TECHNOCULTURE

The hero myth and the rhetoric of science

Episode 30

Full transcript

Guest: Brigitte Van Tiggelen [Brigitte]
Host: Federica Bressan [Federica]

[Federica]: Welcome to a new episode of Technoculture. I'm your host, Federica Bressan, and today my guest is Brigitte van Tiggelen, a historian of science who holds several appointments: she is director of the European Operations at the Science History Institute, she is Chair for the division of History of Chemistry inside the European Chemical Society, and she is Associate at Centre d'histoire des sciences et des techniques de l'Université Catholique de Louvain à Louvain-la-Neuve, in Belgium.
You may remember Brigitte from episode number 7 of this podcast. She was a guest on the occasion of Marie Curie's birthday in November 2018, talking about the life of Marie Curie, who is an icon of science. Today we meet again to further explore this concept of icons in science. This is part of a larger discussion on the rhetoric of science. So, without further ado, welcome Brigitte, it's so nice to have you back.

[Brigitte]: Thank you for having me, Federica. I'm really glad to be back.

[Federica]: When last time we talked about Marie Curie, what we tried to do was to reconciliate Marie Curie the icon with Marie Curie the person. The person is often times less known than the icon and Marie Curie is of course not the only one to have become an icon in her field. A male counterpart in science is of course Albert Einstein but we can think of Mozart in music and Michelangelo in the arts. So can you talk a little bit about what icons are and why it happens that some individuals transcend their simple human life and become icons.

[Brigitte]: Well I'm gonna take a long way to answer your question and I'm gonna start with the International years. UNESCO has every year at least two or three international years.

This year one of them is dedicated to a scientific topic - which doesn't happen all the time - and it is the International Year of the periodic table of the chemical elements. That's the long version and there's a short way to say it: it's IYPT, International Year of the Periodic Table. There has been other years devoted to a scientific topic. There has been two international years of chemistry, one of physics, one of light, one of crystallography, and so on. And it's always to celebrate specific domain of science, to celebrate not just what is going on but also a look back. It's very striking that in all of these international years there has always been a historical ingredient. For instance the International Year of Physics in 2005 was linked with Albert Einstein's so-called annus mirabilis 1905 in which he published seminal papers. So, the whole of the community was a in a way connected to the myth of the origins. And I think this is really interesting. It sometimes is not just the origins. In the case of 2011 the International Year of Chemistry it was linked to the second Nobel Prize of Marie Curie, 1911, the one she actually received alone. It was a Nobel Prize for her work on the discovery and the characterization of two elements she had discovered with her husband and other people - but mainly with her husband, polonium and radium. So again it was a way of putting a myth at the origin or as the reason for celebrating and I think this is interesting. This year in a way is even more interesting because the periodic table is always said to have been invented or discovered - those two words are different but it's interesting to talk about the discovery of something that man made. And it has been proposed in 1869 by Dmitry Ivanovich Mendeleev. I would say here the sense of history is even bigger than before because it's the one hundred and fiftieth anniversary. If you go online and google IYPT you will see the page and the logo appear. You have the face of Mendeleev which is very telling. Again you have this idea that there is a start with one man, one action, one place everything happens, all of a sudden like in a fairy tale. This is where I think we can start thinking about heroes of science and what do we miss about the history, the nature of science, and the nature of scientific community when we just tell the story with our heroes.

[Federica]: So, it seems pretty obvious that associating a person with something like the periodic table makes that thing more relatable, it gives you a chance to tell a story around and about that thing. But I think that where we want to go with this discussion today is in a direction that explores how there may be a dark side to doing this, am I right?

[Brigitte]: You are very right, Federica. On the one hand all these stories of signs are always intended at least from those who are telling it and who are not making hagiography or trying to found a specific domain and then they have to have founding fathers or founding mothers. But generally there is a good intention behind telling those stories - exactly what you said - is giving humanity to science. You know, science is done by people. Where the problem starts is when these people are stated or presented as heroes, as lonely heroes - sometimes the family context is explained, for instance in Mendeleev's case, his mother who was - they were from a rather poor family or poor circumstances. [His mother] She insisted on him having a good

education and so on. But then afterwards it becomes a kind of lonely trajectory. A lot of all what builds a person, which is encounters, bad problems, having to face them, controversies, sometimes also bad behavior, stealing things, not quoting this and that person, not making a reference - all these things are really channeled into the story so that the stories remain linear. And of course that's an easy way to tell a story. You have a beginning, you have a quest, you have a hero, you have problems along the line and then in the end, the hero triumphs. So there is a good intention but there is a bad tool. The tool actually reveals the dark side of this heroic story. Basically - just in the case of Mendeleev - luckily enough historians have investigated that over and over again, but Mendeleev is not the only one to propose a classification. He is not the only one to propose a table. There has been a lot of history work done on predecessors and contemporaries who also had a system they proposed. There have been some studies but less about why one system survived. Because of course the easy answer is always to say: "Well, it's because he was right." - or the best, or the most suitable. But we all know - you and I - that sometimes, let's say, in nowadays technological area, it's not necessarily the best device that survives. There is a lot of marketing. There is knowing the users, the audience, and for instance in this case, there was a lot of persistence from Mendeleev. But he had also a fan base so to speak, which made sure that he would be known, his ideas disseminated and so on. Also he was adamant to claim: "this is mine, this is my ID." Just so your auditors or your audience knows, very much at the same time as Mendeleev a german chemical professor Lou Tamiya also suggested a classification of the elements. He was less adamant to defend his system compared to Mendeleev. That's one thing but it is really telling that at one point further down, so this wasn't until the end of the 1860s - when the periodic table was at last regarded as something really useful by the chemical community, the Royal Society of Chemistry supported and gave an award to both of them. So the story is complicated, is complex.

[Federica]: Again talking about Marie Curie, last time we observed that icons can actually do a disservice to the community in that they are not relatable. We say: "oh, but she was genius or, Einstein was genius." Like everything came easy to them and that is not the case. So when we talked about the struggles in Marie Curie's life, we observed that to know the real story makes her gain power as a role model, as an inspiration. That's why it's fair to say then icons can do a disservice to the community. But becoming an icon can also have some negative effects on the person who actually becomes an icon. Was this the case for Marie Curie or Mendeleev? Do we find Mendeleev hurt or damaged by notoriety in this new condition?

[Brigitte]: It is hurtful to Mendeleev in a way, as well as it was hurtful to Marie Curie, this stardom so to speak. Because once you write a story where the hero after having - so to speak - slain dragons is triumphant, then the problem is, when this hero beat Mendeleev, Einstein, Marie Curie, makes a mistake, we are at pains to explain these mistakes. Are these statements that are not confirmed and so on, or misunderstandings? It is always then the question from the general public is why such a genius couldn't understand this or that. So it does hurt the

hero of the story because in the fairy tales the story ends at the summit, when the discovery or the new theory is accepted. But of course these scientists, they have life after - I mean, they don't stop like, they get married and and live happily ever after. They continue their scientific investigation and they are back, not completely, to their former situation but in terms of cognition, I mean they are not the genius that others claim they are. So they are faced with difficulties that other researchers will still have. Maybe they have more access to money, access to better assistants or technicians or better labs and so on, but they are still human minds and human brains. So that's a way it can hurt. In general it also hurts I would say, the community. In that way, it's just the nature of science that is hurt in this way, by narrating history. A colleague of mine from Norway, Annette Lykknes (professor at NTNU and Trondheim), and I are editing a collective volume on women behind the periodic table. It's called 'Women in their Element'. It's going to be published in August of this year. It could have been called "let's not talk about Mary Curie" in a way because because I told the story about the periodic table and Mendeleev. I say there are contenders, they are all males, of course, because that's the visible part of the community. It was of course that at the time chemists were mainly male and other male historians have written the story about these male contenders of Mendeleev's. When you go to women there's Marie Curie who with her husband is credited to have found two elements. Then there's another one also finding elements, Ida Noddack with her husband and another co-worker. Then there's Lisa Meitner, not with her husband but with a co-worker Otto Berg. And then there's one woman, all alone, Marguerite (...) but that doesn't make a lot, does it?

[Federica]: If I may ask, can you clarify the difference between proposing the system or filling the gaps? Because I know that some elements were discovered later on so this periodic table had holes so to speak. So these women, were they involved in building the system or did they contribute to filling the gaps?

[Brigitte]: It's a very good question. In our book we are trying to address the whole of the this issue. There is no female proposer of a periodic system, that's for sure. What we discovered through this project is that there are women behind the periodic table. That is, women that have contributed at one stage, precise stage but very much needed stage, to either help the shaping of this periodic system or - as you say - fill in the gaps. Or even when elements are discovered, the story is far from ended. Elements have properties: one discovers the toxicity of this, the magnificent wonderful new property of that and it is used. So life does not end when the periodic table is set and it does not end when the periodic table is filled either. So there's a lot. And then also there's all the understanding behind the periodic table because you put all the elements according to their rising atomic weight. Now we use the atomic number but that's not the problem or the question. Once you have that, there's all sorts of new theories of chemistry that have appeared in the meantime. When Mendeleev proposes this first classification and ends up saying: "this is a system and there's a law underlying it." - they're still debating about whether or not atoms exist. Not to mention we knew nothing about the structure of

atoms, the nuclear charge, the electronic configuration, and so on. We know nothing about isotopes; we know nothing about radioactivity; we know nothing about a whole bunch of things that actually the periodic table can still accommodate over all this time. So this is why we wanted also to have a long story about the periodic table and a long story about the women behind the periodic table.

[Federica]: Can you give an example of the contribution that some of these women behind the periodic table gave - a type of behind-the-scenes work?

[Brigitte]: At the time of Mendeleev, women in Russia had emigrated a lot to our Western countries to get university education. This is the weird thing at that time: women's education at the university level was not favored in our countries but since they were coming from abroad - so to speak - it was not going to change the social habits. They were strangers, foreigners. They would go back or whatever their career would be. I mean, they would still remain the foreigners. These women were really tempted to come to have an education because just before, for a short period in tsarist Russia, there was an opening for women's education. Then it was stopped so they had to find elsewhere what they could not find at home anymore. One of these women, Julia Lermontova, she decided to go with another woman so they would go together, or they would get married, just for the sake of being with a chaperone. Sometimes the marriage was just fake. She decides to go with another well-known woman, Sofia Kovalevskaia. She's a very famous mathematician. She goes on to study chemistry. Of course, Mendeleev and other chemists at that time knew about that. Mendeleev was very supportive of women's education. So he knew about her. He also knew that she was doing very well and he is setting up his table - as I said - according to atomic weights. The problem is that to put them in the right order, you need a precise atomic weight. To have a precise atomic weight you need that the substances you are dealing with, are pure. To have them pure means that you have devised analytical chemical separation methods, that are very reliable and very effective. That was a problem with platinum metals. Those are metals from - I would say - the middle of the periodic table, around platinum. They occur in the same mineral ores sometimes, most of the time together, so you really have to separate them. That was really a difficult thing. So Mendeleev has this trouble and he writes to Julia Lermontova and says: "Since you're in Heidelberg, where Bunsen, a very famous chemist, is working (and Bunsen is working on new separation methods), could you please get to know these methods? Could you investigate the matter?" So the only trace of this, we only have in Mendeleev's archives. But this is a contribution, this is a behind-the-scenes contribution. It didn't solve the problem but this is a very good example of the shadows in which a lot of things were done before a few men, Mendeleev included, could come up with a general solution to a general problem. In our book, that's what we're trying to achieve. To really showcase those women, showcase how they relate to the problem of setting up a classification and the system. And also not go into a heroic story, because if we replace heroic stories of men with heroic stories of women, we're not an inch further. We're just falling

in the same dark side we were talking about.

[Federica]: There is another way in which the hero myth does not reflect the way in which science is done today. That is in groups, teams, there are networks of people and organizations. Can it be that the hero myth reflects an ancient way of doing science before it was institutionalized? When you had these isolated wealthy individuals in their Wunderkamer, the cabinets of curiosities. But was it isolated? Were these individuals actually working alone?

[Brigitte]: So this goes back to the Republic of Letters, which is a concept invented in the early modern period and put forward as - I would say - the first form of scientific community or 'savant' community, because science maybe is not the right word for the 16th, 17th and 18th century. But you are right that the teams were smaller. Inside the teams, there was a hierarchy between the technician (most of the time invisible - you don't know anything about technicians; sometimes in pictures you can see them working but they don't have a name. Of course they don't appear in the publication). Nevertheless, there was already teamwork. A good example of that is Lavoisier and the way he navigated teamwork, communal enterprise, marketing, and making sure in the end his name was kind of above, so to speak, the teamwork. So we are in France, second half of the 18th century. He is not really a high nobleman but he's very well-off, because he's actually collecting the taxes for the French King and he has a lot of time on his own. He's also very devoted to science and he wants to learn science in a very efficient way so he goes step by step. He realizes that there is a way to do chemistry that uses the logic of mathematics. Basically, it's making balances - what comes in what comes out - and the famous law of Lavoisier. Nothing is created, nothing is destroyed, everything transforms or is transformed. Interestingly Lavoisier's story also has been told as a hero, as the founder of modern chemistry and so on. Interestingly all the scholarly work in historiography has tried to evaluate what was the part of the genius. And again the social - and maybe if I tweak the argument a little bit further - the feminine side has been left aside. Because you don't invent all alone. You have to communicate, you have to have counter arguments, you have to fight, you have to struggle and bring your ideas to your colleagues and so on. He was very good at marketing and so to speak, engaging scholars or savants of the time to come and work with him. And so he could exchange, he could discuss, he could convert them. So which is another opening. There is something quite religious about science and being right - that's another topic we could also explore one day. What I mean is that, he is really in relation with this community and he can do that. He can afford that because he's a member of a very powerful node in this Republic of Letters network. He is a member of the French Academy of Science so that's a powerful situation. He's able to publish, he's able to spread the word, he's able to attract others who either have a high position. Through these high positions he can spread the word, or he can also attract the younger generation which, if you want to make a change, it's always best to address the younger generation. They're gonna kind of forward the new ideas. About the feminine side, it is more and more recognized now that Madame Lavoisier did more

than just take notes (because we see her writing in the laboratory notes) or organized salons. She wasn't really an assistant, because there was someone who took care of those tedious tasks, but she was very much an asset in Lavoisier's strategy. First off, she entered in marriage very young. She had a big admiration for her husband. She was taught modern languages like English and Italian because her husband didn't know them, so he would be able to reach out to other communities. She learned how to draw and to etch. She was the one who made the tables and the figures in Lavoisier's Traité élémentaire. She was also a salonnière and a very good correspondence writer. Moreover - and I think this is often forgotten - when Lavoisier was beheaded because of the revolutionary times in 1795, she fought until she got what she wanted. She fought to get back all the archives, all the instruments, all the papers and also belongings that had been confiscated by the French Republic. She prepared the way for a heroization of her husband. And if you look at all the heroes of science, it's really telling that either a family member or a close - I would say almost - a spiritual family member, like a student or a postdoc that has this admiration for the man, creates all the basis for the heroic stories. In the case of Marie Curie it's very clear, she wrote the biography of her husband and her daughter (the one who was not doing chemistry) wrote the biography of her mother. So there is a kind of freezing in this heroic role by people who we don't always look at but who are really instrumental in this heroization process.

[Federica]: So it seems a certainty that science is better done in teams and this has always been the case - not just today that teamwork is built into the structure of the institution, of how science is organized. If you have a great idea but you're in the middle of the woods, the quality of that idea is irrelevant. You have got to be part of a community and this has always been the case, not just today.

[Brigitte]: Of course. Science is foremost a human activity and this is why it is so sad in a way that these heroic stories, while they try to convey the human side of science, actually miss the point. I think it's especially clear in our times where, as you say, we have a huge project - let's say, finding the Higgs boson. It can't be pinned down to one person. The Nobel Prize has been given to those who had the idea and were successful enough to promote it, to convince their peers and to convince peers who were able to convince others, and fundraise and do all this big machine. But in this big machine, every person counts. Sometimes it is seen like, there's the thinking head and then there are the others. And the others can be interchangeable, which is very dehumanizing in a way. It's not human, it's like they're just pawns. This is where our book 'Women in their element' is kind of an interesting challenge because on the one hand, we want to bring to the fore sometimes technicians, sometimes people who for some reasons didn't make to be public persona, but nevertheless had an input. We really insist not to go to the heroic side for these people because then we're not moving one inch. You know, the danger for instance would be to say: "Oh, this or that person, she didn't have access. She could have done this, she would have deserved a Nobel Prize." I mean, there are a lot of stories that are kind

of - I don't know how to say - 'retrospective conditional history'. For instance, "this person should have gotten the Nobel Prize". Well, I see the point but the real question is: how can we explain the process through which this person didn't have the Nobel Prize - and a lot of other people didn't have it by the way, I mean, because of the selection process? What does that tell us on how we value, and how we award recognition and credit? That's the important question. But that's often a question that's left aside. Because it would really require the scientist, the scientific community, the whole system to think about itself in other ways and I don't think we're there yet...

[Federica]: Very interesting! This makes you want to rethink a lot of stories around science. This makes you think that we are just biased as humans and we tend to give more credit to some sources over others, just because maybe they come from someone who got a Nobel Prize. In a way it makes sense but the thing is that we should always want to verify, be critical of the statements regardless of the source. That's the whole point of providing evidence, of backing a statement up. Is it possible that we are underestimating, if not overlooking altogether, the human factor in all aspects of how science is done, in the results, in how the results are interpreted, in how science communication is done?

[Brigitte]: It's a tough question and I think that again, we can only go step by step. Really important is to have a reflexive behavior. I'm not sure people at the very high level have always the time to reflect because they're so embedded in the processes. Not just because they are the beneficiary of it but I think it's just that it has become a way of structuring things. You get more funding if you are you have a better Citation Index and so on, but there are things that are changing. For instance, now, in a lot of scientific journals, after the end of the article and before the references, there is a statement that the authors have to make together. And in this statement it is clarified what each author has contributed. So that I think that's a first step. It's interesting because it ranges from - I would say - the instruments (who owns them, who got the funding, who made them work) to the ideas, to the conversations, to the correction, to the discussion... So I think it is already a first step and that's that's really interesting. But it's still hard to make the establishment think about itself. One example - I mean it's a personal example but you know, that are the examples you know best, isn't it? Annette and I were asked to contribute to a Nature comment piece, exactly on the topic of women behind the periodic table. To that aim, we drew of course on this coming book and on contributions we haven't written. In such a comment piece, it is the tradition or the usage not to make a lot of references and not to make acknowledgements. In one of our first drafts we thought: "okay, we're gonna write an acknowledgement to all the authors of the contributions whose substance we are using to make our point, because that's only fair." And we were told: "No, we don't do acknowledgements." So we discussed with the editor and said: "Look, we are trying to make a point that it's important to emphasize contribution and that's how a lot of women, and a lot of men as well, have become invisible. So we would really be at odds with

our own statement or position if we cannot include acknowledgements." Happily enough, we were actually surprised with the response. They actually put the acknowledgements at the end of the text. Which was even better! I mean, we wouldn't have dreamt of it. I think that once you're conscious about this, you can start working step by step. Now of course, this doesn't set a trend - I'm very aware of that. I mean, most people will just continue but we were really happily surprised by the response of a very highly established, reputed journal who has its way of functioning since forever, and that we - two females historians of science - were able to say: "Look, we want it differently and this is why." And that they could listen to our argument. I think there's hope but I think it's gonna take some time to really make the system think about what they really are doing, beyond just saying: "Yes, everyone should work in teams." And how they actually transfer that into the acknowledgement system - one step at a time, as I said.

[Federica]: Maybe, step by step, we could get to a point where we stop falling for the hero myths, although I personally think that we could never get rid of them entirely because, like you pointed out, they also have a positive function. We admire them, they inspire us. So it's not just a matter of getting rid of them, but could we realistically do something to change the current narratives? Can we debunk the hero myth and what would happen next?

[Brigitte]: We should debunk it when we have something to put in the same place because, as you rightly pointed out, this is a need. We need these histories, we need stories. This is why I would hope that historians of science get the message better across. I would hope also that scientists read more of history, and not think they just make it, and because they make it they know it. I think they need some kind of training and education, and in social science in general and history definitely. Because what I noticed is that when you explain that on one-on-one or in a group to scientists, they actually agree, they fully agree, but they are not trained to think that way, and they are not given the right literature. So we need to come up with narratives and stories, for instance of Marie Curie. Tell the story in a short way - I mean, not the big heavy biographies that mainly only historians will read or very curious people - so we need to have something to put at least in contrast or superimposed to these heroic stories. Maybe also - and that's where social science would be needed - provide the scientists and equip them with some kind of ability to reflect on their own practice, because I'm struck by the fact that, it's not they don't want to do it, they are just not educated in that way. They are educated to jump to equation, formulas, and go to the lab or experience, and look at the data, and so on, but they are not educated to sit back, think: "What is it that what I'm doing? How does that relate to my belief system, the way I function, the way I relate to the establishment, and so on?" And not only are they not educated, but this is not even valued.

[Federica]: Thank you for saying that. I could not agree more. This is in part why I have the podcast: it's my way of learning more, and talking to very interesting people such as yourself, in a way that diverges from the exact specific topic of my research project, but in a way that

I believe makes me a better, more complete researcher and citizen. And I also agree with you that today young researchers are not really encouraged to learn more about history of science, for example, or the impact that science can have on society. Everyone just works on their specific topic. I do not like this state of affairs. So I do my best, you know, to try to combine my duties with these extras that I do, and I'm inspired by top scientists for whom I have endless admiration, people who took the time to be advocates, for example for the disarmament of nuclear weapons. So, it's not just about communicating your own science, it's really about trying to have an impact on society, with the things you know and with what you represent as a scientist. It takes time to do that, it takes more time because you need to educate yourself on those things, on the political situation, and number three, it requires that you care, and I think that we're missing all three things, and I don't know which one is worse. So I am often inspired by scientists like those who wrote and signed the Einstein-Russell manifesto, for example. They were top scientists, and they had the time, and they cared enough to also be active in society in this other role which is not a different role in fact, it's just something that complements you as a scientist. I truly believe in that. Let me ask you something about something slightly related to this, that is, the only way maybe in which we as young researchers are encouraged today to engage with the generic public (so not with our peers but people who don't necessarily understand or have the tools to understand the content of our research) and that we need to be able to talk to and to explain what we do to. So we are encouraged to communicate our science on social media. Normally every research project has a website. We are encouraged to organize public events or lectures in schools, and you know, laudable initiatives like that. My podcast is just a more time consuming way to do that, if you want! And my question for you is: considering what you said about Lavoisier and how good he was in promoting himself, do you think that he would have been on Twitter a lot? You know, if you want to be known today, you cannot not be on social media. But is this the way, is this an effective way to communicate science? And when we talk about communicating science, is this the type of communication what we are talking about?

[Brigitte]: So do I understand well, I mean I'm not a user of Twitter, I have to confess. And I'm a very lousy user of Facebook for instance. I am not sure that those are formats that allow for a real communication, in that it's always short. Because there's so much going on, you have to be incisive or aggressive or very - I don't know how to say that - kind of brilliant in a marketed way. I'm not sure that's the best way to convey. I would actually argue that in the end, it creates invisibility because there's so much noise! How do you pick up, how do you single out what is really important? If you tell me that you are asked or required by your grant to tweet now and then, not when you have something significant to say, how will your voice be heard better when you really have something to say? How will you be able to articulate it because it's not just one idea, you know. Let's go back to Mendeleev. When he came up with the first layout, he reworked it for years and he published, and again and again and some people came with details that were not working, and he reworked it. So we always think - and

this is also the problem with these stories - that they put everything in one place, one moment, one time, you know, the idea is...

[Federica]: Like, "where were you when it hit you?"

[Brigitte]: Yeah, exactly. And there is a total lack of recognizing this as a process. I'm not sure how very punctual things like Twitter can serve the purpose. And about Lavoisier tweeting, I really don't know. I will have to think about that. I'm sure he was a man using everything that he could be using. I mean, he was very efficient and maybe he would have found a way to use Twitter but this is conditional history so I'm not going to go any further.

[Federica:] I agree with you so much and I think that the picture you're portraying makes so much sense but it's not really how things are going today, is it? There is this fundamental rule of social media that says that you need to schedule your messages or be consistent. So put something out every week or so, every a couple of days, or the audience will forget about you. That means that one day you might want to take a picture of yourself in the lab and say: "hey, we're working on the periodic table today!"

[Brigitte]: Well, I guess they were doing that in correspondence. But the correspondence was addressed to a chosen audience. I'm not sure how Twitter works - is the audience chosen? And it also seems to me that a lot of these social media only are focused on promoting yourself, not especially always your ideas because as you say, they forget about you. The point is not sharing 'you', it's sharing the ideas you have so that's already a slight difference. Also, it strikes me how much it creates reactions, aggressivity, - I wouldn't even say controversies because controversies are centered on a content. It's very epidermical, if I may use this, so I would love to see how it works to disseminate stories and and real debunking this way. I think that it only amplifies something that's already there.

[Federica]: I am guilty of that. I have to admit that I'm guilty. I am on social media and I do share, you know, collateral things about my research. Of course, like, not the results of my research but the visits I do to other research centers. I was refractory to do it in the beginning but because a little bit, we're encouraged to do so. I tried. I started playing with and I have to tell you that I realized that what you create is a parallel narrative and for me, it has had a positive effect, in that it did expand my network. But not automatically, like, it just puts you in contact with more people because you get more visible but then I selected the new contacts and I proactively established connections with them with visits or with private communication, that started then going in the direction of a serious professional collaboration so I built something on the superficial connection that I got thanks to being on social media. So I'm guilty but for me, I can say that it's had a positive effect. It's like game: to communicate science and also to be engaged socially, publicly as a researcher goes beyond this, clearly. There is something that you said in the last episode on Marie Curie that really struck me. That is that someone

like Marie Curie would probably not have been successful with today's evaluation system with this pressure to be on social media, to also kind of be brilliant and look good, and because of her character and personality she might not have been successful in this environment. That should have everyone think.

[Brigitte]: I often wonder about those things. Also, there are some values that in the case of Marie Curie - she really impersonated them: persistence, continuous devotion to her passion (science), and consistency. Though she was a passionate person, she was consistent. I think that some of these people like Marie Curie or even Einstein, are - if I can take a Belgian example, Georges Lemaître - I'm not sure if they had to be evaluated with the same system now, about what kind of career they would have had. On the one hand, of course, one hopes from these heroic stories, this resistance and the fact that they really had a very clear idea of what they wanted to achieve, the path to it wasn't clear. But I think they had their center really inside of themselves. For instance, let's go to Lemaître. He was labeled as the father of the Big Bang Theory, which is something isn't it? I mean not the show on the TV but the real theory of the beginning of the universe. He did that as a very young person and he wasn't taken seriously by some part of the scientific community. He was even mocked at one point. That's where the name Big Bang came from because he was not talking about Big Bang. It was a way of mocking the idea. Isn't that funny that it came out? It's only on his deathbed that he heard that there was noise coming from the universe, that could be related to the original Big Bang, out of echo. He only learned that on his deathbed but in the meantime he was able to have a career. And a fruitful one in various different ways. He worked on computers. He was fascinated by the use of computers to do all these calculations, which he had done by hand. He knew that the power that was lying there and how much it would help. Again, to talk about the hero, initially he thought that the whole universe was in an atom. He called it the primeval atom ("atôme primitive") and this was based on a bad understanding - to put it mildly - of quantum mechanics. For a long time all his work was put aside because of this bad understanding, thisinability to do make quantum mechanics right. Here again, I think this is interesting to know, is that he didn't understand that part but he understood other parts better than others. His Big Bang Theory in the end is not just his, it's also what others were able to build in. Coming back to the evaluation, if he had to be evaluated on his first ideas, well, it didn't take ground very rapidly, did it? Now, when you think you have to be evaluated for a project in three years, five years is an eternity, isn't it? That would have been difficult. I hope that at some point all this management of science goes back to a more reasonable pace, with less less meticulousity, not always following the numbers with all these tools of evaluation but maybe more trust. And here is where the human factor comes in again: where is the trust in humans? In the fact that if you trust this or that researcher with his research program, let him have at least 5-10 years and then evaluate.

[Federica]: When I think of these things, I think of the case of Europe, for example. I have

to say then, for how much I would like to be in a higher trust system that does not require of me that I say, before I do anything and sometimes years before I do it, what the results will be, why this research matters to whom, and quantify the number of people I will reach with my communication activities. That's probably gone too far but I totally understand why they cannot finance a research project with public money and just give it to you because you deserve to be trusted, or they like you. I understand why that doesn't happen. It's again a matter of striking the right balance. One last question on the hero myth: we've been talking about Marie Curie and Einstein and in general people who achieved something that they are remembered for, that has a positive connotation but is there an antihero in science?

[Brigitte]: Oh yes, there are a couple but even then, you can reinvestigate the story. A big empty hero in the history of chemistry is Fritz Haber. Fritz Haber is a very interesting figure because he is from Jewish origin. He had converted to Lutheranism and he made an excellent chemist. He was able to come up with an idea to extract nitrogen, which is a very important ingredient to grow plants and crops. So this was a huge step and a huge solution to feed the world, so to speak - I mean, to put it in grandiose words. For that he was indeed awarded the Nobel Prize. But in the meantime comes World War I and he is engaged in creating chemical warfare.

[Federica]: I see where you're going...

[Brigitte]: Yes, he was the one behind the release of the first chemical gas on Ypres fields in 1915. You know you have the double-double faced genius, so to speak. He used to say that in times of peace a scientist belongs to the world but in times of war he actually belongs to his country. He thought he was doing his patriotic duty. Now, two things about this story. First off, after World War I he was quite praised but then came Nazism and anti-semitism. Although he was a war hero in Germany, although he was an immense chemist, although he had converted to Protestantism, he was led to flee Germany and he died on the way out (somewhere in Switzerland). So that's one thing, you know, it's kind of it's ironic, isn't it? The second thing I want to say is that you have this dark or antihero, and of course, there's a lot of stories around saying Germany used chemical warfare, Haber was a bad chemist because he used it against humanity. Now the response of both French and British armies was immediate. Why was it immediate? Because they also had a program on chemical and sometimes even biological warfare. The question was really, who would be the first to dare? So here again, you have the antihero Fritz Haber but during the rest of the war, over the trenches, coming from both sides, there was chemical weapons used. I think again here the dark antihero myth encapsulates the badness, at a very little point, so that it doesn't spread. Here again, we have to consider the humans in all their dimensions.

[Federica]: He became a scapegoat.

[Brigitte]: Yes, in a way, it is a scapegoat. More and more historians are writing on these periods and it's very clear that - what I tell you is not my own research, I mean, this is a knowledge shared by my colleagues so it's well-known. But it's not known by the public or by the scientists themselves.

[Federica]: Let me thank you, Brigitte, for being on Technoculture for the second time. Speaking to you is so interesting and we all learn so much I think.

[Brigitte]: Thank you, Federica. A conversation with you is also interesting because I realize I have so much to tell... Then maybe we have to have another episode together or we could have an entire podcast series on these topics. I think it's so interesting! Thank you for being here today.

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