a focus on toxicology and environmental sanitation. However, my PhD project involves new fields of expertise: microbiology and analytical chemistry, which will broaden my knowledge and skills. The main difference that I perceive is that as PhD student, I can access a broader diversity of courses, seminars, and workshops. They can be categorized as core training and soft skills courses. They do not need to be strictly related to the doctoral project, and this allows to personalize your scientific formation. In the end, all the training will facilitate employability after the doctoral research. All the courses and skills that we learn can be transferred to our CVs when applying for work positions in the future.

I want to share a phrase that my supervisors told me at different stages during these 16 months: “the purpose of the PhD is to form and train a Scientist”. This reminds me that the main goal is not the diploma nor the articles but the training process itself.

### *Strong bonds keep your back*

Danilo explained that it is not always easy to establish lasting social relationships as a foreigner. Despite cultural adaptation, the flow of the new social interactions may be different from what we were used to. I witnessed that Latin Americans may struggle to establish warm relationships with locals in European countries in my personal experience. However, it helps to have a social circle with other internationals. Building healthy social relationships has a positive impact on our wellbeing [1]. To my surprise, Nowelties enabled me to improve my social relations. I have a nice group of fellows interested in each other beyond academic purposes. Although we can only socialize virtually, it brings me comfort. Besides that, I feel fortunate within the research group in Germany, which is friendly with foreigners. This opened my vision and forged a new experience that made me feel welcomed by local people.

**Picture source**

<https://depositphotos.com/vector-images/cartoon-laboratory-background.html>

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[1] Maguey, H. (2018). Las relaciones sanas producen salud física. Las malas relaciones de pareja afectan la salud. Gaceta UNAM online. Website revised on 24.2.2021 (<https://www.gaceta.unam.mx/las-malas-relaciones-de-pareja-afectan-la-salud/>)



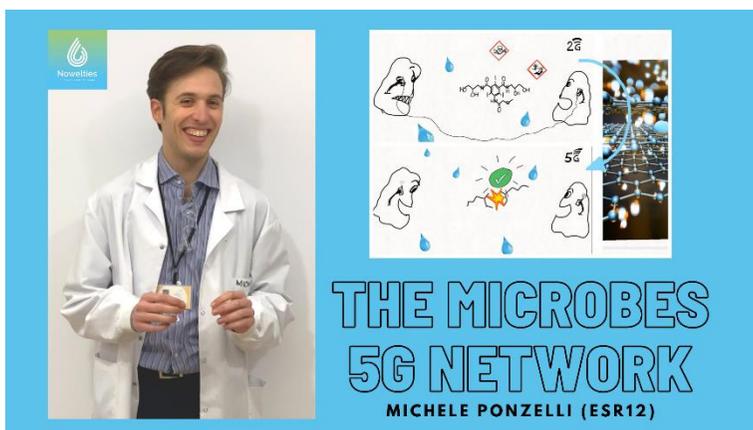
# Chapter Five



## Video: The Microbes 5G Network

**Michele Ponzelli** - ESR12

*08/03/2021*



The water cycle is being challenged by the discharge of persistent contaminants, which current sewage treatment systems cannot remove.

In this video, Michele Ponzelli (ESR12) presents his research as a Ph.D. student in the NOWELTIES ITN project.

**YouTube link**

<https://youtu.be/i8SkIlojVo>

## PFAS: Forever Chemicals – Forever a Challenge?

Nebojša Ilić – ESR13

12/03/2021



Greetings fellow water and science enthusiasts. Today I want to discuss with you a challenge we are facing globally, but are not all aware of. This is one of the biggest challenges that we are facing in water treatment and a problem that has many different fields of science scrambling to join forces in search of a solution.

What I am talking about, which you might already know from my previous posts on the topic, is the removal of per- and polyfluoroalkyl substances (PFAS) from water. I wrote a brief introduction on what PFAS are in my first blog post on the topic. Briefly, they are a class of man-made organic chemicals that are significantly drawing public attention in recent years due to their toxicity and bioaccumulation potential [1].

Why do these compounds present such a big treatment issue? In order for this to be tangible, I will explain it using the example of perfluorooctanoic acid (PFOA), one of the most

known compounds from the group. As you can see in figure 1, PFOA is an organic molecule with a 7-carbon chain and a carboxylic headgroup.



Figure 1. Chemical structure of PFOA.

Furthermore, all hydrogen atoms on the carbon chain have been substituted for fluorine. The widespread use of these compounds is due to their desirable properties, which originate from the high electronegativity and small size of the fluorine atom, making the carbon-fluorine bond one of the strongest in organic chemistry. This makes PFAS thermally stable, resistant towards acids, bases and most oxidizing agents [2]! As you can imagine, they are very hard to degrade into less harmful compounds since they practically have a fluorine shield around them.

PFAS are classified as trace organic contaminants, “trace” being the key word here as the concentrations of PFAS found in water are usually very low, in the low ng/L range. This number is higher (usually in the lower µg/L range) in high PFAS activity areas such as PFAS-related industries or airports.

Such low concentrations give the challenge of removing PFAS from water a whole new level of difficulty. Even the processes that can degrade PFAS are quickly disregarded, considering that operational costs are often highly dependent on the volume of treated water. We are therefore left with very limited options for treatment as a consequence.

To date, granular activated carbon (GAC) is the favored solution on the market. Water flows through beds filled with GAC, which serves as an adsorbent removing many different contaminants from water. Among these removed contaminants are long-chain PFAS (note that short-chain PFAS are not effectively removed with this process). However, GAC is a non-selective adsorbent, which means that the “available spots” for adsorption quickly get occupied by many different compounds.

This is why the current GAC filters that are in operation to remove PFAS from drinking water need to be exchanged every 6-9 months. And even then, the environmental issue remains, as the removed GAC is saturated with toxic chemicals that still need to be disposed of. This is again why many simple but effective separation processes such as reverse osmosis do not present an effective solution on their own – their concentrate is rich in PFAS and still an issue to dispose of.

In order to address these issues, a process is needed that either selectively removes PFAS from water or has a destructive effect with no regard for selectivity. This is why our group is conducting research in these two directions, one technology for each of the conditions mentioned. You can read more about our research in the second post I have written on the topic of PFAS.

Ultimately, I highly doubt that a single miracle process will tackle this treatment challenge with success. Engineering multiple processes into a treatment train in order to use their strengths in synergy is the most likely approach to succeed in effectively reducing PFAS concentration to levels deemed safe for drinking water [3].

In the meantime, if you're interested in how current water treatment facilities cope with the PFAS issue, this publication is a good study to start with [4].

In the end, with everything bad comes some good. This environmental crisis has made us look long and hard at our current water protection practices and regulations. The times are changing, but the laws take time to catch up. The new European Commission drinking water directive is proof of that, finally being put in place as of December 2020 [5].

This directive addresses many emerging and known issues. It is the first regulatory decision to put a strict limit on the amount of PFAS present in drinking water provided to the residents of the European Union (as opposed to advisory regulations) – 100 ng/L for a sum of 20 selected PFAS and 500 ng/L for PFAS total.

As other countries are sure to follow this example, more interest in the topic and more allocated funding will drive more people into this research field. So, keep your fingers crossed and your eyes peeled; this is just the beginning!

**Picture source** (and a good insight into the PFAS pollution issue)

<https://www.bridgemi.com/michigan-environment-watch/environmentalists-outraged-michigan-warning-about-pfas-went-unheeded>

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- [1] <https://pubs.acs.org/doi/10.1021/acs.analchem.9b05269>
- [2] <https://www.sciencedirect.com/science/article/abs/pii/S1383586619317964>
- [3] <https://www.sciencedirect.com/science/article/abs/pii/S030438941931917X>
- [4] <https://www.sciencedirect.com/science/article/abs/pii/S0304389420312243>
- [5] [https://ec.europa.eu/environment/water/water-drink/review\\_en.html](https://ec.europa.eu/environment/water/water-drink/review_en.html)

# World Water Day: Facts and Tips to Save Water

**Nikoletta Tsiarta** - ESR14

*19/03/2021*



Our NOWELTIES project logo is a drop of water. This drop starts from green and ends up in clear blue color. As you may know, the project's whole idea is to provide some new technologies to clean the wastewater efficiently.

Many other scientific projects worldwide are also related to water. It's a fact that a large sum of money (millions of \$) has been spending on investigations related to water in any field. That can be (waste)water treatment, water reuse, water management, water monitoring, human health, etc.

But why people keep spending so much money on a good that will never disappear from Earth?

The answer is that water pollution is a global problem confronted daily by a great proportion of the human population and livestock. A problem that brings a lot of challenges in our everyday life. But let's check some interesting facts about water and water pollution.

Water! What could be more important than this element?

1. The recipe to form its molecule is easy. It only takes an atom of oxygen (O; one of the most abundant elements in Earth's atmosphere), two atoms of hydrogen (H; the most abundant element in the Universe), and a lot of energy. However, when someone tries to create it, they will probably cause massive explosions.
2. You can find it everywhere as water continually changes location and state. Sometimes it's a liquid (oceans, lakes, rain, groundwater), a solid (iceberg, snow, ice), or a gas (water vapor such as steam).
3. Only 2.5% of the total water on Earth is freshwater when 70% of the Earth's surface is covered by water. In fact, if you imagine that all the water on Earth could fit into a one-liter milk carton, it would all be ocean water except for only two tablespoons of freshwater.
4. 80% of the water pollution is caused due to domestic sewage. This is because more than 80% of sewage is discharged untreated in developing countries, polluting rivers, lakes, and coastal areas.
5. Every day, 2 million tons of sewage and industrial and agricultural waste are discharged into the world's water (UN WWAP 2003), the equivalent of the weight of the entire human population of 6.8 billion people.
6. Asia holds the prize of the continent with the highest number of contaminated rivers, mainly of bacteria from human waste. The Ganges river in India is considered the most polluted river globally and contains dirt, garbage, dead animals, and humans.
7. More than 8 billion kilograms (equivalent to 40 large cruise ships) of trash, mainly plastic, end up in the oceans every year.
8. Contaminated water is the leading cause of various diseases such as cholera and typhus.
9. An average of 250 million people suffers from water-borne diseases each year. According to the World Health Organization and UNICEF, nearly 2.5 billion people do not have access to valuable health care.

10. Every year, more people die from unsafe water than from all forms of violence, including war. Water pollution kills around 10,000 people every day - that's 3.6 million people every year
11. **BONUS:** By switching from bottled water to tap water, a household of four may save on average €500 per year. Bottled water is around 40 times more expensive than tap water (more info [1])

You understand fresh and clean water is a valuable resource. Water pollution and contamination are some of the worst enemies of human health. A person can survive without water only for three days (on average). Having access to clean water for irrigational or drinking water purposes is extremely important. The United Nations recognized it as a human right [2]. It's our duty to preserve the only human right that gives us life. Let's be conscious and don't violate it.

What can we (as individuals) do to help?

- Be aware of the amount of water you consume daily and save it!
- Take shorter showers.
- Don't leave the faucet running while brushing your teeth or washing your hands.
- Make sure the toilet isn't running.
- Before washing your plate, scrape it clean into the trash first, so you avoid grease going into the kitchen drain.
- Keep track of trash.
- Prefer to buy a biodegradable product than a non-one.
- Follow the 3R concept. Reduce, reuse, recycle.
- Always pick up your trash, especially when you are close to aquafers (beach, lake, or river).
- Minimize the number of herbicides and fertilizers used in the land fields.
- Change your eating habits. By cutting down on meat and dairy and eating seasonal vegetables, you'll help conserve water.
- Follow a quality- and seasonal-eating-based diet.
- Steam your veggies.

- Reduce food waste.

And don't forget to celebrate the #WorldWaterDay next Monday, March 22nd, 2021, by just doing one small gesture for saving this precious source of life.

**Picture source**

<https://www.istockphoto.com/es/search/2/image>

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[1] [https://www.aquapublica.eu/sites/default/files/document/file/apc\\_water\\_affordability\\_fi\\_nal\\_0.pdf](https://www.aquapublica.eu/sites/default/files/document/file/apc_water_affordability_fi_nal_0.pdf)

[2] <https://www.unwater.org/water-facts/human-rights>

# My Value of Water: From the Bolivian Water War to Nowelties

**Silvana Ines Quiton Tapia - ESR1**

*26/03/2021*

Last Monday, March 22nd, we began the week with the celebration of World Water Day. This year's theme is on valuing water by focusing on the different values of water that go beyond its price.

As water professionals, we talk about water daily. But most of us ESRs are dealing with the technological aspect of water, and we focus mainly on calculations and experimentation at the lab. However, it is also important to bear in mind the social aspect surrounding the topic. In this week's blog, I want to share a few thoughts about the value of water from my perspective as a Bolivian citizen.

In Bolivia, water sanitation is implemented roughly around 40% in the rural areas and almost 60% for urban areas. Safe drinking water coverage is just 90% in urban territories. In contrast, in rural regions, the coverage is as low as 60% (Last census 2012). But water is more than what comes out of your pipes. Its value relies on the significance of water in your life.



In my own experience, I can recall certain experiences that influenced my perspective on the value of water; and hopefully by doing so, inspiring the readers to do the same insightful exercise.

One of the first meanings of water to me was water as a fundamental human right. Back in the year 2000, an important milestone occurred in my hometown of Cochabamba, Bolivia: The so-called “Water War”, consisting of fateful uprisings against an exorbitant rise in drinking water price.

The privatization of water triggered these conflicts. These conflicts even inspired awarded films like “Even the Rain” (*Tambien la Lluvia*). I was just a kid when these events occurred, but their significance engrained the value of water as a pivotal element for the well-functioning of a society.

Later, as I grew older, I began to value water quality as the foundation for better food and health. By simply watching the news or going to the market with my mother, it was clear that changes in water abundance through precipitations or droughts had a direct impact on food



availability and price. In Bolivia, just as in many other countries in the world, water stress forces most farmers to reuse even untreated wastewater for their crops at the expense of impacting human health (i.e., infectious diseases). In Latin America, the increased frequency of extreme weather events like “El niño” and “La niña” phenomena exacerbates the need to have proper sanitation to safely reap the benefits of wastewater reuse. Hopefully, we all become aware that increasing our access to treated water will directly enhance our food security.

While traveling through the corners of Bolivia, I have witnessed that water is also about community and cooperation. In Bolivia’s rural territories, water use and distribution are managed by members of the community in an informal manner, independently of any governmental or company involvement. These types of “bottom-up” organizations, built autonomously by the communities, have shown to be more participative in the water use and thus have several advantages in the social acceptance of new water-related projects. And this acceptance is particularly important for the success of water related projects, regardless of having the most advanced technology.

In another of my Bolivian trips, this time through the jungle across the north of Beni (near the Amazon jungle) I embraced yet another value: water as a means to progress. Water leads to progress that enhances economic growth and, most importantly, promotes quality of life. Unfortunately, these two things that not always go together. I have also seen water as a means of access and transport. Rivers allowed to reach areas otherwise inaccessible by land. I have also seen water accumulated in dikes at the top of the mountains as a way of water storage and together as the construction of ditches allow the irrigation of our food.



Since I became part of Nowelties, I see water more as innovation. All of us ESRs are focusing on developing cutting-edge new water treatment technologies, employing new materials, or improving the integration of existing technologies. For our Nowelties project, we are zooming on water-related issues even more sharply and mitigating problems ahead of the current legislation. We are tackling emerging contaminants that are of great concern but for which water quality standards are still being elaborated.

By the end of last year, water became a commodity traded on Wallstreet. But the stock market won't reflect the true value associated with water. The price and value of water are two different things and sometimes contradictory. But how can we define the true value of water?

Above all, water is at the heart of my commitment to the present by focusing on my research to find nature-based solutions for its treatment. Water also stands for my hope that by being aware of its many values, we can be more environmentally conscious and have a better future.

And for you? How do you value water?

**Pictures source**

- <https://sites.google.com/site/guerradelaaguaboliwia/>
- <https://akvosphere.com/water-war-in-bolivia-and-reverse-privatisation/>

# Escape from the Ivory Tower of Water Science

Ana Paulina López Gordillo - ESR2

09/04/2021



Have you ever struggled to share your ideas clearly with different audiences?

This is one of the challenges that we face as ESRs along the PhD pathway. Clear communication allows us to share ideas, findings, awareness, and so on. However, it takes time to develop speech and writing skills. Throughout my project, I can strengthen my communication at events such as conferences and seminars. As these occur in a scientific environment, you can think that communication flows naturally. Surprisingly, I learnt that even a poster design might play a key role in attracting an audience and thus transmitting the message efficiently to scientists of different fields of expertise. This is important because tackling water pollution requires multidisciplinary research. Conveniently, tips to design posters and presentations are promoted in conferences via workshops; thanks to this, all attendees can practice avoiding saturated and boring slides and posters. I hope to wake up my dormant designer throughout my PhD project!

*A bridge for science*

Scientific knowledge often includes technical and complex terminology, and wastewater treatment of organic micropollutants is not the exception. This is one reason why the information may remain in the scientific niche and out of policymakers' or society's reach. As Danilo mentioned in his article, the technologies that we investigate at Nowelties may face a lack of legislation favoring their implementation. There is an increasing need for training scientists to work with diplomats in the Science Diplomacy interface to ease the translation of scientific knowledge into legislation. In the case of water legislation, water scientists struggle for successful communication with diplomats and the inclusion of social and cultural concerns in the intended legislations [1]. While this field is in development, it opens further possibilities for ESR to become a bridge between scientific and legislative communities.

*Let's go out of our tower*

As Silvana and Camilo mention in their blogs, water is linked to diverse society problematics. Despite the elaboration of water legislations to solve some of those difficulties, successful implementation requires time and society's participation. As water researchers, we can facilitate this step by going out of our "Scientific Ivory Tower" and sharing the ongoing research with the public. Like other EUH2020 projects, Nowelties encourages all ESRs to engage with the community via outreach activities, such as the current online blog. Nevertheless, I discovered that explaining science in simple terms and easy flow is not that easy. Creativity and empathy are some of the main ingredients for me in science communication. Because pictures are a good support to transmit our ideas efficiently, I dare to plunge into the digital ocean of images, find a matching one or make my own creation thanks to editing tools. While elaborating my image and writing the text body, I imagine that I did not know the science and let my inner child help with some ideas, which hopefully works. Besides, I try to be in other's shoes and to avoid complex language. My friends and relatives used to say that I pronounced tongue twisters when explaining my thesis and naming long names of compounds or enzymes such as Glutathione-S-transferase, but now they do not because I go back to general concepts. Analogies are handy too.

Apart from outreach activities, Nowelties promotes that we disseminate our research results via open access publications, which means that no membership or fee is required to read the published articles. This approach boosts science transparency and availability to anyone interested in the topic of water treatment and micropollutants. You will never know who reads you! Naturally, open access benefits other water experts to compare and/or integrate our findings in their future or ongoing water treatment projects.

#### **Pictures source**

- <https://pixabay.com/es/illustrations/torre-castillo-medieval-puerta-1417887/>
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[1] “Water Diplomacy: Intersection of Diplomacy and Science. “ S4D4C European Science Diplomacy meeting (15-19.3.2021). Online (<https://www.s4d4c.eu/s4d4c-final-meeting-17-march/>)

## A PhD Is Expensive. Would You Go for It?

**Edwin Antonio Chingate Barbosa** - ESR3

*16/04/2021*

I'm about to share with you personal feelings from my own journey. Everyone would follow a different pathway, and for some, it could be very different from mine. Even though I think that most people experience some hard times while doing their PhD. In my PhD time, I got good moments after lots of effort, but bad moments too. Moments without any clue about how to proceed, and times when I feel that I'm very close to breaking down.

Since I started my PhD, many things changed, especially because it's easy for me to hyper-focus on stuff that I enjoy. I don't have so many hobbies at this moment of my life, and rarely I can stop thinking about my work. Even though some people advise me to relax and try unrelated things, it's difficult to stop thinking about something when I don't feel so much progress.

A PhD is very different from all previous academic stages, and it's not like a regular job, neither. In a PhD you have to study to develop your tasks, and you always find new tasks to do. Most of the time, your final goal is related to things that no one else did before, and you could feel like walking in the dark. You perform experiments to solve questions, and you need to organize those experiments as arguments to support your statements. Everything should be



very clear, and easy to reproduce by others that may find your conclusions useful in their pathway.

A PhD is a constant learning process where you define your route. You got support and advice from your supervisors, but you are the one in charge of this project. You will find several moments when you don't know what's happening or why your experiments don't work after putting in that much effort. Frustration will be a constant friend, but you will have to understand that it's natural to fail and that if you want to achieve your goals, this feeling won't help. Your only option is to keep trying. You're performing your research, but your research is shaping you!

Too frequent failures won't help with your self-confidence. It's easy to think that you're the problem for the experiments, that you're not enough to prepare, or that you're making too many mistakes. You may lose some self-confidence for a while, but it will return after you realize all that you did and compare yourself with the person you were at the beginning of this journey. Instead, you will get a lot of resilience in exchange, training and keep trying is the only way to proceed.

The way that the PhD system is designed is not very good for mental health neither. A lot of people experience anxiety and depression on their journeys. You may follow your dreams, but one has more requirements in life. In general, salaries are not very good compared to what industry would offer for the same formation. Contracts are not very stable, and you push yourself to get the better result as soon as possible and fit the project's frame.

A PhD is a step in professional formation but also drives to several valuable products. Society should offer better conditions after that much effort and sacrifice. PhD projects are pushing knowledge barriers in all fields.

I wanted to show you that this is a difficult pathway. As long as I'm going deeper in my research, I feel more admiration and respect for all of those who managed to overcome this before than me, my senior colleges, the ones that successfully defended their thesis, and of course, all my professors since my bachelor until my supervisors now.

Finally, with these words, I would like to promote the campaign

*#HugPhDStudentsTheyAlreadyLostTheirMinds*

## India & Croatia: From Water Facts to Fun Facts

**Amit Kumar & Barbara Kalebić** - ESR4 & ESR7

23/04/2021



Hi readers!

We are Barbara and Amit from Croatia and India, respectively, but you may be wondering what brings us together. Well, we are ESRs of the Nowelties ITN project and today we want to show you some facts on water and our different perceptions. For example, did you know that more people in India have access to phones than to safe drinking water? Or that, on the other hand, Croatia tops the EU standards with 27,330 cubic meters of water per capita?

First, let us give you a couple of facts related to the countries we are come from.

India accounts for about 2.5% of the total surface world area, with eight major rivers and with around 400 rivers within its borders. It has approximately 16% of the total global population, while it contributes only 4% of the world's freshwater water resources.

On the other side of the world, in the heart of Europe, is Croatia. Located among the lowlands and mountains, along the Adriatic Sea, and it is about 58 times smaller than India. It has around 30 major rivers and 25 billion cubic meters of surface water supply.

Considering only these numbers, do you think that both countries share the same water issues?

One of the problems is the uneven distribution of water resources among countries as well as worldwide. This leads to the dwindling availability of clean water resources for use. It has been estimated that around 47% of the global population lives in such areas where people suffer from water scarcity.

For example, due to the topographical, hydrological, and other constraints, only 60% of India's natural water resources (surface and groundwater) can be exploited for various applications and is mainly used for irrigation purposes. However, in one part of Croatia, numerous underground stream flows are hard to determine due to the presence of karst. People do not influence water distribution, and it makes the management of water resources difficult.

Besides natural laws, water management is a man-made practice that includes control of optimum use of water resources. Its idea is to minimize the negative impact on life and simultaneously maximize the beneficial use of water.

Regarding this, India is reputed to be one of the world's most water-stressed countries due to the poor water management with available treatment capacity for approximately 37% of its wastewater streams (Central Pollution Control Board report, 2015). Considering that India is the third-largest exporter of groundwater globally, we all can see that something is missing in this equation. Nowadays, in various parts of India, people are still using untreated groundwater for drinking, even though it contains much higher concentrations of inorganic (particularly fluoride and arsenic) as well as organic compounds and bacteria than permitted.

On the other hand, Croatia belongs to a group of countries where water issues are still not a limiting factor of development. The Croatian potable water supply consists of 86% groundwater and 14% surface water, and the tap water is safe for drinking. We can consider the relatively high quality of both surface and groundwater as an advantage. Still, problems occur in summer when the natural discharge is small, the groundwater level low, and water demand increase due to tourism and enhanced irrigation.

What can we do about it?

As young scientists, we need to encourage the re-use of water and promote sustainable water fashion. We need to find a way to make available technologies suitable for use in areas of diverse conditions. Although there are enough developed methods for water treatment, there is always room for new ideas and improvement. You know how they say – there is additional space in the glass visually full of rocks. You can always add some more sand or even sugar to improve this fullness.

With so many differences in the way of living, water is a common commodity that holds us together. It is something that we all need to share and take care of to live a healthy life. The water you drink today had probably seen a good part of the world before it “ended up” in your glass. So, now it’s your turn, as a citizen, to be aware of not just water consumption but also the water cycle and its footprint in general.

We conclude with two fun facts.

Barbara’s amusement in the differences between Indian and Croatian cultures lies in their ways of preparing food. Indians make almost everything too spicy for the palate of a Croatian girl, so all potable water in the world won’t help her survive a traditional Indian meal.

On the other hand, Amit feels more comfortable about tap water here in Europe than where he grew up in India. This is a good motivation for him to find appropriate solutions for Indian “water worries”, and have this comfort at home too.

Aaand, what is your favorite drink? 😊

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# On the Road to Knowledge

**Barbara Topolovec - ESR5**

*30/04/2021*



Hello dear readers!

As you could've realized while following this webpage and our stories, we 14 ESRs are a group of young researchers and scientists gathered under European Joint Doctorate called NOWELTIES with one main purpose: to find and develop solutions for wastewater treatment (WWT). We can say that the core activity is the individual projects, but part of this research programme is also training activities. Organized periodically at different places (institutes, countries) by supervisors, coordinator, project manager, and collaborators, we present our work and get a chance to learn about different WWT technologies, new materials and innovations within the water sector. All that through theoretical and practical approach. As a result: create a new generation of trained wastewater professionals able to face future challenges. A group of scientists with potential future collaboration on solving today's water problems.

*Expectations...*

When I applied for this project, I saw a whole package here for me. A chance to work on my PhD at amazing institute. To learn and better understand the issue of organic micropollutants in water. Learn about different advanced oxidation processes, design processes, water management. Most importantly, learn how to implement all that knowledge in practice. And who would better teach me than professionals and experts, people who went through a path in which I am walking now? In short, “Team supervisors”.

*...and reality...*

It started with a beautiful trip to Santiago de Compostela where I met my fellow ESRs and our supervisors [1]. Each of us came with a different background: chemistry, engineering, biology, physics. It was an amazing opportunity to hear and share different experiences and get a “glimpse” of how future meetings will look. We were involved in various activities: lectures, laboratory practicum, visit the full-scale WWTP. And of course, social activities gave us the perfect moment to create “Team ESRs”, especially while eating those 14 boxes of pizza. With fresh ideas and fully motivated, we went back to the host institution, working on PhD and getting ready for the next meeting.

Unfortunately, due to the outbreak of COVID-19 in Europe, our gatherings and training courses have been moved to virtual rooms. Field trips and laboratory practices were canceled, but that didn’t stop our supervisors from an enormous effort to organize us online meetings, lectures and exercises.

Recently, together with my ESRs, I have taken part in the Advanced Training Course (ATC), which was organized by the Technical University of Munich (TUM) and the Catalan Institute for Water Research (ICRA). 30+ hours, I expected tons of slides, me just listening, taking notes, tired after 1 hour. Sitting in front of your computer and paying full attention can become exhausting quickly for both sides. However, it was a little bit different. During sessions, supervisors included us in many discussions throughout small exercises, working groups, assigned case studies. My camera was ON most of the time, so my group can see me and hear me. I learned more about water system designs, potable and non-potable water reuse. I got a

chance to find useful software and tools, discover what lies behind “risk assessment”. And I realized that I actually like electrochemistry which I was trying to avoid through most of my education.

The most interesting part was when real water-reuse case studies were assigned to us. Quite a training experience. That was the chance for me to learn more and understand better where I am today with my knowledge, what I can integrate into my work, which “knowledge holes” I still need to fulfill.

In all that period, I did miss our live gatherings and social activities a lot which I believe, in general, all of us miss these days. The sitting part and paying attention were challenging. But as it goes in research, we all try to find another possible solution and take out the best of it. Also, when you find yourself in a group of people with a good sense of humor, you end up having a good and quality time.

We are still on our road to knowledge; let’s just hope that we can soon have that dinner together as well.

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# Video: Organic Micropollutants in Water: Awareness and Regulation

Danilo Bertagna Silva - ESR6

07/05/2021



In many parts of the world will be necessary to have safe and clean water.

Danilo Bertagna Silva (ESR6) uses a photoreactor to eliminate substances that are currently not removed by conventional treatment. Above treatment, it is crucial for him to raise awareness, especially due to a weak legislation framework.

**YouTube link**

<https://youtu.be/eeVXj5Ym1q4>

# Water: Quality More Than Quantity

**Camilo Sánchez Tobón - ESR8**

*17/05/2021*

Did you know that the water amount on the planet has always been the same, and it just recycles over and overtime?

In other words, the water is used nowadays is the same water that our ancient civilizations consumed. Although the water bulk has been the same over the centuries, its quality has not remained the same.

Water recycles through different processes that integrate the water cycle as follows: evaporation from rivers, lakes, and oceans; condensation on the clouds; precipitation as rain and/or snow; and collection to rivers, lakes, and oceans. However, with the fast-growing population and industrial development, water quality has deteriorated over time.

Every day, thousands of new chemicals are developed for different applications. At the same time, they are discharged into the environment without regulation, polluting the water sources. Among the various pollutants released into the environment, organic micropollutants (OMPs) have gained special attention recently because they are persistent. Some of them bioaccumulate over time, representing a threat to aquatic life and human health. These OMPs, mainly pharmaceuticals, personal care products, disinfection by-products, and endocrine disrupters, are not easily removed by conventional wastewater treatment plants.

So, what are we doing to tackle this issue?



In the Nowelties project, we are developing new processes and techniques for gaining valuable information about the identification, transformation, and removal of OMPs in water. The first step is to find a way to identify and quantify these OMPs. Once the identification techniques are developed, transformation and removal of OMPs can be done applying different approaches such as biological treatments, oxidation processes, or hybrid systems.

For example, Silvana, Ana Paulina, and Edwin are using biological approaches to understand how microorganisms can uptake, transform and remove OMPs, while Sabrina and Michele are developing hybrid systems in which they combine biological and physicochemical processes. In the case of oxidation processes, a wide range of technologies is being studied to transform and remove OMPs. Nikoletta is using ozone combined with membrane filtration; Amit applies cold plasma and even developed a super cool reactor. Nebojša is running an ultrasound system. Francis and I are working with a catalyst (TiO<sub>2</sub>) activated with solar radiation, while Danilo is developing a new reactor concept for TiO<sub>2</sub>. Finally, but not less important, Marina and Barbara are using adsorption processes applying different absorbents.

At the end of the project, all the different strategies will be compared to identify which technologies are more suitable according to a target compound (OMP). All this information collected from the project combined with other research projects that are conducted in the removal of OMPs could be helpful input to support future regulations that avoid the continuous degradation of water quality.

**Picture source**

<https://unsplash.com/photos/uMLKLCmlAk0> Photo by Steve Halama on Unsplash

# Time Can Heal Wounds – Effort Prevents Injuries

Sabrina de Boer – ESR9

21/05/2021



Even though NOWELTIES is a project funded by the European Union, I am currently working in Switzerland at the FHNW in Basel as part of a research secondment. Despite not being part of the EU, Basel is one of the most European cities I have been to. When you walk across the history-loaded streets, you are surrounded by people speaking English, French, German, Spanish, Italian, Portuguese, Dutch, and every language you can imagine. These people are mostly not tourists, but employees from all over the world who have chosen Basel as a (temporary) home to thrive both in their careers and personal development. Basel is also the center of the three-border region between Switzerland, France, and Germany, shaped by one of the ten largest European rivers, the Rhine.

Thirty-five years ago, this vital lifeline was severely damaged when a storage hall for chemicals caught fire and 10-15 million liters of contaminated firefighting water, mostly containing insecticides, blood red colored, were released into the Rhine. Up to 400 kilometers downstream, dead eel and other fish were washed up the banks. Even in Lobith, a Dutch city located 700 km downstream, elevated concentrations of the insecticide Disulfoton were detected [1]. The population of Basel was furious about the limited information the company

released about the environmental and health risks, stemming not only from the polluted river but also from the toxic fumes released during the fire.

The increasing public pressure led to the implementation of stricter laws. The Convention on the protection of the Rhine was signed in 1999, entrusting the International Commission for the Protection of the Rhine to implement monitoring and enforce prevention and mitigation strategies [2]. Surprisingly, this association was already founded in 1950, even before the foundation of the European Coal and Steel Community, one of the precursors of the European Union. This shows that fruitful international cooperation does not necessarily have to be driven by economic interests and that we should valorize more the non-economic benefits of the European Union.

It is now almost unthinkable that the catastrophe took place less than a kilometer away from the institute where I am currently working on developing new catalytic materials for wastewater treatment. Today, the Rhine is a primary source of drinking water for more than 30 million people in France, Germany, and the Netherlands [3]. In the summertime, people in Basel can enjoy a swim in crystal clear water. A program to resettle salmons in the Rhine is showing first success. Switzerland is currently the only country regulating the release of organic micropollutants from wastewater treatment plants as important point sources for the “everyday catastrophe” regarding the release of pharmaceuticals, hormones, and industrial chemicals into our rivers, lakes, and oceans. Even though additional treatment steps have increased the costs, the measures are widely accepted by the population [4].

This example shows how impactful public protest and public action can be for the way we live with and within our environment. We as researchers are trying to find the best solutions to reach our common goals, prosperity for all people, not only economically but also environmentally.

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# See You at the Crossroads

Francis dela Rosa - ESR10

28/05/2021



Hi readers! It's my blog contribution time again!

As of this writing, I realized that we (Early Stage Researchers) are more than halfway through our journey to complete our PhD studies. Thus, I would like to summarize the lessons that I have learned during this period.

1. *"If you fail to plan, you are planning to fail"* - Benjamin Franklin

With this regard, I learned that planning your schedule is one of the crucial steps that you need to take. You must also need to include backup plans in case that your experiment will not work. If you will be lucky for the results, then it is good, but please always have backup plans. I promise this tip will save your sanity.

2. *"United we stand, divided we fall"* - Aesop

My colleagues help me a lot to adapt here in Croatia. I really had a good working environment with them. I can work with them easily and very lightly. Indirectly, they boost my morale, and it gives me the energy to work every day. It's just that I hope I have more time to

spend with them. Unfortunately, one and a half years have past and time is running out. I will really miss my colleagues here.

3. *“It is not the strongest of the species that survives, nor the most intelligent. It is the one that is most adaptable to change”*- Charles Darwin

Corona lockdown, earthquakes, and inevitable errors in experiments are factors that make me much stronger as a researcher and as a person. Adaptability skill is crucial for survival, and I am very glad that I became stronger during this PhD period.

Well, I think that is all in my mind right now.

See you at the crossroads!

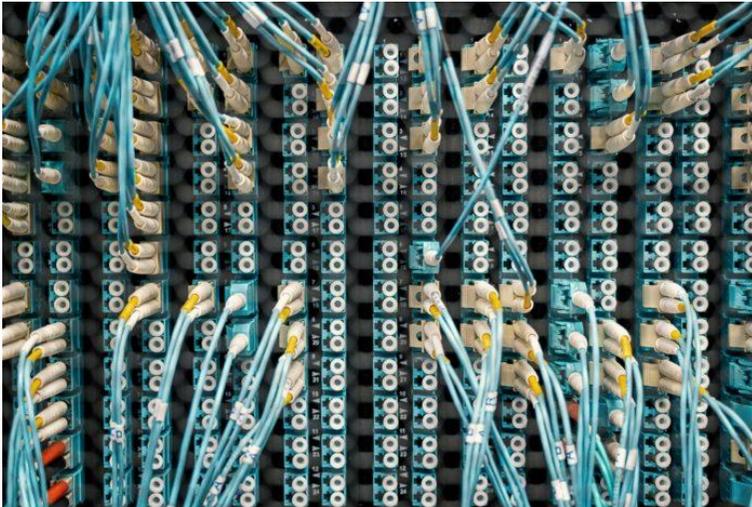
**Picture source**

<http://www.johnkingz.com/tag/choices/>

# Big Data and Water Safety

Marina Gutiérrez Pulpeiro - ESR11

23/06/2021



Some weeks ago, I started to work with some data from a wastewater treatment plant (WWTP), as part of my PhD thesis. I was working with this huge Excel file full of data on flow regimes, quality parameters, and operational conditions. The data was from the last five years, and it was incredibly accurate. As an example, I could check the wastewater flow entering the plant each minute of every day from 2018.

A few days later, I read a news article that I thought was fake. Some hackers almost poison a city in Florida by entering the control system of the drinking water treatment plant and increasing the concentration of sodium hydroxide [1]. A chemical used for increasing the pH level of the water and thus avoiding the release of heavy metals and corrosion, but very dangerous at high concentrations. Luckily, an operator passing by noticed the 100-fold increase of this parameter and reduced it on time before any harm to the city's water supply was produced.

How can it be possible? Is it so easy to hack this kind of software? Were there examples of hacking of WWTP instead of drinking water treatment plants?

Many developed cities have created very creative and efficient ways to overcome the challenges related to the urban water cycle: Upgraded sensors and pumping systems to improve the operation of many automated systems; restructuring of the sewage system to better deal with natural events such as storms; reuse of water for groundwater injection or irrigation of recreational areas. All of them seem cutting-edge solutions for the optimization of the urban cycle. Still, it surprises me how fragile it may be and how it can still be improved in many ways. In the example of the drinking water treatment plant, it was enough to find out the password for the software used in the facilities to enter the system.

Before the internet era, much of the data obtained in WWTPs was gathered without a purpose or analyzed afterward. In the era of *big data*, I have the opportunity to work with a great amount of data online that allows me to understand very well what is going on inside the WWTP.

The point is that *big data* can benefit water issues on a local scale. New technologies with big data offer solutions to solve imminent issues (and don't let hackers enter into the system!) or contribute to scientific research. Information collected allows WWTP operators (and researchers like me) to understand, manage and optimize the reliability and performance of the plant. Information becomes meaningful and useful to make better decisions and be more proactive during plant operations. No matter what specific tools or wastewater utilities are used. It is essential to have a management plan that pulls all the important data together and identifies trends or their absence, so potential problems are identified before they happen.

We are currently working on how to dosage activated carbon according to the necessities of the plant. It has been a very nice experience to learn about how the panel control and the security system works in this WWTP. Now, we can adapt to the fluctuations of the load influent and look for the best conditions to remove micropollutants on the real scale (and they let me push a lot of buttons on the control panel).

**Picture source**

<https://www.pexels.com/photo/cables-connected-to-electrical-connectors-in-data-center-4682187/>

**Reference**

[1] <https://edition.cnn.com/2021/02/10/us/florida-water-poison-cyber/index.html>



# Chapter Six



# Video: Removing Antibiotics with Biological Wastewater Treatment

**Silvana Ines Quiton Tapia - ESR1**

04/06/2021



Do you remember the last time you took antibiotics? What could have happened if you didn't take them? Antibiotics allow us to improve our life expectancy and quality of life.

However, these artificial chemicals are complex molecules not readily biodegradable and can persist in the environment without adequate treatment.

In this video, Silvana Quiton (ESR1) presents her research as a Ph.D. student to remove antibiotics through biological wastewater treatment under the NOWELTIES ITN project.

## YouTube link

<https://youtu.be/9eIqx-XbYHg>

# Perks of Doing a PhD in Germany

Nebojša Ilić & Edwin Antonio Chingate Barbosa - ESR13 & ESR3

18/06/2021



Hey everyone,

We are Nebojša and Edwin, two researchers from two sides of the world that science brought to the same place. Most days, we are sitting in our offices at the opposite sides of the same hallway (well, not every day, thanks COVID!).

In today's blog post, we'll discuss all the positive aspects that pursuing a PhD in Germany brings and all the things we learned to appreciate. The memories that we left back in our home countries and the new adventures that we encountered here.

Germany has always been a powerful force in the world of science. Einstein, Gauss, Heisenberg are some of the many names that shaped science as we know it. Therefore, it is difficult to think about doing research in Germany without feeling the weight of their accomplishments and to think of Germany other than a work-demanding country.

This is far from the truth, though.

Germans have very high respect towards leisure time, both their own and others. The diversity of hobbies and activities to choose from and get lost in is incredible.

Do you want to practice mountain biking? There is a trail going by the river Isar, basically in the city center. Rock climbing? Just choose one of the many centers spread around the city. The quality of your off-time can be as active and as engaging as you want it to be. Practically, there are no limitations.

That being said, science would not be possible without proper planning and discipline for pursuing your goals. Scientific development requires more than good ideas and curiosity. It requires hard work and clear communication.

One thing that is clear the moment you set foot in Germany is that general societal values are in line with science values. When you live in Germany, you see that everyone is very organized and disciplined. A clear plan is an essential tool in your everyday life (like we have a choice with the way the bureaucracy is here!).

And yet, working in research groups here feels more like a family than a job.

You can ask for help from any of your colleagues, group leaders, and technicians. They always will be open to supporting you with a smile on their face. They will also finish a workday with a beer or ice cream on a sunny day.

We find ourselves leading scientific discussions over beer and laughing at all the issues we face during research. Before we know it, our social circle is suddenly our primary source of ideas!

Being productive and focused is easier when you know that you are not alone.

This is a much-needed support system during a period that is bound to put a few gray hairs on your head. On top of this, the diversity of people working in the lab with us is incredible. Not a week goes by without finding some sweets in the shared kitchen or having somebody prepare awesome food for everyone (looking forward to the next Cinco de Mayo, go Mexico!).

There's more to it than food, though. Autonomy and critical thinking are integrated into daily life, and critical thinking is a basic skill for doing science.

In addition to that, general environmental awareness is impressive! Kids are encouraged to be autonomous for all of their tasks from very early on in their lives. There are many

engineering-related games on playgrounds, and nature is well integrated with the urban environment. Doing research is also like being in the playground, you just have bigger and more complex toys. For us, it was great to find a place where scientific curiosity is cherished and ideas have space to grow.

It is truly an incredible thing to be in a place where we have a lot of freedom to develop our ideas with sound guidance. Our laboratory infrastructure is excellent, and most of the time, we get everything that we need in house (or down the street, considering that we are located on a scientific campus). We have access to a lot of resources, and time optimization is easier. Experimental set-ups can be made out of old systems from former PhD students. Sometimes, you can get new ideas from old solutions. For example, do you need a reactor that a group from another University owns? Just figure out the transport, and you can have it!

A key factor for science development is financial support. Germany values science, and there is a significant investment in science from a variety of sources! Both companies and the government appreciate the outcome of the research. It is clear that not just solutions are developed but also experts that will ensure that the wheel keeps turning. There are many strong universities to choose from, research institutes bridging the gap between academia and industry, and even companies themselves offering research topics. You just need to know where to look, but nothing to be afraid of. Your research family will always help you out if you need help looking.

Got any questions regarding a PhD in Germany? Feel free to reach out! You'll probably find us in our labs, trying to find new ways to clean water for the future.

# Post-pandemic Secondments: Changes, Adaptations, and Difficulties Conveyed by Joy

Nikoletta Tsiarta & Barbara Topolovec - ESR14 & ESR5

02/07/2021



Hello dear readers.

We are Nikoletta (ESR14) and Barbara (ESR5). Our PhD journey started a year and a half ago by working together at the ICRA institute in Girona. It didn't take us long to find out that we have more than "two girls from the Mediterranean" in common and soon, we became very good friends. On top of that, we found ourselves going on our long-awaited secondment trips at almost the same time (finally,) leaving our beloved Girona (and roommates). So, we decided to share our experiences and thoughts with you about our journey.

*Q1: What do you do during your secondment?*

Nikoletta: My second-host institute is the Faculty of Mechanical Engineering and Naval Architecture (FSB) of the University of Zagreb in Croatia. As you might know, my project focuses on the design of a hybrid system that combines ozonation with microfiltration using ceramic membranes with the aim to degrade micropollutants found in wastewater, like pharmaceuticals and antibiotics. Since FSB is specialized in materials, during my stay I'll modify a few commercial ceramic membranes by developing and depositing a very thin layer (only a few nm thick) of a material with catalytic properties, on their surface. That's how we aim to increase the degradation of these harmful substances from the wastewater effluent.

Barbara: During my stay at one of my secondments at the Institute of Physics in Belgrade (Serbia) I am performing experiments using plasma technology for the degradation of per- and polyfluoroalkyl substances (PFAS). In terms of wastewater treatment processes, many studies had shown that most PFAS are highly recalcitrant not just to conventional wastewater treatment, but also to many advanced oxidation processes (AOP). Plasma-based technology showed one of the most promising results and can be suitable for PFAS degradation so my job is to investigate what would be optimal conditions for a promising degradation of those compounds.

*Q2: Was it easy to reach your destination?*

Nikoletta: In terms of organization, I had plenty of support from my host institute (ICRA), to make all the arrangements required for the trip. Even though, I didn't have an exact day in mind because of some experiments I wanted to finish before my departure, in three days I had all I needed: tickets, a PCR test, and accommodation! In terms of traveling now, the truth is that it was not that straightforward like it used to be before the beginning of the pandemic. It takes more time to reach your final destination because of the lack of direct flights and you get more exhausted by the use of a mask and all the controls. However, when arriving in Zagreb I had my Croatian friends waiting for me at the airport, and that made me immediately forget all the tiredness.

**Barbara:** At the beginning of the PhD, Serbia was not that far away (direct flights of 2 hours were possible). But now, in these not so normal times, it was a bit of a challenge to find flights with a good connection, hoping without cancelation. Plus checking all these regulations, they like to change all the time. Luckily, with the support from my supervisors, I managed to arrange everything on time, flights, and accommodation.

**Q3:** *What do you like the most about the country (city) you are in now?*

**Nikoletta:** Well..Mediterranean meets Mediterranean! Croatia is a country where you can combine trips to mountains with trips to beautiful beaches and not only. You can also visit one of its 718 islands! Yes... Croatia has the largest archipelago in the Adriatic Sea with beautiful landscapes and a lot to discover. I'm currently in Zagreb which is the capital and largest city of Croatia and what I like the most is the chill-out vibe of the city. People are enjoying every second of their life here. The city is very safe, the food is amazing, the weather is nice, and trying pelinkovac, a typical drink is a must. Živjeli!

**Barbara:** Croatian girl in Belgrade, it almost feels like I went home :D. No language barriers, familiar culture, food, people, and their habits. Belgrade is a big, beautiful city with many places to visit. When in Belgrade, you will never get hungry because you can easily find a nice restaurant with amazing food and the view either in the city center or next to the river. There are also many parks, especially near the Sava and Danube rivers where you can walk or sit and relax. But what I like the most are the people who will greet you with a warm welcome. And with “domaća kafa”.

**Q4:** *Is it a good idea to have a joint doctorate and split your work into two or three different places?*

**Nikoletta:** Hmm, “Joint PhD”; it means that doctoral research is conducted “jointly” between two Universities, with two supervisors from each one. Before starting my PhD under the NOWELTIES project I could never think that I would refer to it so many times. In the beginning, you don't realize what that means until it comes the moment to face the bureaucracy from both universities. At this point, good communication and supervisors' help play a vital

role. It can be frustrating, but I see it as a journey of learning how to be adaptable, organized, collaborative, and responsive. If you ever get the chance just go for it!

**Barbara:** Moving to another country during PhD gives us a good chance to work in a different environment, to improve our knowledge, and meet new people with different experiences. However, splitting work while moving more than one time is quite a challenge. You have to “surround” yourself with patience and very good organizational skills in order to do your tasks on time. But, at the end of the day, I like the idea of a joint doctorate. I think it will bring me more opportunities and I will learn more about myself and my management skills.

*Q5: How easy was it to adjust your initial research plan after the pandemic?*

**Nikoletta:** Making good plans is crucial when it comes to research that needs to be accomplished in a short period. Following the initial plan may be ideal, however, plans never go as we wish! No one was expecting that a pandemic would bring so many changes to our lives. And that’s why it’s good when project plans are responsive to any unexpected events. Together with my supervisors, we tried to adapt my plan twice without changing the objectives by reducing my secondment to FSB and I believe it works pretty well so far. Even though it was difficult with the right guidance you can achieve more than you think!

**Barbara:** That was not an easy task. Most of my work was canceled because I was not able to travel, and the initial plan had to be adjusted a lot. And yes, in one moment, I did feel lost. But the “beauty” of this work is that you are not alone. With guidance and lots of support from supervisors, colleagues, and friends, I have found my path again. It is a sprint, to be honest, but it is a good one.

*Q6: What is your advice to the PhD students who need to change their plans due to the pandemic?*

**Nikoletta:** Of course, after the pandemic, a lot of PhD students are concerned about the completion and quality of their work. It’s normal that most of us felt anxious because we got out of our schedule. From my own experience, I would recommend you consider a different

research route for your project and reassess the priorities of your study together with your supervisors. And of course, to get some help from colleagues and friends to get your confidence back! Just move forward and do it smart!

Barbara: The sooner you accept the situation, the better, especially because you can't influence it. What you can do is think about the time that is given to you and how to use it. Changes are always difficult, but they can also bring something even better. Find your focus. What I have learned during this period is that health is important! Both mental and physical. And we should never forget that. The second thing is you can always ask for help. Colleagues, friends, supervisors, family. Even a small advice can mean a lot.

## Video: A Day in the Lab

**Michele Ponzelli - ESR12**

*09/07/2021*



Join our Ph.D. student, Michele Ponzelli (ESR12), in his daily routine in the lab and discover his recipe for removing pharmaceuticals from water.

**YouTube link**

<https://youtu.be/BEh2IWvlaYE>

## Transmitting Water Value, Easier Said than Done?

**Ana Paulina López Gordillo** - ESR2

*16/07/2021*

Every time we visit different places during a holiday excursion, a study exchange, or a professional trip, we can compare the living conditions. In my case, sometimes these contrasts made me value what I had at home and other times to wish for better conditions. Has this happened to you? Have you reflected on how privileged or restricted you are regarding water supply and accessibility? As my fellow Silvana wrote, what is your value of water?



Back in time, I see an old version of me in a town where sometimes the water reserve was finished for some weeks. The city hall had to offer potable water with tank trucks so the inhabitants could carry it and store it in buckets. Then you develop skills such as taking a full shower with less than one bucket of water! And we know that this type of situation happens elsewhere nowadays. Whether the reason is an unequal distribution of water, insufficient maintenance of the water pipes, or a drought season, we all need water daily, and these sorts of scenarios have an influence on the value of water to people.

When people are conscious of their accessibility to clean water, they often take care of its consumption and avoid contamination. In other words, the water turns more valuable to them. Fortunately, there are several ways for any person to take care of water with some minor changes in the daily routine. You can check here some tips given by my fellow Nikoletta. Whether you are unsure of the relevance and impact of applying these small actions, you can look at Nebosja's article and be surprised by the results that an individual can achieve.

Moreover, as NOWELTIES ESRs, we also contribute by broadening the knowledge of various water treatments regarding organic micropollutants (OMPs), which are environmental and health issues.

Regardless of the diverse range of ways to care about water, some persons remain passive or unsensitized. From previous experiences, I noticed that water is usually taken for granted, and even if people are aware of water scarcity and water pollution, those problems are perceived as external because they occur outside of the social circle or the proximities. Additionally, it can be challenging to change habits that lead out of the usual comfort. In some cases, the perception is that the focus and pressure to solve water issues should lay mainly in the industry since any of its actions would have a greater and faster impact than what citizens achieve.

As a sensitized citizen and a scientist in formation, I realized that it could be overwhelming to approach so many perspectives. While trying to transmit knowledge and the importance of taking care of water, I discovered that some actions could be seen as extreme in one place while in others not. For example, how much to turn on the water faucet to wash dishes. It is not perceived the same as using abundant water in a town where water treatment and reuse are efficient than where it is not implemented, and each extra drop is crucial to avoid hydric stress and costly bills. Unfortunately, these actions can be a constant source of tension.

Overall, we are all cohabitating on this planet, and taking care of water resources involves teamwork that will benefit everyone. I am sure that you would like to live in a place with less as possible water supply and sanitation problems.

What about you? Do you succeed in transmitting the value of water without being an extremist? How do you react when you see another person's water usage?

**Picture source**

<https://www.pexels.com/photo/person-holding-clear-glass-ball-1296265/>

# Why Water Quality in Serbia Needs to Improve?

**Amit Kumar**- ESR4

*23/07/2020*



Hello readers! It has been almost two years being a PhD student in Belgrade. In this week's blog, I would like to share a few pieces of information about water quality in Serbia.

In the beginning, let me give you a small introduction about the country itself. Serbia is a landlocked country, with about 92% of the land located within the Danube River Basin. Serbia is a small country in Europe with roughly 7 million people. Around 24% of people live in the capital city - Belgrade. Many people argue that Balkan countries are one of the most attractive destinations in the world. There is no doubt about Serbia. It has vibrant and unique natural beauty. The country has various national parks, stunning monuments, nature reserves, whereas cities are without the hustle and bustle. It has been recognized as a 159 World's Centers of Biodiversity.

Now let's talk about the Serbian water sector. Serbia has adequate surface water resources. Several rivers, such as the Danube River, the Sava, the Tisa, and some other small rivers, account for 90% of all surface water (162 billion m<sup>3</sup> per annum). The Danube and Sava Rivers are the main sources of drinking water in Serbia. In Serbia, surface water contributes to 27%

of drinking water, whereas 88% is used for all water consumption. According to the Danube water program, around 73% of groundwater is used as raw water for drinking water supplies.

In terms of service coverage, Serbia has better connectivity with access to piped water (about 90%) as well as flush toilets (about 93%). On the other hand, most of the tap water in Serbia is safe and drinkable.

However, water pollution is one of the main issues inside the country. The rivers are polluted by untreated wastewater from Serbia's cities. It was found that Serbia's capital city ends up with around 190 million m<sup>3</sup> of wastewater (which is almost equivalent to a volume of 60,000 Olympic-sized swimming pools) into the rivers every year. Furthermore, the effluents from industrial activity, agricultural activities, and household sewage are the main sources of wastewater. Around 33% of the city's population doesn't have access to sewage systems. However, just over 48% of Serbia's population is connected to sewage systems. Others rely on the septic tanks where it emptied by trucks and sewage dumped into the river. In Belgrade, the number of households connected to sewage systems is only 85%, which is less than in other European cities.

Do you know that none of the few Serbian wastewater treatment plants are located in Belgrade?

Belgrade is the only European capital city situated on the Danube River Basin without any wastewater treatment plant. In Serbia, only 28 towns have a municipal wastewater treatment plant, whereas some major cities do not have one. According to the survey from 2019, it was found that the whole country treats only 16% of its wastewater every year. The data also shows that only about 40 wastewater facilities are available in 168 cities and municipalities, and many are not operational. Due to the lack of treatment facilities, Serbia's industries just treat over 50% of their wastewater.

Various organic pollutants, such as perfluorinated compounds, organic dyes, pharmaceuticals, and pesticides, have been found in trace amounts in groundwater and rivers and their tributaries in Serbia. Several sources, such as untreated domestic, agricultural, and industrial effluents, are responsible for discharging the pollutants into water bodies. These

pollutants can have negative consequences on environmental and public health and affect lower productivity of agricultural land.

In order to tackle the situation, the Serbian National Environmental Strategy plans to improve the existing infrastructure, increase the number of sewage networks, and build more wastewater treatment plants in 20 to 30 large hotspot locations. The government of Serbia has announced that 70 municipalities around the country will get access to water purifying plants and sewage systems. The Belgrade city authority has an agreement with the international community to build wastewater treatment plants. There is a lot of work to be done in the Serbian water sector, and there are so many opportunities to engage, to connect, and to share knowledge, ideas and visions, to establish a vast network and global platform of water professionals related to all areas of the water sector, including water and wastewater treatment, groundwater, etc.

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# Research Careers: Our Perspectives

Danilo Bertagna Silva & Marina Gutiérrez Pulpeiro - ESR6 & ESR11

30/07/2021



Hi! We are Danilo Bertagna (ESR6) and Marina Gutiérrez (ESR11). In this joint blog, we would like to talk about the scientific career prospective in our countries of origin, Brazil and Spain, while working in the Faculty of Chemical Engineering and Technology of the University of Zagreb and the University of Ferrara, respectively.

## BRAIN DRAIN - Brazil

My generation heard through all of our lives that education is the key to a better life. Chances are that most of our parents had to make huge sacrifices to provide us quality education, so we could broaden our horizons and be the owners of our own future.

In Brazil, high-quality universities are public and free. However, admission is conditioned by performance in an entrance exam (called “vestibular”) in which students coming from private schools typically have a considerable advantage since public education before

University is shabby. The result is an invisible barrier disguised as “meritocracy” limiting poor people’s access to knowledge, college diplomas, and better-paid careers.

But nowadays, even an academic degree cannot guarantee a decent job for a living in Brazil. A process of deindustrialization has been accelerating since 2015, making most of the young engineers a redundant workforce who need to resort to other ways to earn a living. The situation of young scientists and researchers is just as worrisome. In the last two years, the government cut 30% of education and technology funding, which led to massive losses for the country. Most MSc and PhD students had to drop out of their courses since their scholarships and salaries were cancelled. Unfortunately, the average public does not understand that these students are providing a crucial service for the country’s technological development and should be paid accordingly.

This results in a massive brain drain: Brazil’s most educated young people leave the country because they see no prospects of a decent life there. While their workforce is being attracted to developed nations with an already established technological park, Brazil remains like a huge 19th-century plantation, acting as a low-value commodities exporter.

To overcome these challenges a scientist in Brazil has little option except going abroad; which certainly provides lots of experiences but also prives you from others. The scientific career can be very unpredictable and take you to places you never thought could go, but depends on short-term funding, contracts, grants and even the approval of the higher ranks of the (sometimes) archaic hierarchy present in Universities. Nowadays I find myself in a well-funded program which allows me to learn a great deal both personally and professionally. However, there’s always that uncertainty of what is going to happen once the project ends. The title of a doctorate should be the beginning of one’s scientific career, not the ending. But I feel that if I go back to Brazil, my value as a qualified worker will be underestimated because at this moment Brazil underestimates science as a whole, unfortunately.

The scenario is very sad because a highly educated and skilled workforce is a key aspect of a country intending to improve and grow. By repulsing and disillusioning its most talented and capable citizens, Brazil remains forever underdeveloped.

### IS THERE LIFE AFTER THE PhD? - Spain

The researcher's career in Spain is difficult, underrated, and has plenty of uncertainties. The lack of a marketplace in the public system and low interest for researchers in the public sector worry every young researcher in Spain. Many researchers consider that the effort put into their professional careers doesn't assure a stable position in the following years.

After finishing high school, students in Spain must pass a process called EvAU (Evaluation for the Access to the University). It consists of three days of exams based on the main subjects studied in the last two years of high school. It is slightly different for every region, and it turns out to be very competitive for highly demanded Bachelors. Indeed, the qualification for admission depends on the qualification of the students admitted in the previous year. In some cases, it is almost impossible to enter in highly demanded Bachelor's, and students must decide whether to try EvAU next year or to study a less demanded Bachelor.

Although most of the universities in Spain are public, there are some costs and taxes to pay for the enrollment, ranging from 600€ to 3,000€ approximately, depending on the Bachelor's degree and University. However, regional and national governments offer many grants to help students depending on their economic status.

Obtaining an academic degree in Spain, as in the case of Brazil, doesn't assure a decent job for graduated students, which feel forced to enroll in one (or even two!) Master's degree for a competitive curriculum. In this context, a PhD seems to be a good option to acquire expertise and competitiveness in the job market.

In 2019, the number of doctoral graduates for 1,000 inhabitants was 1.1, a very close value to the mean of 1.2 per 1,000 inhabitants of the EU. Spain is a country that produces high-skilled PhD students, even when national funding for research is low, and research groups make great efforts to perform high-quality research with low investment. Many PhD graduates work in the public sector since the number of researchers hired by the private sector is low.

Unfortunately, highly qualified PhD professionals are not hired since the R&D investment in Spain is less than 2% of GDP. In order to find a job, many young professionals end up leaving the country or changing their professional perspectives. There's an imperative need for

both public and private sectors to invest in young researchers, increasing their capacity to perform and develop innovative activities.

In the case of going abroad, there are some European initiatives that support research mobilities and career development (e.g., Euraxess). Indeed, this platform helped me and many other ESRs to find out about Nowelties project. While joining Nowelties is a good opportunity to contribute to our work careers and improve many skills, once a researcher would like to come back to their home country, options are very limited. Coming back to Spain with the gained experience doesn't assure a stable position once returned. Many scientists look for government grants for postdoc positions, but the limited number of grants and demanding requirements lead to many scientists to continue abroad for an undetermined period of time.

## OUR PERSPECTIVES

As many other scientists, we will continue our journey abroad for a while. While Danilo thinks less about coming back to Brazil, Marina expects to find someday a good opportunity to go back to Spain. Although there are many uncertainties regarding our future research career, we consider that wastewater treatment and micropollutants' pollution is a relevant topic for the future, and we are willing to continue contributing to it with our research.

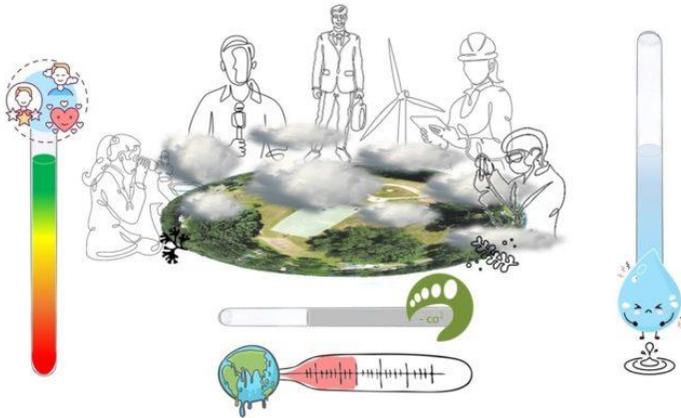
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# Act Before It's...GAME OVER!

**Barbara Kalebić** - ESR7

*27/08/2021*



Hi readers! I hope that you enjoyed this summer, that you had the opportunity to visit the sea, a lake, or a river, and felt the refreshment provided by water in combination with the sun. This magic combination relaxes even the tensest bodies and recharges our batteries to prepare our minds for the new tasks and duties that follow.

Since I believe that we are all still stunned by the heat and the holiday's impressions, in this first post-summer break blog, I chose to write about one complex world issue via an imaginary world. My plan is to bring the impact of global warming on water closer to you through something that entertains you and simultaneously makes you think a little - a video game!

You don't need to be fully concentrated but open-minded and aware that anything is possible.

Imagine yourself as a character in a video game whose aim is to balance a couple of parameters and find a sustainable way of managing the effects of global warming on water. You can choose between the following characters.

<b>Character</b>	<b>Challenges</b>	<b>Abilities</b>
Biochemist	- disruption of the match between organisms and their local environment	- develop new technologies that reduce the anthropogenic environmental footprint - reduce the industrial activities
Environmental engineer	- human destruction of the environmental balance in order to increase the quality of human life	- identifying key components and hot spots in the principal global nutrient and element cycles - understanding the biological and chemical processes in water bodies
Environmental lawyer	- changes in legal standards regarding environmental protection and new rules application difficulties	- knowledge of the law - represent clients in legal issues (clean technology, water law, climate change law, and land management)
Hydrologist	- extreme precipitation events and decrease in water quality	- measuring the properties of water bodies - studying public water supply issues, including flood and drought effects on water quality and wetland habitats
Journalist	- political barriers and danger	- Informing the public about extreme climate events, their consequences, and the ways the public can contribute to climate change mitigation - The power of media in tackling global problems

You can choose one character and play with bots or with your friends, so you will always have the possibility of cooperation and synergy of these five professions.

The general aim of the game is to create sustainable conditions on the Earth for both humans and the environment. One depends on the other, of course, and vice versa. The game is based on keeping the four main parameters that are listed below within normal limits.

1. Global air temperature (0.5 °C - 2.0 °C compare to pre-industrial levels),
2. Water quality (WQI\*: < 40 - poor, highest concern; 40-80 - moderate concern; > 80 - good, lowest concern),
3. Carbon footprint (< 2 tons per person a year),
4. Life satisfaction (red - not happy at all; orange - surviving; yellow - almost enjoying; green - fully enjoying).

In order to control these parameters, there are two different types of items that can be put or removed from the map. These items include the ones that absorbed CO<sub>2</sub> - trees, glaciers; and those that release it in the atmosphere - industrial plants, traffic.

Your every action will result in a fast environmental reaction, which will create a couple of different scenarios that you need to handle. You need to keep in mind the complexity of the environment, but don't forget the public requirements.

With climate change, rising air temperatures lead to higher rates of evaporation and plant transpiration, which can cause droughts. However, it consequently impacts the whole precipitation pattern, which provokes intense periods of precipitations and flooding.

Furthermore, the intense precipitation periods lead to increased runoff in the waterway that humans use for different applications and decrease water quality by pollution with pesticides and other toxic substances from the soil. One of the expected results of increased water pollution is algal blooms. Overgrowths of algae produce "dead zones" in the water where aquatic flora and fauna cannot survive because of the lack of oxygen and light.

But that is not all. Rising air temperatures increase water temperatures as well. Higher water temperatures are associated with reduced dissolved oxygen levels in water bodies which place significant, additional stress on aquatic animals.

So it is of great challenge to find an effective and available strategy to mitigate the global warming impact on water and simultaneously make people on the map called Earth as happy

as they can be. Maintaining all the parameters within limits keeps you away from GAME OVER.

The main question is still – how can you use your skills and knowledge to direct a world towards a more sustainable future for all?

Do you already have your strategy?

Then, let's play and see what'll happen!

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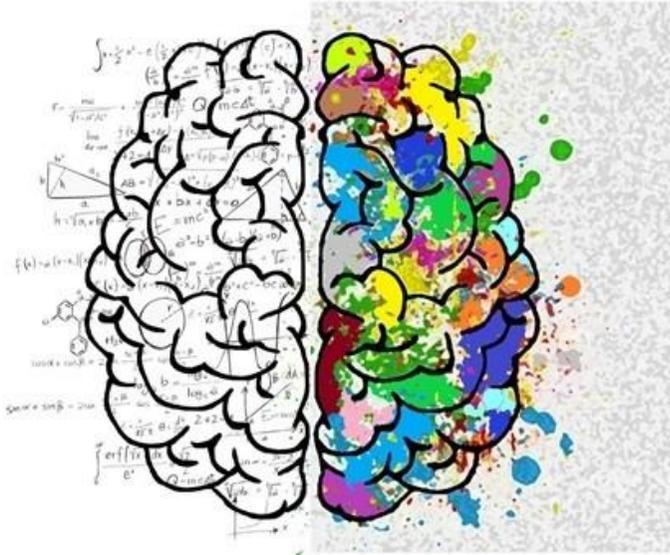
\*Water Quality Index

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# PhD Is More than a Title

Camilo Sánchez Tobón - ESR8

03/09/2021



Hi everybody, it is my turn to contribute to the blog, and this time I want to share with you a little about my PhD experience and how I end up in Zagreb.

Since I was doing my bachelor's, I was enrolled in a research group where I could work with PhD students and learned many things about sciences. At that moment, I realized that I want to pursue a PhD title in my professional career. As usual in Colombia, to start a PhD, people must have a Master, i.e., five years of bachelor plus two more years for the Master. However, doing a Master's in Colombia sometimes is more expensive than abroad. Therefore, my wife and I decided to start an International Master in Germany in cooperation with Poland. Apart from the knowledge we got, it gave us an incredible life experience. We knew new cultures, traditions, and more importantly, we met amazing people and made friends worldwide.

After the Master's, we returned to Colombia, where I worked in the industry while my wife started her PhD. After some time, I decided that it was time to continue with my PhD dream; therefore, I began to apply to every opportunity in water treatment technology. By coincidence, I found the Nowelties project. Among the different individual projects that the program offered, I choose the one at the University of Zagreb for two reasons. The first one was the topic because I have a clue about it from the bachelor experience; the second was to visit a new place and learn about it. Regarding the second reason, I feel happy to have chosen Croatia as a destination.

Before travelling, I had many doubts because it represented a significant change in my life. Mainly because it was the first time I would be away from my wife in 14 years. In the beginning, I experienced different and contradictory emotions. On one side, I felt excited about knowing new people, landscapes, and cultures. On the other hand, it was challenging to adapt to a new way of thinking and work. I used to be in a hurry all the time, and here people take things in a more relax and enjoyable way. Also, a feeling of loneliness grabbed me, especially when I got home.

During the first year of my PhD, let's say that my research was going as planned, which kept me busy and motivated, forgetting about sad emotions. However, the Covid-19 pandemic started, and to make matters worse, a strong earthquake hit Zagreb. I never experienced such a crazy situation. At that moment, I just wanted to drop my PhD and return home. I didn't feel satisfied with myself, and I lost in some way the purpose of my job. Seeing everything so hopeless and frustrating made me reflect on my life itself. This created an inflexion point, in which I decided not to worry too much about the future or no regret the decisions I made. I should just enjoy every day no matter what happens.

After this inflexion point, I started to do many things that I wasn't used to doing because of "lack of time". I began to read more, exercise, eat healthily, and enjoy the little things of life. After I experienced all these emotions and even similar problems that my colleagues had experienced during the PhD process, I could conclude that the PhD's final purpose is not all about the title. It is more about the journey and personal and professional growth we get. Every situation and every decision that we make defines us. As a final message, I want to tell you that

to overcome any complex issue, we just need to have a positive mindset and keep in mind that nothing is forever.

*“If your problem has a solution, then why worry about it? If your problem doesn’t have a solution, then why worry about it?”*

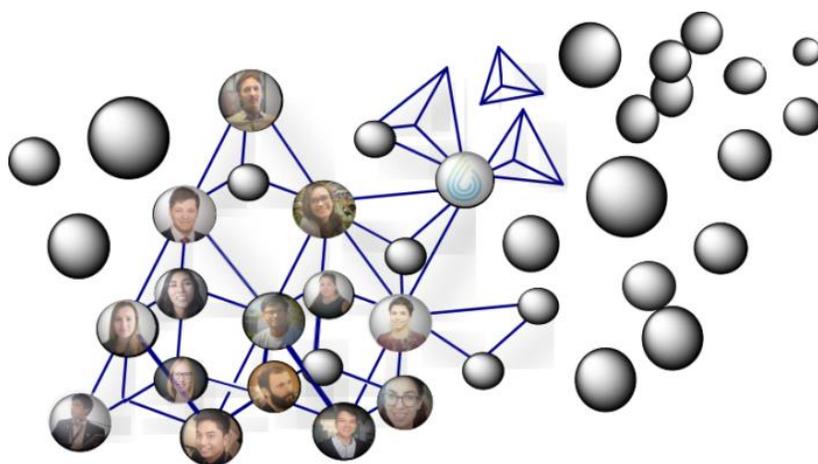
**Picture source**

<https://pixabay.com/es/illustrations/cerebro-mente-psicolog%c3%ada-ocurrencia-2062057/>

## (S)elective Affinities

Sabrina de Boer - ESR9

10/09/2021



In science, all observations perceived with our senses or the machines we build are the base for theories we create to understand and transform the world. The increasing knowledge and constantly refined theories make specialization into disciplines inevitable. I graduated in chemistry: the discipline of the transitions of matter.

The underlying rules of bonding between atoms, ions, and molecules eventually making up the world we live in have been studied, postulated, discarded, and refined for centuries. But in not much more than 100 years, our perception of matter led from the raisin cake theory to the possibility to calculate and predict bonding states with quantum mechanics equations. It becomes evident that it is impossible to master every aspect even in one discipline, forcing young scientists to decide which path to thrive on. For me, it became environmental chemistry paved with some nanotechnology.

The German novelist Johann Wolfgang von Goethe, who did not have to worry if his brain was made of raisin cake since he lived 100 years before this atom model, could still be

described as a polymath. He was not only educated but also productive in the fields of law, literature, and natural sciences. Since polymathy is impossible to achieve in our complex modern world, scientists nowadays form networks to support each other in developing new ideas and technologies. Innovations are often a result of interdisciplinarity. Similarly, our Network “NOWELTIES” brings scientists with different backgrounds and aims together to achieve new ways to synthesize and apply materials and processes for more efficient wastewater treatment.

In 1809, Goethe wrote the novel “elective affinities” (German: “Wahlverwandschaften”) describing the fate of a happily married couple which decides that both invite someone to live with them in their remote estate. Both get attracted to the invitee of their partner, leading to their complete disaffection and subsequent separation. Goethe explicitly adapts the latest theory of chemical reactions as an allegory to depict the transience of human bonds. What allegories would he have found to describe our modern ways of interaction?

Apart from the apparent benefits of networks, the term sounds somehow also lifeless, as if we as participants are building blocks to be glued together in the most efficient way to build up a working construct. Just like the functional (nano-)materials some of us PhD students are exploring. In modern Chemistry, unusual bonding states between atoms can be stabilized and studied in frozen gas matrices. These bonds immediately disintegrate when brought to normal conditions. Many connections we make during our nomadic life we try to conserve in social networks. But having moved between several countries, these bonds become more and more artificial and unstable as further you move away both in space and in mindset. (see also Danilo’s Blog)

The initiation of a human bond could also be described with theories from chemistry. Even though there is an affinity between two strangers, the initial prejudice against the unknown is the activation energy that must be overcome to form new bonds of friendship. (Regarding activation energy, Edwin has shared some thoughts too). Social distancing protocols act as an inhibitor of creating those bonds in a new environment. I felt pretty isolated in the first month of my secondment in Switzerland since it was almost impossible to interact with my colleagues and practically forbidden to meet strangers. Virtual bonds helped but were no complete

substitute for conversations with real people. The situation improved and I finally made friends. One of my colleagues told me that he stopped to relate too much to new students and workers arriving at the lab when I was about to leave. Too soon, they would be gone again. I can understand this strategy of self-protection, but as Danilo, I have to object.

Conversely to chemistry, the strongest bonds you create with people are not attributed to the most favorable state of energy, motivated only by selective egoism. Inspiring friendships are seldomly formed in optimized conditions, as a chemist would design them. They're the bonds that are hard to maintain and require effort beyond the selective liking of each other's stories in social networks that have the chance to survive the many transitions in life. Bonds formed despite the mutual awareness of their vanity. Conversely to chemistry, where the balance of masses and energy is a fundamental principle, even the dissociation of human bonds can leave both parties with more energy and knowledge than both individuals had before their connection.

## Chance of a Lifetime

Francis dela Rosa – ESR10

17/09/2021



Hi readers! It's my blog contribution time again!

I am very happy to share with you my marvelous experience during and after the 17th International Conference on Environmental Science & Technology (CEST 2021) in Athens, Greece. Finally, a hybrid (physical and virtual) conference is happening, and as slowly as it gets, physical interaction among researchers is coming back. For a young aspiring researcher like me, it was a really heart-warming experience to present my work at a conference. I thought that all of the conferences that I am going to attend would be all happening online. I miss the coffee break, lunch break, and live Q&A portion for presentations. Moreover, having an extra trip after the conference is a privilege, super thank you to my mentor and supervisor, Hrvoje! Hahahaha.

On the other hand, I would like to tell you that I have become sentimental these past few months. I think that for some time, I am fortunate to be part of NOWELTIES, and I also believe that in one year (or 1.5 years), the program will be done, and I will be really missing the experience. I am getting used to the feeling. It feels like having separation anxiety. Imagine that after one or one and a half years, the people you are working with will be gone because you need to leave and move on. It was a good experience and, at the same time, a bit sad since I will need to enter a new door of my life. These past few months, I became much more silent and thinking about my next steps in life.

Anyhow, for now, I just need to enjoy this moment ... a “CHANCE OF A LIFETIME”  
See you!



# Chapter Seven



## Navigating the Waters of Research Stays

**Michele Ponzelli** - ESR12

*24/09/2021*

The life of a young researcher is often peppered with travel. From short stays of a few days for conferences to periods of exchange and collaboration. It happens that researchers stay abroad for months, if not years.

You leave to discover, to learn, and also to change.

Before you leave, it happens that in the evening, after dinner, you sit down and think about what it will be like.

Months before, you begin to create expectations about the research group you will visit or be part of, how many things you might learn, and how many people will cross your path. You imagine yourself dressed in white coats wandering around the labs. You fantasize about what new tools you will use and what new methodologies you will put into practice to expand your knowledge and enrich your research.

And of course, there is also the tedious and often underestimated part of the experience abroad, but at the same time, the most time and energy-consuming. Searching for accommodation, filling out residence paperwork, checking that your sim works, digitizing your lab notes, applying for health coverage, choosing the proper clothing, and keeping it to a minimum. All of this, often, in a new language.

Research and life experiences abroad are a key-value to your growth. Leaving for a destination (where you have never been before) allows you to reset everything and set up new



thoughts and consequently new personalities. They are not only places where you have to confront yourself with new challenges from the outside world. But it is at the same time you are discovering yourself, getting to know yourself better, and gaining self-awareness. Just as the more you read research articles, the more it seems that you don't know anything (or at least that you are not up to date enough), in the same way, you realize that in each experience abroad, you add a piece to your life.

In my case, I like to discover, to push myself beyond my comfort zone. So I left Italy for Germany, then for Canada, then for Spain. Now I am back in Germany, knowing that I will return to Spain to complete my Ph.D.

After six years abroad, I started to take for granted that adapting immediately and entirely to the new country is a normality, and so I adapted. I must admit that each country I've lived in can bring out of me or make a specific part of me prevail. It seems that although you remain the same, with the same temperament, your character shapes and molds itself to the country you are in and the people around you.

I realized that there is no such thing as the perfect country. In my opinion, you have to be firm in your actions and not lose sight of the end goal.

**Picture source**

Photo by Garrett Sears on Unsplash

# Water Tastes Best Among the Stars

Nebojša Ilić- ESR13

01/10/2021



After seeing the recent call for new astronauts by the European Space Agency (ESA), I started thinking about water reuse and how different this concept is for us down on planet earth compared to those in the international space station (ISS).

In a man-made pressurized capsule floating in space 400km away from the surface of planet earth, every resource is valuable - especially a life-bearing resource such as water. When your life depends on your fellow crew members and the technology aboard the ISS, everything must run perfectly smooth, all the time.

So naturally, when you are a biological organism that can't survive longer than a week without water, you don't second guess the reuse water that originates from recycled toiled water, sweat droplets, and exhale mist. This closed loop is all you get.

Between visits by cargo or crew-carrying rockets, the station operates on a fixed amount of air and water. Resource recovery must therefore run continuously, efficiently, and without any leaks. Unlike sewer systems on Earth, where you can just flush, and the municipal wastewater

treatment plant takes care of the waste for you, the ISS must operate its own miniature wastewater treatment plant. Naturally, with much higher efficiency.

The Environmental Control and Life Support System (ECLSS) takes care of this aboard the ISS. The ECLSS was deployed to the ISS in 2008 to “close the loop” of water and reduce the astronauts’ dependency on consumables. It consists of a Water Recovery System (WRS) and an Oxygen Generation System (OGS). The WRS recycles cabin humidity condensate, urine, oral hygiene, hand washing water, and other Extra Vehicular Activity (EVA) to continuously support the activities aboard the station. It was designed to produce around 2 liters of water per hour, enough to support a crew of 6 at all times.

The WRS is comprised of two modules, a Urine Processor Assembly (UPA) and a Water Processor Assembly (WPA). In the UPA, a low-pressure vacuum distillation process is used to extract water from the urine. Due to the lack of gravity, the whole unit is mounted on a centrifuge to create an artificial gravitational pull - required to aid in separating gasses and liquids in the microgravity environment. The steam is then recondensed in a separate chamber, combined with the humidity condensate and further led into the WPA.

The WPA is designed as a three-step process. First, the filters remove particles and debris from the water, followed by a multi-filtration bed that removes organic and inorganic impurities via adsorption and ion exchange. Finally, a high-temperature catalytic reactor assembly removes volatile organic compounds and kills bacteria and viruses. Integrated conductivity sensors then test the treated water. Depending on the quality, the water is either cycled back into the WPA or sent further into the system for use. Finally, iodine is dosed into the water to prevent microbial growth (chlorine is too reactive to be stored and handled onboard).

Aside from providing fresh water for the crew’s needs, the WRS has the important task of providing clean water to the OGS, as seen in the diagram below. The OGS splits water molecules via electrolysis, generating breathable oxygen and hydrogen, the latter vented outside of the aircraft.

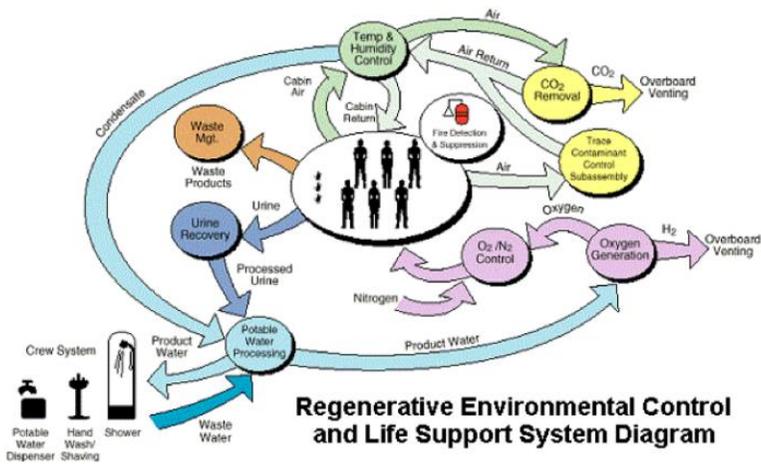


Figure 1. The interactions between the components of the ISS Environmental Control and Life Support System (ECLSS).

Many years of research have been invested into optimizing the ECLSS to increase the percentage of reclaimed water. Every droplet counts. And yet, back here on planet earth, we take water for granted. We look at the vastness of water that surrounds us and think, “How is it possible that we keep hearing about water shortages with all of this water around us?”. Even looking at planet Earth from space, we see a vastness of blue.

We are overlooking the fact that planet Earth is just a giant version of the space station. It is a very sensitive closed-loop system. The ecosystem that surrounds us is the only one we can turn to for the essentials for life. The water sitting in a glass on your table might be the same water someone enjoyed in the roman empire. In fact, the effluent of the water treatment plant near you is very likely released into a river upstream from another settlement. We all live downstream!

We might have the illusion of vastness, but the amount of drinking water available to us is only 2% of the total water on our planet, including glaciers and polar ice caps. The effects of climate change are felt already worldwide, with extraordinary droughts forcing nations into water reuse research and application. The natural water cycle cannot keep up with the growing demand of humanity. If we are to maintain this delicate balance, mother nature needs our

help. We must start putting in an effort to understand the technology behind water treatment better and consequently accept water reuse as a concept of our future. Besides, in most places, it would probably be a better-tasting option compared to regular tap water (\*).

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- [www.esa.int](http://www.esa.int)
- (\*)[https://www.youtube.com/watch?v=p-f\\_F3tE9rA](https://www.youtube.com/watch?v=p-f_F3tE9rA)

# Climbing the PhD Mountain

Nikoletta Tsiarta - ESR14

08/10/2021



“When life gives you lemons, make lemonade!” , this is the phrase it comes to my mind when thinking of how my PhD life looks like until now.

As all my other ESR colleagues, I am now finishing the second year of the ITN project NOWELTIES (ohhh time flies, indeed), and I cowardly take the step to enter the third and final year of my PhD studies! To me, it looks like a mountain, like Montserrat actually, this weird multi-peaked mountain near Barcelona. If you ever want to visit Catalonia, it’s a place where you should be. The rock formation is amazing, and the view from the top is even more astonishing.

Coming back to our topic, I feel that I am very much related to those peaks. Each one is unique, and the furthest you go, the more peaks you will see. I am now standing on the foothills and watching all the way up. I’m thinking about where to start and what path to take to make it to the top; 1,500 points and 5,000 routes are available! I know the road will be difficult (it’s all uphill!), but on the way, I will for sure find more people trying to reach the main peak. Everyone wants to see the view from the highest point. I told you, it’s magical.

Hmmm, I take a deep breath, and I start. I soon make a stop, and I think. How did I end up here? What has brought me in front of that weirdly shaped mountain? I look back, and I see the two years of my PhD life. They are waving at me, and they are encouraging me to climb that mountain.

These two years were not easy. But who said that a PhD is an easy thing? Many factors can affect the performance of a student; family issues, adapting to a new country and homesickness, lack of guidance, mental problems, and a lot more. (Believe me, PhD students are six times more likely to develop anxiety and depression than the general population!) But the important thing is that you still stand there, and you keep going. And it's what I am trying to do, all of us actually. The easiest would be to give up, but we are missing all those beautiful views from the top of each peak.

For long hiking/climbing routes, someone needs good shoes, comfortable clothes, some energy drinks or protein bars, supporting equipment, and of course, good company. And this is what the last two years offered me. All the necessary supplies to get ready for this trip.

I take a second breath, and I continue. I know that I have been dealing with a lot of administrative work (this is what a double degree requires!). At the same time, I was trying to progress with the technical part of my project. Now I feel that the time is running after me and that I need to speed up and reach the first peak, any! And then continue for the next and the next until I finally make it to the top.

I know I can make it, even though sometimes I reach valleys and stay there for a while. But it's just OK. Sometimes, you need this time for yourself. To evaluate and refill your energy tanks, not only physically but also mentally.

It's going to be a challenging route. But if I managed to stand in front of Montserrat, I think I can face Pyrenees (they are quite close) and then the Alps (a bit further away but still close!), and who knows? One day I can climb Everest! ☺

Don't be afraid of the mountains. They are full of surprises and exciting experiences. You need to put some effort to get there, but still, this is life. Just think positive and keep going.

And just let me finish with this, "If you want to go fast you go alone, but if you want to go far, we go together" enjoying our homemade lemonade on the top of the peak!

**Pictures source**

- <https://unsplash.com/photos/QKt8oQJa9WY>
- <https://unsplash.com/s/photos/lemonade>

# Sense of Belonging

**Silvana Ines Quiton Tapia - ESRI**

*15/10/2021*



For most of us in the Nowelties team, the secondments have started, and we are experiencing living in a different country, being in a different lab and interacting with different people. This is an exciting time in our PhD journey and, for me especially, was a long-awaited experience.

Aachen is the 6th city I have been living in for the last six years. Coincidentally, this is my 6th blog, in which I want to talk about the sense of belonging as an important aspect of mental health. Moving abroad, by definition, involves stepping out of your comfort zone. Consequently, this provides you the opportunity to have different perspectives, and traveling is not only an exciting activity, but it also involves being mindful of the emotional impact.

While adaptation is an important trait in our globalized world, there is a difference between fitting in and belonging. When we adapt to situations, places, or relationships, we evaluate the status quo. We adjust to being accepted, or as Michele mentioned in his blog, our character

shapes and molds itself to the country we are in and the people around us. Having the capacity to adapt is not only an essential trade as a travelling researcher but all throughout our life experience. We can quote Charles Darwin to remember the importance of adaptation: “It is not the strongest of the species that survives, nor the most intelligent; it is the one most adaptable to change.”

However, there is more than adaptation and fitting in. There is belonging.

The sense of belonging is a concept in psychology that can be defined as the experience of personal involvement in a system or environment to feel themselves to be an integral part of that system or environment (Hagerty et al., 1992). It is comforting to have an identified role and goals that gives you a sense of purpose from a professional perspective. However, there is also a sense of belonging from a social perspective.

Rene Brown, a research professor at the University of Houston, who focuses on vulnerability, emphasizes the conjunction of “true belonging” from a more holistic view. She eloquently affirms that “because true belonging only happens when we present our authentic, imperfect selves to the world, our sense of belonging can never be greater than our level of self-acceptance”.

From the two definitions mentioned above, we could say that the sense of belonging is a paradox undeniably linked to mental health. Ultimately, the more we exercise our authentic self while also making connections to others, the more we exercise our authentic self while also making connections to others. This is a powerful practice that helps us thrive. In fact, you can have a sense of belonging in you anywhere you go as long as you can make real connections.

In all my different trips, I got the fortune to run into kind and friendly people who helped me transition to my “new normal” and feel connected. However, I reckon the most important interaction is with myself. The more I accept myself, the better I navigate my relationships with people and/or the environment. My sense of “true belonging” is now a practice I have incorporated into my life. Although it is a work in progress, I believe it is being accelerated with the wonderful opportunity of living abroad and getting the chance to meet and discover different socio-cultural “normalities”.

**Picture**

Taken at Praia das Catedrais, Galicia - Spain (2021)

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# Horizons Through PhD Nomads' Eyes

Ana Paulina López Gordillo - ESR2

*22/10/2021*



To follow a PhD means to follow a path that generally takes several years. For some persons, it may take three years, and for others, five. In either case, you usually reside where the host University or company lies, and you may explore new horizons when doing a secondment. Students who live mostly in their home country have a different experience than those who relocate to study abroad. So how can it be living abroad for a long time?

The idea of visiting new places and getting to live in them is often exciting. It is said that the first months of living abroad include the “honeymoon” period when everything turns to be fascinating: new food, sightseeing, biota, architecture, traditions, persons, and so on. Your inner explorer and founder merge and let you live intensively. After some time, this sensation starts vanishing and normalizes once you are used to your new environment. This transition may be faster or slower, depending on one’s adaptability and personality. Still, until then, it represents a period of constant growth and change. Emigrating can speed up acquiring independence and open our minds to perspectives that we never thought of before. All the

process clears your thoughts, and you get to know yourself a bit more: you can confirm or define the type of lifestyle that you prefer; learn if you like to accumulate things or to live lighter, or even clarify if you would like to settle or become a modern nomad.

Besides the overall enriching experience, there could be an “other side of the coin” when you live a long time away from home. A degree of melancholy often arises for all the persons you were used to meet and all the things or activities you had in your home country. Despite videocalls and chats facilitating communication and virtual hugs, this is not equivalent to sharing space and time with people you are bound to. In addition, a difference in times zones complicates the flow of communication too. Nevertheless, the impact of this experience will vary depending on how attached and satisfied a person was in the home country before moving abroad. With all these nuances, the identity of one person can diffuse and starts to be re-shaped.

Many of the ESR had the experience of living abroad before becoming part of the team of Nowelties. Thus, the life experience of living abroad has been present for longer than the PhD. I am sure that each of us is getting impregnated with many valuable experiences from the cities that became our homes. It is mostly inevitable that a part of us stays behind when it arrives the moment to leave our cities to start a secondment. As it is said, we could develop a feeling of not being “neither from here nor there” but rather from nowhere or a little bit from everywhere. I am glad to feel identified and belong in a community of PhD nomads.

If you are curious to live for an extended period in another country, go for it. It helps learn as much from every obstacle and embrace a mixed identity development even when it may get complicated. Whenever you have the chance, take the time to visit your home country, encounter your roots and beloved ones, this may bring comfort and the impulse to keep going!

# Video: Removal of Organic Micropollutants from Water by Using Cold Atmospheric Plasma

**Amit Kumar**- ESR4

*05/11/2021*



Amit Kumar (ESR4) presents his research topic to remove organic micropollutants using cold atmospheric plasma jet under the NOWELTIES ITN project.

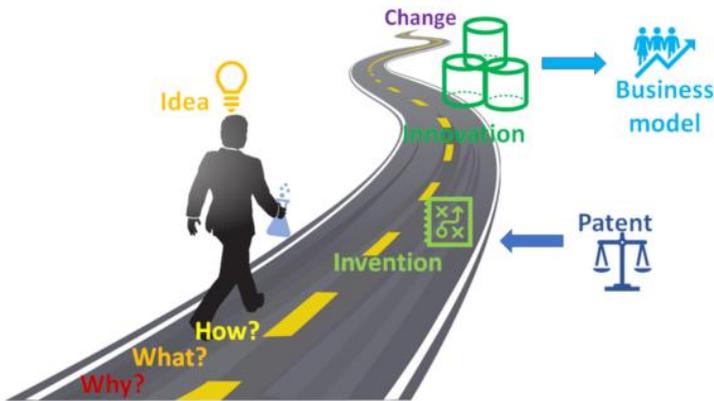
**YouTube link**

<https://youtu.be/u-aJvTxvHAY>

# From Belgrade to Business and Back

Sabrina de Boer - ESR9

19/11/2021



When you first arrive, Belgrade can be quite a confusing city: Narrow, picturesque alleys lead you somewhere, but certainly not where you expected. Eventually, you get carried along with the crowds on broad, somehow intimidating boulevards. Antiquated trolleybuses which offer better WiFi signals than German universities are making their way along the inscrutable net of overhead wires.

It almost seems that these wires are necessary to maintain a connection between this variety of architectonic styles, epochs, and the extremes of brimming wealth and furtive decay extending over the hills between Sava and Danube. We would have walked out on a grey rainy November morning being led more reliably by the pointing of helpful people than by the Cyrillic Street signs or google maps. Certainly, at least one of us would have arrived late to the workshop venue at the Faculty of Technology and Metallurgy of the University of Belgrade...

...If we wouldn't have had once again the joy to come together by wireless connections. I was not very sure what would expect me during this workshop, entitled "Entrepreneurship workshop: From an idea to its commercialization".

Most of us, including me, were so absorbed by our work in the lab, especially one year before our project will end, that we have not thought much about what steps it takes to bring an idea to an invention and finally to an innovation. In this context, an introduction to the process of filing patents by the Serbian intellectual property office could not be missing.

After this introduction, we had the base to get more into the entrepreneur thinking and what to consider when launching a new product according to the well-established business model canvas. After that, we were ready for lunch, but instead of *ћевапи* with Ajvar (which in fact is from Macedonia, as we were taught later), we nourished ourselves by foodstuff with even more controversial origin, be it from the university canteen or the depths of our fridges.

After the break, we had no time for lethargy since Vojin Šenk convinced us that the best way to solve a problem is to do it with child-like agility. And that for finding the right answers, you have to ask the right questions, in the correct order: Why?, What?, and How?

We did not talk about the When?, so we slightly exceeded the session's time limit. Still, we would have liked to challenge ourselves with more creative-thinking tasks, maybe even in smaller groups in breakout sessions. Instead, we had to get serious again and answer a short multiple-choice test to understand the topics we treated.

The rest of the afternoon was more in an open format: young entrepreneurs with a scientific background told us about the not always straightforward path they took to bring their idea to reality.

They told us about their success, but what was even more valuable, their failures, and how they moved on.

We learned about several innovation competitions and the importance of connecting with people having different scientific backgrounds. Be it in the respective Marie Curie Alumni Association chapter or more intensely by participating in a problem-solving competition which consists of working, arguing, eating, and sleeping several days with an interdisciplinary group in an unheated 4m<sup>3</sup>-cube in Swiss autumn.

We were left with the take-home message that it is important to face the crisis, to seek the discomfort, in order to develop new ideas and solutions, and to be persistent and confident along the harsh way of bringing them to reality.

The day ended with a virtual trip across Serbia, leaving us with a little tear that we could not meet there personally.

Altogether it was hardly possible to squeeze more information into this well-organized one-day workshop. I would have liked a session where we could interact as a group, especially since teamwork was one of the main features of successful innovation stories. Maybe a two-day course would have been more adequate to access a lot of knowledge and assimilate it for our future plans.

**Picture source**

<https://de.cleanpng.com/png-s4v88b/>

# Video: Alternative Solutions for Removal of Organic Micropollutants from Water

Barbara Topolovec & Barbara Kalebić - ESR5 & ESR7

26/11/2021



Barbara Topolovec (ESR5) and Barbara Kalebić (ESR7) present their work on developing new technologies for the removal of organic micropollutants such as per- and polyfluoroalkyl substances (PFAS) and antibiotics from water under the NOWELTIES ITN project.

**YouTube link**

<https://youtu.be/ORRspbekMW4>

# Impacts and Implications of Climate Change on Wastewater Treatment Plants

**Danilo Bertagna Silva** - ESR6

*03/12/2021*



Wastewater treatment plants (WWTP) have been playing a crucial role in keeping the environmental equilibrium and reducing pollution impact in waterbodies nearby highly populated centers. Nevertheless, these systems are vulnerable to the effects of climate change.

The most immediate effects would be changes in the water intake. In the case of severe floods and intense rainfall, groundwater infiltration and infrastructure damage would occur. Treatment performance would be affected due to inundation. Pumps would require more energy, and facilities built near sea level could be completely lost and submerged. In the case of intense drought periods, issues concerning smell would rise. Cavitation of pumps and damage to the pipe system could also happen. The increase in the average temperature would

affect the solubility of oxygen, the metabolism of microorganisms and biodegradation processes, compromising established levels of BOD. Effluents with higher toxicity character and eutrophication potential could cause severe impact in rivers, lakes, and communities.

These impacts are not merely technical, but they cascade to social, cultural, economic, and environmental areas. They can cause loss of assets, the disruption of local business, isolation of villages, water rationing, destruction of biomes, extinction of species, increased incidence of diseases, and mental issues. In the case of the indigenous population, such a severe change in their environment could cause loss of identity and forced migration.

Many of these impacts are already taking place and action will be required immediately to avoid worse case scenarios. Governments have to act globally and locally to make critical long-term decisions relating to their WWTP infrastructure. Global warming needs to be considered during the project and design of new facilities and the update of existing ones. Stakeholders' decisions need to be based on scientific evidence, using the best available information as tools for education and raising awareness campaigns. An open dialogue with the indigenous population should exist due to their unique relationship with the natural environment, socioeconomic deprivation, and increased susceptibility to disease. Indigenous knowledge and customs can be a valuable tool in responding to impacts of climate change, for example, through diverse approaches to adaptation, unique cultural governance and practices, and increased awareness of environmental change. It is essential to prioritize the most vulnerable, think in long-term adaptive policies using renewable resources, cooperate and collaborate with other countries, and consider the knowledge and experience of those affected and that they are involved in decision-making.

Disruption of water treatment systems and deterioration of water quality are just a few examples of the challenges we are to face in the next few decades if we keep ignoring these issues or choosing superficial solutions. There is clear and compelling evidence for the need to act now on climate change and adopt a precautionary approach because of the irreversible nature and scale of most of the risks involved.

**Picture source**

<https://unsplash.com/photos/Ac97OqAWDvg>

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# Time Flies

Francis dela Rosa - ESR10

10/12/2021

Hola Amigo y Amiga!

Hi readers! It's my blog contribution time again!

It's been a while when I was still in Croatia. I have met really amazing people there, and I consider it my 2nd home next to the Philippines. Now, I am in Girona, Spain, where my "secondment" studies are located. I met new people, and I am very much looking forward to working with them and joining them during parties hahahaha.

Actually, I don't feel lost or out of place. Spanish Culture is similar to the Philippines Culture, so in terms of food, beliefs, and gatherings, I must say that there are lots of similarities. Here in Girona, Spain, I will work for six months at the Catalan Institute for Water Research (ICRA). I will be involved in identifying the transformation products of my target pollutant (amoxicillin) using HPLC-Orbitrap mass spectrometry. For an early-stage researcher like me, it will be an amazing experience to work with new people and high-caliber instruments.

I look forward to the best!

Time flies...One year more, and our fellowship will be done. It feels that whatever I see now are just photos flashing in my head. I will really cherish the moments.

Well, I think that is all in my mind right now.

See you!



# A Nowelties Christmas Tale

Marina Gutierrez Pulpeiro - ESR11

17/12/2021



Ho ho ho! It's Christmas time! I am very happy to announce that we have prepared some Christmas stories to share with you.

All ESRs are starting the 3rd year of PhD studies, and I think that this is getting me emotional. I don't know; maybe the huge Netflix catalogue of Christmas movies also contributes to the mood.

Our lives changed when we got accepted in the respective PhD positions, and we decided to take this pathway. Let's say the truth. It has not been easy for most of us. There have been emotional, intellectual, and work-related ups and downs.

"Am I going to end on time? How can I find an answer to this phenomenon? Am I forgetting any deadline? Do I have to do something during the weekend?"

Those are just some questions that have come to my mind during these years. Living abroad, a new language, a new culture, new people, loneliness, hard work, and a pandemic are just some of the words we use when explaining our situation.

Since this PhD started, the way ESRs celebrate Christmas may have been changed, as Nebojša Ilić explains: “Generally speaking, Christmas since the PhD meant to choose either to celebrate solo or travel to see family. Luckily my home is not far like for some people on the project, but Covid has been active for the biggest part of our PhDs, so that was not an option most of the time, at least not comfortably and with a holiday spirit.”

Sabrina de Boer gave me a sincere response I think we can all relate: “The weeks before Christmas are always getting a little stressful, thinking about all the important people in your life who you want to appreciate with good wishes or a present. Anxiety mixed with joy flushed down with mulled wine and Christmas cookies.”

In my case, organizing Christmas before starting the PhD was just about choosing a flight to go back home every year. Now it’s about taking complex decisions. My heart is divided, and my free time is limited, so I am always struggling to choose where I will be during the holidays.

Living abroad during Christmas can be stressful, but still, there are some ESRs that are not scared about spending Christmas by themselves, as Daniilo Bertagna says: “The company changed all the time, each Christmas I spend with a different person or sometimes alone walking around and looking at the pretty lights.”

Indeed, it may turn out to be a completely new experience, according to Edwin Chingate: “I’ve been quite far from my family for the last two Christmas. The first time was the most difficult, I was very sad with a friend of mine, and we looked for a Latin party, some people as lonely as us. It ended crazy but amazing! It’s one of my best stories and extremely different from any Christmas for me before. The second time was different, but my ex-girlfriend’s family opened their doors for me, so it was a family environment again. A German family is not the same as a Colombian family, and they were not family! Traditions are different, and the mood is different. At least I got some gifts full of love that warmed up my heart.”

Christmas holidays can even result in very particular situations, like this one from Francis dela Rosa: “The first time I saw snow was during the Christmas holidays, and I was taking pictures somewhere along my way in Croatia. At that moment, the police approached me and asked for my passport and ID card, which were expired during that time. What I didn’t know is that I was taking pictures in front of the Ministry of Interior of Croatia!”

Indeed, sometimes it is not about how you celebrate Christmas but which mood you decide to have. Some people can stoke the fire wherever they are, and Barbara Kalebić is a good example of this: “I have not changed the way of celebrating Christmas; I have learned how to deal with it without people close to me and to sheard my Christmas spirit with the ones around me at that moment. I had an old neighbor for whom I prepared Christmas lunch and dinner and kept company during those days. I have also been on a video call with my relatives, so it was almost like I was home, and I spent these two Christmas without tears and sadness”.

Whether returning home or staying, these years have taught us the importance of sharing. While some ESRs realized that family is really relevant for them, others have changed their perception of family reunions, even reconsidering the concept of family. To capture this, I share with you the following testimonies:

Francis dela Rosa: “Since PhD started, I am celebrating Christmas away from family. I haven’t been to the Philippines since Sept 2019; it’s a bit lonely. This makes me realize that I need a family in the future since I am the only child (“Unico Iho”). In my case, a simple video call is enough for me to see my parents. Hopefully, next year, 2023, I will be able to go home.”

Barbara Topolovec: “Celebration of Christmas hasn’t changed much (...). What changed for me is that I love and appreciate those moments more than ever. Living abroad, far away from family and friends, at this time not knowing if we will be able to travel at all... I was beyond happy that I was able to see them all.”

Silvana Quitón Tapia: “In 2019, I took a short trip to Sant Gallen, Switzerland, to spend the holidays with one of my best friends of my master and her family. We had Glühwein, baked cookies, and played house games. I see her as more of a sister now, as it was a bonding experience. Her mom and I cried when we said goodbye. Happiness is multiplied when it’s shared.”

Camilo Sánchez Tobón: “Christmas has not changed in its form but in its meaning. Before the PhD I related Christmas to presents and festivities. Still, I didn’t internalize the idea of sharing within my family. Since I started the PhD, my perspective changed, and now I enjoy more every moment: a conversation, a cuddle, or seating all together around the table. In the

first year of PhD, my wife visited me, and we spent our Christmas holidays with some friends in Germany. The second-year was even more striking. After a year of being abroad, I had the opportunity to travel to Colombia. Meeting my family was very emotional, especially with my grandfather. I started to feel grateful for my life, and Christmas started to have a new meaning for me, a spiritual one.”

Christmas time is also a good moment for evading stress and daily-based routines. Coming back home may become an annual ritual to rest, recharge our batteries and prepare ourselves for the new year, or at least is the vibe I get from these ESRs:

Nikoletta Tsiarta: “I haven’t changed my way of celebrating Christmas since I was already for four years abroad. However, I would always go home for Christmas since I think it’s a season where the family needs to spend time together and, of course, to enjoy all the good yummys my mom prepares!”

Sabrina de Boer: “Regarding the celebrations, I had the big luck to be able to reunite with my parents. So conversely to the rest of the year, for me, Christmas is not the time to experience something new but to calm down after the pre-Christmas stress, make peace with the year which lays behind you and regain forces for the one to come.”

Barbara T.: “My holidays were the perfect time to reunite with my loved ones, spending time with them and, of course, take some time for me to rest and prepare for the next round of experiments in the laboratory.”

Anyway, even if you are planning to stay home and relax for a bit, life can change unexpectedly at any moment, as Nikoletta explains below:

“I like going home on Christmas. Family, good friends, good atmosphere, and of course good food! And no need to worry about yourself; mom does everything for you! It was a bit unfortunate last year, and I did not celebrate Christmas as usual. My house was hit by a tornado where the whole roof flew away, causing a lot of damages and making it unlivable. As soon as I heard it, I took the first plane and went to Cyprus to help and support my family. A week later, my parents and my twin sister tested positive for COVID with some mild symptoms, but the quarantine was necessary. Therefore, my younger sister and I moved to a different place

and spent two weeks (including New Year's Eve and New Year's day) separately from the rest of the family. The misfortune we had, however, did not stop us from celebrating Christmas through a screen with positive vibes and smiles!"

But don't worry! I asked to check if everything was fine now at her home, and her answer was yes. Fortunately, during this Christmas, I have only heard about some good news that I am delighted to share: some of the ESRs are finally reuniting with their relatives after such a long wait (I am so happy for you Barbara K.!). Here are some important declarations:

Edwin: "I was far from my family for two years and three months, until now. I'm still missing Christmas, but the vibe in Colombia is different. Streets are full of music and colors. Even with the pandemic, people work hard and live their lives very intensely. My family is different, and I'm not the same. I learned to enjoy traveling, and I wanted to take the chance to enjoy my country by myself, so this time is a mixture of quality time with my family and getting connected with my roots. "

Silvana Quiton: "I am travelling next week, and I can hardly wait. I'm so excited to meet my family, friends, my dog, even walking on the streets of MY city is a yearning!"

Ana Paulina López Gordillo: "I finally could return home during fall this year after almost four years of no stepping on Mexican territory. It was energizing, and of course, the time was short. I fully enjoyed it! I wish to go back soon."

Nebojša: "This year, my girlfriend and I moved in together and planned to celebrate it for ourselves in our new flat without pressuring ourselves to travel anywhere. So, we will use it for much-needed mental rest. This is the biggest value from it for us currently, slowing down the pandemic-driven constant delay in PhD plans and try to enjoy a bit of holiday spirit."

Since Europe is full of well-preserved local traditions, I wanted to ask ESRs if they have experienced any new Christmas tradition they didn't know. I received two main answers: The orthodox Christmas in Serbia and the so-called Caga Tió in Catalonia, being this last one something that personally changed my perception of this region when I lived there.

Amit Kumar explained that Christmas in Serbia is aligned to the Julian calendar rather than the Gregorian one, which means Christmas is celebrated on 7th January rather than 25th December. Mismatching dates of holidays in travel restricted times can be difficult. It may somehow contribute to losing weight as vacations, according to Nebojša. However, from the other side, Barbara K. had the perception in Belgrade that the Christmas period lasted longer than usual during her two years of PhD. She said to me she experienced a new vibe where there was no standard rush, “hustle and bustle”, or endless search for presents a couple of days before 25th December. Barbara K., as well as Amit, experienced for the first time Christmas in Belgrade, and they learned a lot about it, as Amit explains below:

“I have lived in Belgrade (the capital city of Serbia) for almost two years (...). I went to Sant Sava Temple (located in Belgrade), a massive orthodox church in the world. The temple is constructed with a very magnificent architectural style. The interior of the church is also very luxuriously decorated with golden champagne. I was fascinated by the beauty of the temple. During Christmas time, Serbians like to decorate the outsides of their houses, churches, shops with amazing lights, and sometimes even statues of Santa Claus. I have visited several places and tried a lot of Serbian dishes. It was a different experience than India.”

Regarding the Caga Tió, Barbara T. and Nikoletta explain that:

“It’s a character from Catalan mythology, can be found in many Catalan homes and on the streets. (...) The Tió is a piece of wood with a smiling face that is usually placed on a small table, and it’s covered with a blanket, preferably red (...). Tradition is that one gives the Tió a little bit to “eat” every night and usually covers him with a blanket so that he will not be cold. The story goes that children must take good care of the log in the days preceding Christmas, keeping it warm and feeding it (...). Underneath the Tió, people place some gifts and sweets (...). Participants should hit the Tió with a stick while singing a typical song for him to poop out the sweets and gifts on Christmas Eve.”

Many ESRs have been experiencing Christmas from the northern hemisphere for a while. It seems that festivities during winter are a whole new experience, such as seeing the snow for the

first time in the case of Edwin, Francis, and Amit. While some ESRs as Danilo and Ana Paulina, liked a lot the advent traditions for the countdown to Christmas, other ESRs had quite a revelation regarding the change in the Christmas mood:

Silvana: “Christmas for me was a big meal, all my family talking loudly and most important Christmas was SUMMER until, of course, you come to the northern hemisphere and all those Santa Claus and snow begin to make full sense. I was aware that baking cookies was a winter tradition, but now I relate it also to Christmas time as I had the chance to experience it first-hand.”

Edwin: “Winter in Germany is COLD! You go to a Christmas market and drink warm wine to get warm. I could enjoy that just in 2019, then 2020 was very sad. I’m coming from pretty much the south. We don’t have seasons, and my first time with snow was in Munich. Then I loved to see and walk through the mountains full of snow; this kind of beauty is still new for me. I’m not used to low temperature or light either, and sometimes it was just too much for me. You just turn sad in your room.”

Christmas can also be an opportunity to try something new and improve your cooking skills.

Silvana and Ana Paulina learnt to bake Christmas cookies. Moreover, Ana Paulina has learnt how to prepare seasonal Romanian bread that we would be delighted to try. On the other side, Sabrina de Boer has been determined to bring their culinary Christmas traditions where she goes. Barbara K. tried her best to prepare all her favorite Christmas recipes while staying alone in Belgrade.

When ESRs don’t want to spend time at home, travelling during the Christmas holidays has become a suitable option given our situation abroad. But what about this year? Let’s see what some ESRs have to tell us:

Nikoletta: “This year I am planning to visit Amsterdam and spend Christmas there. I have heard they are throwing a lot of fireworks on the sky, and the sky is becoming colorful! It will be my first time spending Christmas abroad, and I would like to see how other people celebrate

this time of the year. The good thing is that my twin sister is coming too. At least I will be feeling like home, even not being home!”

Edwin Chingate: “The main thing for me in holidays is that I’m earning Euros, so holidays in Colombia are super cheap for me! I’ve been exploring the Amazonas river because I love rivers. Since I’m doing a PhD in water research, this love just got stronger. Of course, I had to visit the strongest river in the world. I’m also exploring other parts of Amazonas. Since I don’t know how long it would survive, no one is taking proper care of that vast paradise. You wouldn’t find anything like that in Europe. Most places I’ve been in are farms or belong to someone. A wild place is something unique and priceless.”

And that’s pretty much of it. As you can see, two years of PhD offer quite good experiences to share. Anyway, we still have a new year ahead, and thus we have time to learn, share and care. I hope you liked the last blog of the year and Merry Christmas from Nowelties!

# Reflections on the Water We're Drinking

Edwin Antonio Chingate Barbosa & Camilo Sánchez Tobón - ESR3 & ESR8

14/01/2022



Today in our blog contribution, we want to discuss on the tap water we get and tell you some interesting facts.

- Do you know where it is coming from?
- What happens with it after we use it?
- Does everyone have access to it?
- Is it the same quality worldwide?

Before answering these questions, let us introduce ourselves. We are Camilo and Edwin, two Colombians living and doing a PhD in water treatment technologies in Europe. Camilo has been working mainly in Croatia and Edwin in Germany. Then we found each other in Girona (Spain) as a part of our project, where we shared some of our experiences living abroad.

Living abroad, connected by the same culture and passion for water and environmental protection, we decided today to talk a little about water, which is more than what we are drinking. You may wonder about where it is coming from and where it is going to, but water in the world is highly affected by human actions, and being aware of it, as citizens, would define its future impact in our lives.

Let's start with this fact: the total volume of water on our planet has always been the same and just recycled every day through the water cycle. This water cycle distributes the water worldwide in the form of rivers, lakes, aquifers, etc., from where we collect and treat it to make it drinkable.

Water is the universal solvent and it would always have several substances within. Two drops of water aren't the same! You can't drink water from the ocean because it's too salty. Tap water in different cities doesn't taste the same. Water from a river affected by human activity will change as long as it goes to the ocean. The water cycle is already affected by humans, as water contamination seems to be in our genes. Our impact on climate is changing the path of the cycle as well.

We might have a lot of water, but we can't use it all. More than 97 % of the water is already salty, and most of the remaining is locked up into the ice or the ground. Less than 0.03 % is available as freshwater. We are not doing very well with the good water. We think that we have too much in cities and use it for everything, assuming it will be as good forever. In farms, it goes through the lands while being absorbed by plants and catching all kinds of pesticides and substances that nature is not prepared for downstream in the river.

Before you take the glass of water you're drinking now, do you know where it is coming from? Depending on your city and country, it could be water from the dept ground, a dam in the mountains, or a fancy facility for seawater purification. There are also people without that privilege. They have to carry their water from a well, a river, or wait for the rain to fall on their roof to catch some. Apart from drinking, what do we do with our water?

After we use it, usually the (waste)water goes to the sewer, from where in some cases is adequately treated and then released into the environment. Further purification happens by

mother nature through the water cycle. In other cases, it is just discharged without any treatment, polluting even our water sources.

In developed and prosperous nations, we could say that nearly the entire population has access to tap water. Moreover, there are (waste)water treatment plants where water consumed in the future is protected. It is also observed that their legislation is stricter and focused on water reuse. Meanwhile, not all populations have access to water or sanitation systems in developing countries. Apart from the lack of a sanitation system, usually, there is no wastewater treatment, polluting lakes, rivers, and aquifers, and making the water access in the future even worse.

One of the contrasts that we have seen between a country such as Colombia and any country in Europe was looking at people swimming, fishing, and enjoying rivers in big European cities. Such unique and joyful activities are not possible in our country because the rivers that cross our big cities are thoroughly contaminated, almost deadly.

We think that part of the problem contributing to the lack of access to the water or sanitation system is corruption. Politicians in developing countries put the economy and “progress” before life. They prioritize mining (legal or illegal) over drinking water or allow big companies to discharge polluted water without any penalty. This kind of thinking will affect more the access to water and probably will trigger some water conflicts.

Unawareness of water and environmental care affects water access worldwide, creating water stress and scarcity. You might think, how the water scarcity in another country far away from my place could affect me? The fact is that everything in the world is connected, not just by the internet or transportation. As we said before, the water cycle distributes water worldwide, and the changes that happen in one hemisphere will affect the other. Indeed, we can observe that while some regions are flooding, on the other side of the planet have been affected by a severe drought.

We think that politics related to water will be just more and more important in coming years. No water, no life, and there are already conflicts happening worldwide. In our country, some people think that it is more valuable to do mining rather than ecological activities; Mexico

missing Colorado's river; unequal water distribution in the middle east; and just the fact that there will not be enough water for all of us with our current lifestyle\*.

Despite that the future looks hopeless, there are several actions that we as citizens, could implement to change the current situation and give a chance to the future generations to enjoy what we have. We could start pushing our politicians to develop and implement policies that protect the water and promote greener and sustainable economies. We could use products that save water and ban the companies that pollute the water and environment. We could reduce meat consumption and eat seasonal vegetables and fruits. We could take a shorter shower, etc. So, our future is in our hands, and the sum of all small daily changes will make it better.

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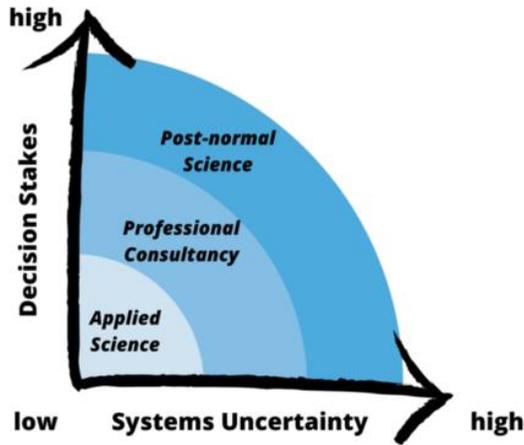
# Chapter Eight



# Post-Normal Science or Normal Science? The Progress Dilemma

Michele Ponzelli – ESR12

21/01/2022



We live in a world of progress.

Progress involves the rise of complex problems with countless parameters involved, leading to difficult risk estimation. Thus, it creates space for uncertainty.

The uncertainty provides the basis for the distinction between experts and laypeople.

In this distinction lies a communication problem where these two parties have difficulties understanding each other. This miscommunication was properly described in the recently released movie “Don’t Look Up”.

The two main protagonists (an astronomy professor, Randall, and his PhD student, Kate) attempt to warn politics and the general public of the imminent danger of a comet impacting the Earth, which will extinguish humankind. However, the two scientists initially based their communication style on facts and observations rather than on the impacts on people’s lives and humanity’s future.

The contrast between hard values (i.e., facts) and soft values (i.e., subjective perceptions) is a recurring theme even in today's COVID-19 pandemic. Or as well for climate change, nuclear energy, and the list can go on and on.

So, the sanitary, environmental, or even disaster risks become breeding ground for political and cultural clashes.

According to post-normal science (PNS), these are all examples that fall within the specific situation where “facts are uncertain, values in dispute, stakes high and decisions urgent” [1].

The “normal” science is seen as problem-solving driven, where experts can adequately achieve a solution since physics laws can describe nature.

For PNS, this is not enough: it requires science to acknowledge different perspectives beyond the facts.

For this reason, alongside the applied scientist or the professional consultant figure, there may be that of the PNS researcher.

This figure will not challenge the professionalism or knowledge of the experts, but the quality of their work in these new contexts [1].

Such PNS researchers will not be just experts, closed in their sphere of confrontation with their peers, rather researchers who know how to communicate the message to a broader audience. On the one hand, they will have the expertise to understand and critically assess the problem, and on the other, to establish an open dialogue with all the parties involved.

They will facilitate the understanding of environmental issues in their communities and ultimately improve society based on transparency, interpretation, advocacy, and participation [2].

The same principle applies to efforts made towards sharing knowledge, such as encouraging the use of Open Access. Thus, allowing citizens to be involved in the scientific process and discoveries [3].

Science remains the tool to investigate reality, i.e., the facts, not to determine the truth. Problems involving values and social and political aspects cannot be solved by science itself.

## Picture

Adapted from S.Funtowicz and J. Ravetz, 2003. Post-Normal Science.

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# Imagine If - How pollution made its way into every corner of our lives

**Nebojša Ilić**- ESR13

*28/01/2022*



In my previous blog post, I shared with you my amusement with the marvelous piece of engineering that makes extended missions in space possible. This incredible machine located on the International Space Station completes a complex system that allows for an almost perfectly closed water cycle aboard the space station, cherishing and recycling this valuable resource.

So, how is it that while astronauts can recycle a fixed amount of water in space practically forever, we down on planet earth keep hearing about new species of dangerous chemicals and pollution issues almost every day? To answer this question, we must first identify what kind of wastewater the astronauts face in space. I wrote more elaborately on this topic in the previous post, but in essence, there are no complex activities in space, and the produced wastewater is

mainly due to the anthropogenic activity aboard the space station. As such, the generated wastewater carries organic matter and an overall predictable and easily treatable.

Unlike the space station, we live complex lives on earth surrounded by traffic, industry, agriculture, and various other activities that introduce different pollution into the environment. And even though we might observe different water bodies around us like rivers, lakes, oceans - in essence, all water on our planet is just one big puddle, forever circling around various forms. This life-bearing resource conveniently comes with many properties that make it useful in all kinds of anthropogenic activities. As such, we expose this delicate ecosystem to pollution and abuse daily for our own personal gain. The significance of this problem has been growing exponentially in recent decades, both due to a sharp increase in the global population and due to technological advancements. New manufacturing processes and chemicals are constantly introduced, which in turn bring unknown pollution issues with them.

For example, a factory that produces Teflon products used PFOA as the main chemical in the production process for a long time before switching to new-gen PFAS. PFOA is a member of the PFAS family, a class of pollutants I wrote about in previous blog posts, known for its recalcitrance and ubiquity. Just imagine, this hypothetical factory has been active and using these chemicals since the 1960s, and kept discarding PFOA-contaminated water directly into rivers due to lack of knowledge (a debatable statement) and regulations. Decades of uncontrolled release combined with the fact that this chemical does not degrade at all means that we can find PFAS anywhere and everywhere.

In fact, a study conducted by the company 3M could not find a single blood sample from all the samples taken around the world that DIDN'T have PFAS in it. You can read extensively about this whole story here [1]. Sure, the public is slowly catching up, scientific communities are rallying behind this global pollution issue, regulations are being set in place. But imagine if this hypothetical company was aware of the adverse effects these chemicals have on the ecosystem and the health of their workers. And imagine if they decided against publishing these findings for decades because this product was bringing in billions in revenue. What a scary world that would be, right? Well, that's exactly what happened. Which brings the question - Is this hypothetical non-stick pan worth all that?

Now *imagine* if our regulations were the other way around. If, by default, no company or public entity was able to release chemicals into nature unless proven to be harmless.

This approach would incur higher capital and operational expenditure for companies. This quantifiable higher expenditure is likely just a tiny fraction of the complex cost accrued because of the release of many toxic chemicals, impacting the health of the ecosystem, wildlife and human population globally. The Coca-Cola company basically invented Life Cycle Assessment when they needed an answer to the question that was the environmental (and economical) impact of switching from glass to plastic bottles. Perhaps this is just the right incentive to start shifting the mentality - dumping waste in a river does not make this waste someone else's problem. It makes it everyone's problem.

Until the day comes when the politicians elected by the people start serving the people, and the health of our planet is cherished more than the thickness of our wallets, we need to choose carefully where we place our trust and whom we support with our money. Given enough time, a silent stream of water can cut mountains.

#### **Picture source**

<https://pixabay.com/it/photos/stagno-acqua-cartello-dead-end-3776437/>

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# From “single-use” Water to Water Reuse

Nikoletta Tsiarta - ESR14

11/02/2022



Take a moment to recall all the small things you do when your daily routine begins.

When we open the water tap to wash our face, brush our teeth, or even drink, flush the toilet, take a shower or put a laundry, water is readily available for our use. We don't have to fetch it from a well or carry it for miles beforehand, which is still the case in some countries.

We use this drinking quality water for all purposes, even those that would not normally require water of such high-quality standards. We don't overthink where it comes from, nor about where it goes after disappearing through our drain. Therefore, most of our water is so-called “single-use” water. After using it, the water turns into wastewater and is drained through the sewerage system into the wastewater treatment plant (WWTP). WWTPs are equipped with adequate technology in order to treat wastewater to a quality that is not harmful to the environment. After that, treated water is discharged into a stream, following which it will sooner or later end up in the ocean, and it is, therefore, lost for further human use.

Recently, the stress on the naturally available water resources increased drastically due to climate change and growing demand in different sectors. For example, poor rainfall stresses natural water resources, especially in the Mediterranean region. Consequently, some regions face severe water stress and cannot cover their demand with the naturally available water resources. According to researchers, 17 countries worldwide, including Cyprus and Spain, face “extremely high-water stress”, which means consuming more than 80 percent of their available surface and groundwater resources in a year.

This is where water reuse comes into the picture. The reclamation and reuse of single-use wastewater describe the effort to intensify the state-of-the-art wastewater treatment to a level that can be reused for purposes that do not require quality drinking water. The agricultural sector, for example, has a very high water demand. Still, the required water does not necessarily need drinking water quality, as long as it does not contain compounds harmful to the environment or human health. On the contrary, reclaimed water even includes nutrients that can be beneficial for plant growth. This is why extensive research has determined the agricultural sector’s highest potential for water reuse application (Alcalde-Sanz & Gawlik, 2017; EC, 2016).

The identified main barrier, keeping water reuse application in the EU well below its potential, was the lack of an EU-level harmonized quality requirements for water reuse. This lack was sought to be mitigated by introducing EU-level minimum requirements for agricultural, industrial, and energy water reuse purposes in the new water reuse regulation (EU 2020/741). But the implementation is strongly dependent on public acceptance and the available capacity of treated wastewater in each country.

For example, my home country Cyprus is the European country facing the most severe water stress. Still, according to the Water Reuse Europe Review of 2018, Cyprus already reuses 97% of all water that enters the centralized sewerage system. However, only villages of more than 2000 inhabitants are being connected to the centralized sewerage system.

In this case, it is important to consider the implementation of decentralized water treatment systems. These systems include a small-scale water treatment unit and a direct reuse application on-site, directly where the wastewater is produced. One of the key advantages is that they can

be tailored to the specific demands of each community, taking into account the financial capacity for investment, (waste)water quality and quantity, as well as soil and land properties.

Cyprus is a country whose economy is mainly supported by tourism. And providing a decent environment for vacations is of high priority. Water shortcut events will undoubtedly negatively impact the island’s economy. So, if we don’t act fast and smart, water shortcuts might be our new normality. Therefore, hotels can be equipped with those systems to tackle the high-water pressure caused by the tourism sector’s demand during the summer months and use recycled water for garden irrigation.

Single-use water should no longer be an option!

#### **Picture source**

[https://www.freepik.com/free-vector/people-caring-about-world-environment\\_3460380.htm#query=water%20reuse&position=16&from\\_view=search](https://www.freepik.com/free-vector/people-caring-about-world-environment_3460380.htm#query=water%20reuse&position=16&from_view=search)

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# Two Years of PhD and...Counting

Ana Paulina López Gordillo - ESR2

18/02/2022



Two years and three months have passed since I started my PhD.

I often forget about this because it feels like everything started not so long ago for me. I recently watched a video about time perception and its alteration and it helped me understand that impression [1].

Generally, every time we are busy or enjoying an activity, we feel that time passes fast. The contrary is when we are bored or do something not enjoyable. However, we may also perceive something long-lasting daily, but it seems to pass fast when thinking on the long term. When we repeat the same routine during the week and weekend, and there is no difference between day and night, we are not generating new memories. The time seems to pass slowly.

New or different activities promote new memories, and our time perception is balanced. For instance, when we go on holidays and do several activities different from our daily routine, the time perception changes and fastens. Most probable, when you do a PhD, and you are very

busy, and without new extra activities, this can lead to the simultaneous slow and fast time perception.

Every time I look back and feel that I do not have the progress that I wished for two years and three months, I recapitulate. It is already challenging to finish a PhD in 3 years, and the pandemic and several unexpected issues increase the difficulty. This can push any PhD student to give 200% of effort and to have an altered time perception.

The time of the doctorate that passed had taught me how much I could go beyond my limits and how much I could achieve even when I did not feel completely ready to continue. I imagine that many doctorates have ambitious goals and high expectations at the beginning of their doctoral studies. Still, we should cherish all the small achievements, even if they are not the expected results. In the end, step by step, we approach our goals.

After two years and three months, I finally started my secondment at the University of Santiago de Compostela. I believe I am one of the last of NOWELTIES ESR who starts this awaited moment that requires time and effort before the actual secondment. I admire all my fellows for succeeding with all that represents to move to another country while still working on the project: the administrative paperwork, packing, finding a new accommodation remotely, in my case, trying to find a subtenant, and finally moving. And this is something that awaits us once more to return to our host university.

In Santiago, I will be again in touch with my mother tongue (Spanish), and I will learn new molecular techniques that will complement the experiments from Aachen. Everything is going well, the food is fine, and the people are friendly. Sometimes I feel a bit nostalgic: the last time that I was here, I met my fellows during the Training School of NOWELTIES, but it is exciting that I will meet them here again in June during the Micropol Conference.

As Francis said, time flies, so let's keep our head up and going forward. Every day and new experience count to reach the finish line of our PhD!

#### **Picture source**

<https://www.istockphoto.com/de/vektor/flache-webseite-design-vorlage-der-zeitverwaltung-homepage-oder-header-dekoriert-gm1175302204-327239005>

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## The Scientist

Edwin Antonio Chingate Barbosa - ESR3

25/02/2022

Today I want to share with you some of my favorite music, and you may wonder: wait! Wouldn't this blog supposed to be about science? And my answer is yes. I want to talk about Coldplay's song "The Scientist", which I used to think was a love song. A song you can sing to your partner, but you can also read it as a love song for science. Not only about the good things, but also the shades that make it shine.

Even though Martin (the Coldplay's singer) stated in an interview: "That's just about girls." [1]. Art is a construction between the artist and the observer. An artist might try to say something based on their own experiences, but the observer would interpret it within their own, as well. Even if the artist explains what they tried to do, it's not their creation anymore, and new artwork will be created every time someone appreciates it.

Let's say this is a song from not just a scientist but a researcher to science. It's a love song that describes a strong passion for what you are doing. Now, I'm gonna tell you what each line means for me at this point of my life, after two and a half years doing my PhD. Come with me:

*Come up to meet you, tell you I'm sorry  
You don't know how lovely you are  
I had to find you, tell you I need you  
Tell you I set you apart*



This line describes those moments when you feel like quitting because you're not good enough for the pathway you choose. In the end, you can't give up because that's your life. It's all you think about, and you need to continue. You will face the frustration and come back stronger.

Insecurities are quite common, and many researchers experience impostor syndrome at some point in their careers. Common statements such as "a PhD is only for the best ones", can feed your insecurities. You will start comparing yourself with only the most successful ones and wondering why you can't achieve the same. However, from a statistical point of view, the number of factors and variables to consider regarding what a person or a scientist is, makes any comparison non-sense. How do you define who's the best?

How many skills and knowledge do you need to be a good researcher? You need to have deep knowledge of the basic science related to your research. You need to be a good reader to keep updated on your field trends. You need to be a good writer to share your work with your colleagues worldwide. You need to know how to use several software to process your data. You need to have some clues on other fields to feed your creativity. You need to be creative in designing new experiments and interpreting your data. And the list can continue because your research is linked to who you are. Still, psychological factors could affect your productivity and hide all your skills.

A career in science shouldn't be a race, but a chance to share your passion with others. Mindset and results are different when your focus is to understand what mother nature is trying to say instead of becoming the best.

*Tell me your secrets and ask me your questions*

*Oh, let's go back to the start*

Back on track, you want to explain your observations and understand what's happening around you. Every forward step will give you more questions and make you re-think your previous assumptions so that you may take two steps backward. You should double or triple-check everything.

*Running in circles, coming up tails*

*Heads on a science apart*

Sometimes you don't know what's happening. Your knowledge pool is not enough to face your challenges. Things can turn far away from what you were expecting, and your head just exploits.

*Nobody said it was easy*

*It's such a shame for us to part*

*Nobody said it was easy*

*No one ever said it would be this hard*

It's not easy! And that's important to feed your passion. Easy things are boring, but sometimes you feel that's too much. Maybe the feeling of being lost is what makes so magical the moment when everything fits.

*Oh, take me back to the start*

Just breathe and take a step backward. Check what others did before in similar situations. Look at the most basic processes behind your challenge, and think about possible sources of interference. Most of the times, you will realize that you were missing only a tiny detail.

*I was just guessing at numbers and figures*

*Pulling the puzzles apart*

Understanding what mother nature is telling you is like a puzzle. You will get some experimental data and try to explain what you can see with your previous knowledge. You have to guess and make assumptions because most systems are extremely complicated, and you can't address all factors simultaneously.

*Questions of science, science and progress*

*Do not speak as loud as my heart*

We can find two kinds of motive forces for scientists, external and internal. While the first one refers to applied science, research that would directly use for society; the second one refers to the one driven by curiosity and passion.

*But tell me you love me, come back and haunt me*

*Oh and I rush to the start*

You want to get some feedback. You want to understand what's happening and see the pieces of the puzzle fit. You want to get some love back from your science.

*Running in circles, chasing our tails*  
*Coming back as we are*  
*Nobody said it was easy*  
*Oh, it's such a shame for us to part*  
*Nobody said it was easy*  
*No one ever said it would be so hard*  
*I'm going back to the start*  
*Oh ooh, ooh ooh ooh ooh*  
*Ah ooh, ooh ooh ooh ooh*  
*Oh ooh, ooh ooh ooh ooh*  
*Oh ooh, ooh ooh ooh ooh*

So, if things are not going well, that's part of the learning process. Just take a step back and  
Oh ooh, ooh ooh ooh ooh

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# Role of Pharmaceuticals on Water Pollution in India

**Amit Kumar**- ESR4

*04/03/2022*



In this blog article, I would like to talk about the impact of pharmaceutical water pollutants on India's current environmental and human health problems. Also, I would like to share the information regarding the role of government and some ongoing projects and partnerships to tackle the situation.

India is one of the biggest manufacturers of pharmaceuticals worldwide. It has been estimated that India is the world's third-largest producer of pharmaceuticals, in which about 3000 drug companies and about 10500 manufacturing units are involved. Pharmaceuticals production has been considered one of the most polluting industries in various parts of India.

Varieties of pharmaceuticals have been detected in the surface, ground, and even in drinking water in many Indian cities due to the discharge of waste effluents. The pollutants majorly enter water bodies due to the following sources: pharmaceutical manufacturing plants, hospitals, wastewater treatment plants, etc. As a consequence, they cause adverse effects on land, water, food, and people's health. It has been estimated that about 60000 newborns die

annually in India because of multidrug-resistance infections, where pharmaceutical water pollution with antimicrobial drugs is responsible for that.

In India, the dominant pharma industries are located in the city of Hyderabad (known as the ‘Bulk Drug Capital of India’). It accounts for more than about 800 pharma/biotech units. These pharma industries play a crucial role in groundwater and surface water pollution. According to the survey, local people argue that the groundwater is highly contaminated in the regions where industries are situated. The water from village wells is unsafe to drink (can have nausea and immediate diarrhea), and the groundwater is not safe for agriculture irrigation. The report from various pharma sites revealed that concentrations of pollutants in some samples were higher than maximum regulatory limits.

A range of emerging contaminants pollutes the rivers near the pharma sites. For example, it was reported that the “Musi River” (which flows through Hyderabad, a city with almost seven mln. inhabitants) is highly contaminated with drugs from pharmaceutical companies. The concentrations were about 1000 times higher than rivers found in developed countries. When these pharmaceutical clusters come in contact with pathogenic bacteria, it causes harmful diseases in humans.

The government of India is taking action against the discharge of pharmaceutical residue in wastewater. They proposed a new limit regarding the concentration of residuals present in wastewater effluents released by the pharmaceuticals industry. Around 86 of the 220 bulk drug makers in Hyderabad have zero liquid discharge facilities, which showed that they could recycle almost all the liquid effluent. However, the only waste they produce is solid, which is incinerated or buried in landfills; hence they do not harm a lot. According to National Action Plan for Antimicrobial Resistance 2017, it was proposed to tackle the problem related to limits on antibiotics in industrial waste.

Several organizations have been working towards setting up water treatment systems to help pharma firms. India’s Central Pollution Control Board (CPCB) has introduced guidelines to various pharma industries to achieve zero liquid discharge. The Ministry of Environment, Forest, and Climate Change has also announced that industries must install devices to monitor the effluent continuously.

According to the survey, it was estimated that the zero liquid discharge policy could influence areas that are suffering from groundwater scarcity (10 states in India: Uttar Pradesh, Punjab, Delhi, Gujarat, Rajasthan, Haryana, Madhya Pradesh, Andhra Pradesh, Maharashtra, and Jharkhand) due to industrial water pollution.

Overall, the successful implementation of innovative water treatment and sustainable water management systems could provide a solution related to future wastewater issues in India.

#### **Picture source**

<https://pixabay.com/illustrations/medications-capsules-pills-medicine-1628372/>

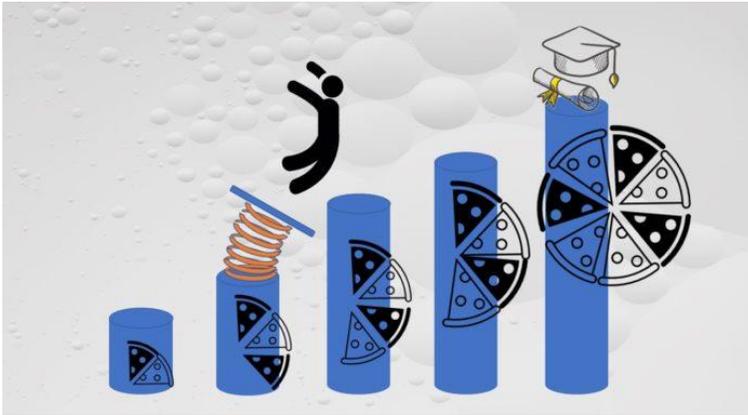
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# PhD: All You Need Is...A Good Pizza Recipe

Barbara Kalebić -ESR7

11/03/2022



PhD life can often be confused with student life by people who are not related to it. It can seem like a good slice of pizza for someone who has no experience in PhD studies. A slice that has a well-baked crust (eight working hours per day), a juicy tomato sauce (social life), a tasty melting cheese layer (proper sleep), and fresh-made toppings (success) as you like. However, being a PhD student includes countless hours of reading, writing, experimenting, thinking, planning, more reading, learning, and solving problems accompanied by a couple of worrying hours weekly. Now, you can see that a PhD looks more like a pizza with too much a bit of everything, and when having even a small bite, you inevitably get a stain on your shirt!

So, today I am gonna tell you what my slice of pizza looks like.

*CRUST - I can make a difference through research.*

The most important part of the pizza is the crust. It needs to be well kneaded to get a decent base, so all the ingredients later keep together. At the beginning of my PhD studies, I had to spend many hours searching and reading articles related to my topic to catch up with the latest

research done and find out what is still missing. I even spent more hours performing laboratory experiments, which I still do, to answer my questions! And this is the way to fulfill the gaps in science by continuously being updated and giving explanations through experiments.

**CHEESE and TOMATO SAUCE** – *I can connect with other scientists more easily.*

Of course, cheese cannot be missing from a pizza since it connects all the ingredients on top of the tomato sauce while melting. It is the key ingredient for a tasty pizza and, at the same time, has the binder role between all the layers. Similarly, the connections and collaborations between the PhD students and the academic community are critical. It is difficult to go all the way alone and to deal with all the obstacles. The PhD programs, especially the international ones like NOWELTIES, are starting and jumping-off points for further professional links. They are the first platforms to share your research experiences. I pretty much like the fact that there is more than one brain dealing with water pollution and making changes for a better and more sustainable future.

**TOPPING** – *I can become an expert in the field.*

What makes the pizza unique is the toppings on the top. Their combination, amount, and position are crucial for the success of the pizza. Although they are of different textures, nutrients, and tastes, the overall taste of pizza is magnificent.

During the PhD studies, you have the opportunity to work in different environments and laboratories and interact with different people, both colleagues and supervisors. Being able to continuously adapt to new working environments and still be focused on your research will take you further in your field of expertise.

PhD requires extreme self-motivation, focus, and a high interest in the research work. To be successful in a PhD life, it's essential to use every opportunity to get you a little closer to your goals.

So, PhD studies can be a slice of pizza, but it takes more time to prepare it, bake it, but eventually, you will enjoy it!

## Scientific Realism: Is There No Alternative?

**Danilo Bertagna Silva** - ESR6

*18/03/2022*

The current political-economic system we live in has a crucial influence on labour relations of scientists (and here I include postgraduate students, professional researchers and university professors). As many other workers, scientists use their time and craft to produce something – commonly called a commodity. Depending on the value society gives to this commodity, workers who are responsible for its creation can go up or down in their careers and be more or less disputed by the market. To employers, the available working force presents itself as commodities on a shelf waiting to be hired based on their attributes. Websites such as LinkedIn illustrate the effort people make to showcase their professional experiences and skills in order to be seen by their peers, increase their network and obtain better career opportunities.



The value of scientists is often measured by their productivity – and a considerable part of that is represented by their list of publications. The academic article is the quintessential commodity of science [1]. To the marketplace, a researcher who worked for a decade but published nothing pales in comparison to a colleague who managed to publish a couple of articles in a year – regardless of the scientific knowledge both may have, the social-economic context of each person or the actual content of the articles themselves. This generates the well-known “publish or perish” culture in academia, which pushes scientists to publish to obtain further grants and funding for their projects and/or even to keep their own jobs. In his book

“Capitalist Realism”, the philosopher Mark Fisher states that a paralysing anti-productive bureaucracy disguises itself in our society as a meritocratic logic of productivity:

“The drive to assess the performance of workers and to measure forms of labour which, by their nature, are resistant to quantification, has inevitably required additional layers of management and bureaucracy. What we have is not a direct comparison of workers’ performance or output, but a comparison between the audited representation of that performance and output. Inevitably, a short-circuiting occurs, and work becomes geared towards the generation of representations rather than to the official goals of the work itself.” [2].

The “publish or perish” culture echoes the work of Guy Debord “The Society of the Spectacle”, in which the history of society can be understood as “the decline of being into having, and having into merely appearing” [3].

In the current scenario of ever-more precarious working conditions, Fisher writes: “The slogan (...) is ‘no long term’, where formerly workers could acquire a single set of skills and expect to progress upwards through a rigid organizational hierarchy, now they are required to periodically re-skill as they move from institution to institution, from role to role.” [2]. The nature of scientific investigation is at odds with this frantic moving from one contract to another. Research (even for experienced scientists) involves a constant effort of learning complex new skills and concepts, which often cannot be done in a short time. Trying to fit experimental results – which are inherently uncertain – into the rigidity of official reports that demand the accomplishment of previously-set goals (on which your job depends) is a fertile ground to scientific misconduct, anxiety and depression [4]. Given our society’s ethos of hyper-individualization of responsibility for our professional success or failure, we become our own fiercest critics and worst saboteurs [2].

Although this would be enough to show how problematic the current labour relations in science are, unfortunately there is more. Academic journals and publishing houses are not non-profit entities. The largest publishers make billions of dollars every year [5]. This profit partially comes from charging scientists to have access to articles written by other scientists and peer-reviewed by some other scientists; all that while publishers pay none of the scientists

involved in this process. Open access principles and practices may have promised free-of-charge access to publications, but publishers charge exorbitant fees for this option. The top journals may charge up to 9500 euros [6] for an open-access publication. For the sake of comparison, this value represents the average net salary of 2 years obtained by a PhD student in my country (Brazil) [7]. This leads to: 1) a considerable amount of public resources dedicated to science and technology ending up in the hands of these publishers (In the EU, 30% of all revenue in R&D comes from public funds [8]); 2) an ever-growing gap between research groups from rich and poor countries. In this context, common-place expressions of the academia such as “scientific neutrality” and “meritocracy” lose all their meaning.

Ultimately, the value of scientists in the marketplace and their access to qualified positions are symbiotic with (or parasitized by) the profits of publishing companies. If it wasn't for copyright-breaching initiatives such as Sci-Hub, which is target to constant blocks and lawsuits by publishers [9], the same would have happened to dissemination of scientific knowledge itself.

Many among us are aware of how rigged this system is, but most will scoff at its shortcomings – as if the game's rules simply fell out of the sky or nothing could be done. The expression “Publish or perish” becomes the order of the day among scientists, repeated ad nauseam and devoid of the criticism it initially contained. More than 30 years ago, the philosopher Slavoj Žižek described how such attitude, instead of a form of resistance, is a coping mechanism:

“The prevailing ideology is that of cynicism. (...) Its fundamental level is not of an illusion masking the real state of things but that of an unconscious fantasy structuring our social reality itself. (...) Cynical distance is just one way to blind ourselves (...): even if we do not take things seriously, we are still doing them” [10].

This scepticism resonates with Margaret Thatcher's famous neoliberal motto “there is no alternative”. The dominant ideology of cynicism limits not only our actions but, mainly, our capacity to imagine different possibilities – which is fundamental for a scientist or anyone else wishing to live in a better society. I would like to end this text with a quote from the professor of the University of Sorbonne in Paris, Anna Geppert:

“However, unlike the proletarian worker who has little power and choices, we are building our cage all by ourselves. We spend an always increasing amount of time applying for grants, managing, reporting, evaluating. We hate the tyranny of metrics and impact factors, yet we keep submitting papers to high ranking journals. We write, edit, review and read academic literature, yet we pay for open access. We live with a prisoner’s dilemma: can we get off the hamster wheel if we don’t know what others will do?” [11].

### Picture source

<https://unsplash.com/photos/a9qWxqw55Kw>

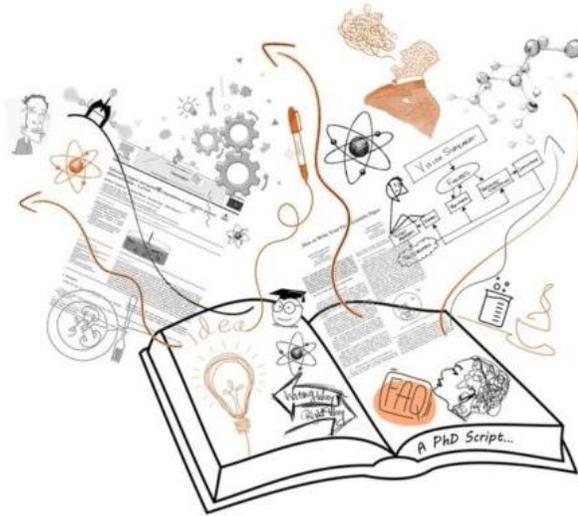
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# PhD Drama: The Script

Barbara Topolovec - ESR5

25/03/2022



To you, future young researchers.

For family, friends and loved ones to understand us better.

And for all of you, dear readers who like to follow our PhD journey.

I am writing to you after two and a half years of my life working as a researcher.

Imagine that a PhD is a sort of a written script. Short plot descriptions, scene settings, time periods, characters involved. The scene is settled - research institution, faculty, laboratory, your office space. The script also tells that the action takes place in different countries. You work on your research - perform experiments in the laboratories, attend training courses, meetings, and other activities. Characters are around you - supervisors, students, colleagues, and other employees. Some play important roles in your project, some of them you don't even "see". With time, you gain a certain amount of knowledge and experience, evolving into an expert in your field of interest. It seems like everything is going according to the script...

But there is more between the lines:

You realize – you are the character who is writing extra pages of the script to make it better. You improvise many times. What you find during research and learn from experimental results makes you change plans. You get lost and end up with more questions than answers. You often get frustrated and stressed, but this experience teaches you how to find yourself again and again. It's not an easy job, but the important thing is that you keep going.

Moving and working in different environments can make you question yourself:

- How can I manage?
- What are my limits?
- Is my knowledge regarding the work enough?

Your research is only one part of the script. In front of you are much more life obstacles that challenge you. You must adapt on different levels at the same time. You may also discover another side of you, which can change you and make you grow as a person.

The script also defines which characters you are going to meet. Even those that initially seemed unimportant can sometimes significantly impact your life. You also find yourself challenging your prejudices and learning to value and respect differences between people. While doing so, you get a clearer image of the person you want to become and the things you want to represent. This road may be hard sometimes, but it enriches you, if nothing else, by giving you friends that can become like family.

Important side characters are often not mentioned. Family, friends and loved ones at home. You learn how much they love you, support you and how proud they are. You learn who are the ones that have enough strength and love to stick with you even miles apart. And it can change them as well.

PhD is not just a simple written script. Many things are open to many interpretations, as well as hidden messages and notes that are indispensable for a happy ending. While it seems the script is just black and white on paper, there is a palette that enables you to perform a very colorful play in reality.

P.S. This script is written and performed in many different languages!

# The Circular Economy of Wastewater

Camilo Sánchez Tobón - ESR8

08/04/2022



Global warming is creating many life-threatening changes on our planet. To reduce the human impact on the earth, reduce inequalities and bring peace, the sustainable development goals (SDGs) have been set as a guideline. Many innovative ideas and concepts regarding the circular economy, sustainability, and environment-friendly processes are at the heart of the SDGs.

Working in the water field, I realized that apart from contributing to goal 6 (clean water and sanitation), water treatment technologies can contribute to achieving several SDGs simultaneously, such as sustainable agriculture (goal 2), clean energy (goal 7), and climate action (goal 13).

It is well known that water scarcity is a serious issue that affects around 25% of the global population, and this percentage keeps increasing. Water reuse has been considered the most feasible solution to mitigate water scarcity, especially in agriculture, the highest water-demanding sector. Nowadays, several regulations worldwide support water reuse in agriculture to reduce the water stress in the regions.

Before reusing, wastewater must be treated using different technologies to fulfill environmental and safety regulations. Usually, these technologies generate some secondary “waste” that must be managed correctly to avoid another negative ecological impact: sludge generation. Nevertheless, this sludge could be seen as a valuable product. From one side, it could be digested to produce biogas, a renewable energy source. On the other hand, it can be composted to create a natural fertilizer for agriculture.

In the level of decentralized communities, for example, in rural areas, especially in developing countries, there is an accessible wastewater treatment technology that could reuse water while producing energy for cooking: biodigester. In this system, biogas is produced while water is treated. Besides, this treatment technology has an additional advantage; the treated water keeps the essential nutrients for agriculture (nitrogen and phosphorous). Thus, the crops are fertilized while they are irrigated. From this perspective, biodigester is an affordable treatment that promotes sustainable agriculture and sustainable energy and contributes to the protection of the environment.

In that sense, wastewater treatment plants can be seen as recovery centers, considering their value. Other valuable by-products can be obtained, such as energy, fertilizer, and others. These recovery centers fulfill all the requirements to be considered a sustainable, eco-friendly, and circular system that contributes to a better world.

### **Picture source**

<https://www.freepik.es/fotos/sostenibilidad>'>Foto de sostenibilidad creado por rawpixel.com - [www.freepik.es](http://www.freepik.es)

# Gender Inequality in the Academic Scene

Silvana Ines Quiton Tapia - ESRI

06/05/2022



Gender equality is a right; however, despite it seeming obvious, it is still a critical challenge that directly impacts water management. Water and gender interlinkages show that gender equity is fundamental to access sustainable water, sanitation, and hygiene (Pouramin et al., 2020). Traditionally, the water sector has been led by men, namely as water provision and sanitation was linked to engineering and technology that included very little female representation. Currently, even if the position of women was generally improved over the years, recent reports have shown that the COVID-19 pandemic is widening gender inequalities and even reverting the progress regarding women's rights and opportunities (UN WOMEN, 2021).

In my personal experience, initially I did not have a clear academic perspective or role model that would engage me into the world of science. If you had asked my teenage self "how do you see yourself in your thirties?", I would have probably told you "Married with kids". However, my life took another path which meant going out of my comfort zone and changing my priorities. Now, I'm about to get my PhD title in a foreign country as part of a cutting-edge training program on water treatment. I surely embraced the life I had so far, and I've had numerous experiences that bought me a lot of personal and professional satisfaction. However, I cannot help to wonder to what extent my experience was affected by my gender and if my path would have been easier if I were a man.

In Bolivia, I'm one of the exemptions when it comes to career choices, particularly by the fact of going abroad to find another type of professional perspective. Most of the women I know from my hometown had already married and had kids by my age and embraced the family life more than their professional careers. Initially, my personal experience appeared like an isolated matter. Still, I soon realized that was not the case. As I moved on through life, I became aware of other women experiences and that ultimately, the gender disparity is a global matter. Although nowadays there's been an effort to balance gender roles, at domestic and professional levels, the truth of the matter is that women make greater family sacrifices to get ahead in academia (Mason et al., 2013).

### No Voice, No Representation

Global stats show that women only represent 33% of research positions and are awarded less with research funding than men (UN WOMEN, 2022).

Women in leading academic roles are distinctly underrepresented, which can directly impact decision making and project implementation. In countries like USA, leadership positions are majority occupied by men even though women outnumber men in earning bachelor's and master's degrees (AAUW, 2022). In Galicia, the region I'm currently living in, the underrepresentation of women is also a critical challenge. It has been stated that women represent only 20% of the academic body in universities and research centers (El espanol, 2022).

In Bolivia, my country, there are very few studies with a gender perspective that analyze the inequality among STEM (Science, Technology, Engineering and Mathematics) professionals. However, there are glaring underrepresentation's of women from leadership positions in political and professional arenas, especially regarding STEM areas.

Studies have underlined that the dominant factors that affected women's participation in STEM were the influence of the immediate environment, lack of role models and self-perception (Rosales, 2020).

Moreover, female academics that can go past their PhDs through their tenure tracks, find yet another gender disparity, that is between maternity and paternity. Mason et al., (2013), explore the latter issue and finally point to an interesting discrepancy:

“While having a family is often perceived as sign of reduced commitment to the job on the part of the female academic, yet is valued as a sign of heightened responsibility on the part of the male academic”

Data to back up these arguments is easy to find. In Spain, according to the Ministry of Science and innovation (2017), the female academic dropout rate is around 50% after the first child. This is unfortunate for the water sector, as evidence shows that water projects can become more effective when women participate (Kholif & Elfarouk, 2014). Gender norms often dictate the male and female engagement in practical water management. For example, in development countries, women are often in charge of the domestic usage of water. Therefore, gender-sensitive responses would generate benefits for the whole of society (Romanello et al., 2021)

### Solutions to Pursue

Fortunately, I have seen many initiatives to promote the presence of women in STEM areas, including at my university in Spain where they try to boost female participation and within our Nowelties project, where the female representation is balanced regarding PhD candidates. However, numbers show that even though the parity of gender at a bachelors or PhD studies is somehow similar, female representation dramatically decreases after women have their first child.

Therefore, efforts to retain women participation in academic environments must be increased. Providing equal opportunities, closing the wage gap, and ensuring practical solutions for maternity challenges (such as on campus daycare, extended paternity leaves, etc.) could help retain staff and establish an equitable working environment and ultimately avoid a brain shortage of female representation within the academic field.

Achieving gender equality while empowering women is fundamental to reach all 17 Sustainable Development Goals (SDGs), as its impact is transversal across all other goals (UN

WOMEN, 2022). Moreover, having a gender perspective for the application of grants and projects is of pivotal importance to tackle gender gap, especially regarding the training of highly skilled water professionals. In addition, it is now widely accepted that climate change amplifies gender inequities (Romanello et al.,2021). The latter is of relevance as we know that in countries from the southern hemisphere, women are responsible for water collection and usage at a household and community level. As women are the main responsible for water management day to day (Ray, 2007).

What to do? We can first raise awareness of gender inequalities, we can raise visibility of women as role models in STEM, we can aim for equity in our professional and personal life, we can tackle gender stereotypes in girls' and boys' education and career interests! Promoting gender equity while also empowering women as the key players for achieving sustainability might as well be our best weapon to better water management.

#### Picture source

<https://pixabay.com/images/search/gender%20gap/>

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# Chapter Nine



## Surfing Waves Even in Shallow Waters

Sabrina de Boer - ESR9

*20/05/2022*



Dubrovnik, Croatia, the city which became famous as a fictitious stage of the series *Game of Thrones*, would become the very real and presential venue for the *NOWELTIES* final conference. It has been almost three years since our introductory training course when we first met our 13 fellow PhD students (sadly with two exceptions) and most of the other important heads of the project. It was a quite emotional moment to see them again (sadly with one exception), excited, and definitively all changed.

The first day of the conference was introduced by an interesting talk by Christa McArdeell about the Swiss legislation to protect surface waters from pollution by implementing additional treatments for wastewater treatment plants. A perfect match to our central aim which is the exploration of new technical solutions for wastewater treatment. The day was divided in two enriching sessions, the first focusing on the understanding and improvement of biological systems introduced by Alette Langenhoff from the University of Wageningen. After a stomach enriching refreshment offered by the representants of the Dubrovnik Inter University Centre,

which hosted our conference, and a subsequent lunch on top, we started with the second round of presentations focusing on advanced oxidation processes including photocatalysis and plasma treatment. Compared to big conferences like the Micropol conference which will take place in Santiago de Compostela next month, the number of participants was small. However, we soon realized how many insights you can get outside of the conference room when talking to people from your field and beyond. We concluded the day with a guided tour around the old city, whose pragmatic citizens managed to stay true to their premise to never sell their freedom but finding ways to buy peace. Their pragmatism is also reflected in their water management system, collecting almost every drop of rainfall, installing a sewage water system as early as in the 14th century and constructing a widespread water distribution system.

In the morning of the second day the talks were focused on advanced materials for wastewater treatment, comprising several inorganic and organic composites based on graphene oxide, enzymes, or zeolites, to name only some. While the exploration of these novel materials is normally a rather empiric approach, we also got a glimpse on the possibility to predict interactions between pollutants and adsorption matrices based on *ab initio* molecular dynamics calculations. After lunch we changed our scope to hybrid wastewater treatment technologies. Regarding the widespread and variable pollution of wastewaters, tailored multibarrier treatment systems are indispensable to prevent pollution of water resources. At the end of the day everybody felt exhausted, but the most motivated people still took the opportunity to dip into the transparent, calm sea and to explore the night life of Dubrovnik.

After a short night (for some more than for others), we created a roundtable (without table) to discuss on our progress and time plans to submit our thesis considering the unforeseeable obstacles we had to overcome including the pandemic, seismic as well as personal earthquakes. We then continued with a multifocal workshop on opportunities we could take after the end of the project. While at this point in our PhD projects, opinions are swaying between thriving in and fleeing from academia, all of us could learn about the most important postdoctoral grants available on a European level and exemplarily on a Spanish level by Mira Petrovic. We certainly learned that the road to permanent positions is not an easy one, and therefore the advice given by Laura Bertolini to write successful research proposals might help many of us

in the future. After a short break, we plunged outside the academic ivory tower into the rough seas of the water management sector, when Lucia Gusmaroli told us her personal story about what it takes to become an efficient, but also happy project manager and how her PhD experience contributed to keep her afloat during the stressful days approaching project deadlines. Tomislav Bolanca then took over, talking about his experience in the water sector from an entrepreneur point of view. Resilience to stress and failure was definitively one of the key qualities all of them pointed out to be important for our future journeys, regardless of where we are heading. We shall stay afloat, promote our ideas without selling our ideals and keep having fun doing what we are doing.

# Final Blog: MSCA Fellowship Impressions

All ESRs

29/07/2022



As Nelly Furtado et al. (2007) [1] claimed: “All good things come to an end”.

So it is with this blog and the NOWELTIES ITN program.

In this last article, we, Nowelties’ early-stage researchers (ESRs), express our impressions on the Marie Skłodowska-Curie Actions (MSCA) fellowship in which we participated. Focusing on four essential aspects:

- Secondments
- Collaboration
- Mental health
- Supervision and guidance

If you intend to apply for a MSCA program that involves a European joint doctorate (EJD), or you want an insight view on the MSCA EJD project, look no further. You are in the right place.

### Secondments

*What hurdles regarding permits, accommodation, and traveling did you overcome? Should and how could supervisors become more involved in this process?*

Being an EU citizen may facilitate all the involved processes. However, one might experience that moving every six months, while extremely helpful for broadening the views, may be challenging to find your place and establish long-term relationships with the people you met along the way. On the other hand, one can expand their way of thinking and learn about different cultures.

As a non-EU ESR, apart from the challenges of finding a place abroad, one might experience additional stress related to residence permits due to the huge bureaucratic procedures. Depending on the nationality as a non-EU citizen, different regulations might apply. However, the lack of administrative support in this situation could put additional pressure on the performance due to the time-consuming procedures. For example, if ESRs need to move from Germany to Spain to perform research for 12 months, they will need to cancel their apartment in Germany and find one in Spain. Their primary employment remains in Germany. At the same time, they must maintain an address on which they are registered in Germany. This most often does not have a practical (and legal) solution. An option to relieve the burden to some extent is to follow a secondment for up to six months. The requirements for obtaining a residence permit for six months are more straightforward, and one could consider subletting your flat.

Apart from the MSCA National Contact Points, the support from the supervisors is an important part of this process since they are the first and maybe only contact at that point. They should provide ESRs with necessary information regarding the documents and procedures, and possible options for the accommodation or give them the contacts of other students who probably have more experience finding the accommodation. Finding a new place to live and navigate bureaucratic procedures (combined with your ongoing research work) can be time-

consuming and stressful, especially if one does not speak the local language. Thus, sound guidance and support from the supervisor can be beneficial at that point in ESRs' work.

Most of us had the experience of working in different laboratories, which is highly insightful because we learned different ways of doing things (techniques, methods, equipment, etc.). However, it is crucial that one plan the research stay (i.e., your experimental work) according to the advantages but, most importantly, to each laboratory's limitations. In this sense, in addition to the support of your supervisor, it may be effective to coordinate practical matters with a lab technician.

### Collaboration

*What did we expect regarding collaboration between different research institutes regarding their technical possibilities?*

An ITN project is designed so that each PhD student can perform their research independently from the outcome of the others. It is okay that each project can stand on its own, but does it have to if students discover possible synergies in their work? Key ingredients for successful collaboration are communication, leadership, and process validation. We experienced some downfalls in that field. Our initial attempt to make some joint decisions on selecting contaminants, water matrices, etc., we found it partially unsuccessful. Due to this, we may have missed potential benchmark to compare, new materials or new technologies.

Moreover, the inevitable substitution of our in-person project meetings with virtual due to the Covid-19 pandemic had a detrimental impact on our potential collaborations and interactions. Fortunately, we at least had the chance to meet in the first and the last project meeting. Still, in hindsight, the quality of face-to-face meetings has no comparison to virtual modalities.

### Mental health

*What were the psychological efforts involved?*

Already in pre-Corona times, mental health was not necessarily the first attribute to describe the life of predoctoral researchers [2]. Quite sad since research is, after all, mental work that

should be sparked by the joy of discovering the unknown rather than following the motto “publish or perish”. However, mental health problems usually are not appearing overnight. They result from constant friction between your current self and the environment. Declaring ourselves to the environment can help to identify these frictions at an early stage and to find ways to eliminate them – either by personal change or by a change in the environment. The limited possibilities to exchange concerns and troubles with other peers during the lockdowns or also because of moving to a new lab, these frictions can cause abrasions, which are often left untreated because they are neglected by the individual and remain unnoticed by the environment. The increasing pressure along the PhD project can finally lead to open, infected wounds. While abrasions usually only hurt when in contact with irritating agents, the pain of infected wounds may be permanent. The same concept can be applied to mental health issues. We all have to stand tough times sometimes and get hurt along the way. The problem arises when one cannot cure these wounds, e.g., by having channels to declare oneself. It would be recommendable to give new PhD students more training possibilities and information on how they can detect and tackle mental health issues.

### Supervision and guidance

#### *How was the interaction with the supervisors?*

Some of us, or maybe all of us, experienced the downsides caused by a structural problem in academia: the lack of sufficiently trained and experienced researchers with the inadequate temporal capacity to train new students. The limited time some PIs have between teaching, conferences, project acquisition, and general management of the research group may not be enough to get deeply involved in the investigation performed by a PhD student. The partial lack of guidance may result in unnecessary waste of resources and delays in the research work since conceptual errors cannot be efficiently eradicated at an early stage of the project. Nevertheless, regular guidance does not exclude delays if the topic is new to the supervisor or the research group, leading to constant uncertainty and slow progress.

On the other hand, there are supervisors whose help and regular guidance were crucial at the beginning of the individual PhD project. To establish good foundations and have clear

objectives, weekly meetings with the supervisor, at least for the first months, are quite fruitful. Later, the meetings can be done bi-weekly and once a month. Being in touch with your supervisor/s regularly can help you keep track of your progress and avoid unnecessary experimental work. However, the initiative most of the time should be taken by the students themselves because of the busy schedule of the PIs.

*What are we most thankful for?*

MSCA scholarships can offer a wide range of benefits. Being a highly competitive fellowship, you will experience no economic difficulties in moving between countries. Thus, we feel thankful to have been able to live in two (or more) countries, discover beautiful places and meet awesome people. The multiple changes in the environment did not make our PhD journey more straightforward, but they made it worth the struggles. All the uncertainties around us made us understand better what our principles are.

Regarding all the difficulties we faced and unfulfilled expectations, we have learned how to:

- take a stand, when necessary,
- adapt to multiple environments,
- and accept and deal with obstacles.

Living in different places allowed us to see and visit countries, beautiful cities, and areas and experience other cultures. This project permitted us to meet new people and gain future contacts for work and life. But most important, it brought us, 14 amazing young researchers, together, and now we can call each other colleagues and friends.

We are thankful for having a formation that promoted constant training, networking, and traveling. We faced different work strategies and met kind and interesting people; this broadened our vision and enriched us. Moreover, the interdisciplinary environment helped us progress with our research.

Overall, the project took us beyond our limits, making us realize how far we could go.

## References

- [1] <https://youtu.be/ZLqN-3FuYVQ>
- [2] <https://www.nature.com/collections/gnlwffjgtr>

## Final Blog Video: Nowelties Journey

**All ESRs**

*29/07/2022*



The Nowelties ITN is almost finished. In this video, we collected the central moments of our ESRs during the last three years' journey. Enjoy the view!

**YouTube link**

<https://youtu.be/IQHhfmixSYQ>





**Nowelties**

European Joint Doctorate

