

Citizen scientists as (inconvenient) partners in research?

Towards an inclusive scientific landscape for non-professional researchers in academia.

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Abstract

The following paper will illustrate that one of the great injustices and cases of discrimination in modern-day academia is the lack of inclusion and valorization of citizen scientists within scientific research. Although the term citizen science is fairly new within the scientific terminology, the concept of citizen science dates back many centuries (Gruenberg, 1935; Mims, 1999). In a very broad sense we can define citizen scientists as persons who (pro)actively participate, contribute or conduct scientific research on a voluntary basis. Citizen scientists do not hold academic degrees in the fields of research to which they contribute nor are they part of an academic trajectory in that particular field. Furthermore, citizen scientists do not receive a salary for their research activities. Engaged within various stages of research participation and encompassing different degrees of involvement, citizen scientists have historically contributed large amounts of work and research on their own or in partnership with their professional peers. However, when it comes to either the valorization of their research, the facilitation of joint collaborations or the inclusion of citizen scientists within modern day academia, we observe that tenacious prejudices and barriers are often restricting these partnerships (Manzoni et al., 2019). This article provides an insight into the problems and challenges faced by scientists and citizen scientists during research and collaborations. Furthermore, this paper also focuses on the mutual benefits for all involved parties when working together in joint partnership. Finally, a list of possible solutions (enabling factors) is presented with the goal of facilitating collaborations and organizing the integration of citizen science into traditional scientific research.

Introduction

Although the contributions of citizen scientists have always played an important role in classic scientific research (Lorch, 2023), a lack of recognition and valorization of their contributions appears to be inversely proportional to their input or involvement. With European and occidental sciences being historically rooted in white male supremacy, colonialism (Monarrez et al., 2022), implicit or explicit (sexual) bias (Skov, 2020; Llorens et al., 2021) and 'ivory tower' mentality (Rawlins, 2019), we have come a long way to make science more inclusive (Saxbe et al., 2022). However, despite these efforts, the problematic status of citizen scientist within academia remains to this day largely unexposed and underrepresented in these discussions. With academia nowadays trying hard to include people of all kinds of cultural and ethnic backgrounds, genders and sexual orientations, we see that the majority of these efforts are mainly directed towards people who are already involved in an academic career or training program (Bilimoria, 2008). The input and efforts resulting in excellent scientific research from outside of the traditional academic framework is still regarded by many as strange, biased and not representative for qualitative research (Golumbic et al., 2017; Wu, 2023). To some, it is even considered as a threat as it might devalue the academic degrees or the research performed by professional scientists. Within this paper we will focus on the existing problems that both professional and non-professional scientists (citizen scientists) experience and how facilitating joint collaborations might contribute to better research. We briefly discuss the situation of citizen scientists contributing to Belgian paleontology as a representative case study for the situation of citizen scientists in a Belgian and/or European context. We focus on the aspect that Belgian paleontology is currently leading the way to become the first Belgian scientific field where a gradual transition into the inclusion and valorisation of citizen scientists in scientific research is taking place. We discuss paleontology and natural sciences in general, as representative scientific fields where research is often conducted, driven and enabled by citizen scientists. Lastly, solutions are suggested to improve the current challenges and problems within citizen science in a Belgian and European framework.

Formulating definitions

In 2014, the European Commission's green paper on citizen science (Socientize, 2014) was the first European initiative to put citizen science on the political agenda on an international scale. At the time of publication, citizen science was a relatively new term and often pejoratively referred to as 'amateurs performing science'. Defining citizen science is a complex matter, as citizen participation or involvement in scientific research can range from either very limited to very

extensive (Vohland *et al.*, 2021a). The lack of a comprehensive characterization, resulting in the prolonged absence of an official and universal definition by the European Commission, compelled many countries and research institutes to adopt their own definition of citizen science according to what seemed most advantageous for them. This free interpretation by governments, scientific funding bodies and research institutes has led to a constricted interpretation, where citizen scientists are often seen as a convenient and cheap source for extensive data collection referred to as crowdsourcing. This was particularly the case in Flanders (Belgium) where the vast majority of all funded citizen science initiatives between 2017-2020 were using citizens for crowdsourcing purposes (Hellemond, 2022). As a result, it is currently rather exceptional that citizens are involved in other steps of the scientific method within citizen science projects funded by governmental or academic funding bodies. This trend suggests that financial motivations are at the root of this application of the citizen science definition, rather than encouraging intellectual interaction between professional researchers and autodidact citizens. It was only until recently (with the publication of the Horizon 2020 guidelines on citizen science) that this one-sided interpretation and use of the concept gradually started to change. Over the course of time, different interpretations and variations of what citizen science encompasses (or should encompass) have been thoroughly documented, evolving into a much broader scope of scientific involvement and participation (Haklay *et al.*, 2021). An example of possible misinterpretation of citizen science are projects which assume that citizen science should always lead to a practical benefit by answering questions or problems faced by citizens within a community (Hughes *et al.*, 2022). These kinds of restricting presumptions create the idea that citizen science is limited to research for the people, using only their basic data input. However, not all citizen science should result in practical outcomes or benefits for (certain groups of) citizens within a community; the obtained knowledge and results can have purely theoretical implications as well. When we take a look at the official definition as proposed by the European commission^[1], it reads as follows:

"...Citizen science is any activity that involves the public in scientific research and thus has the potential to bring together science, policy makers, and society as a whole in an impactful way. Through citizen science, all people can participate in many stages of the scientific process, from the design of the research question, to data collection and volunteer mapping, data interpretation and analysis, and to publication and dissemination of results. Citizen science is also an approach to scientific work that may be used as a part of a broader scientific activity..."

Furthermore, the European Citizen Science Association's (ECSA) also defines 10 principles and characteristics on citizen science adding to the foundation on how citizen science should be defined (ECSA, 2015; Haklay *et al.*, 2020). When combining these definitions, principles and characteristics, a valid framework in which citizen science can be viewed as an enrichment for traditional scientific research can be established. By including citizens and self-taught independent investigators, traditional research can be expanded, diversified and in the long term, alter the exclusivity of academia. Additionally, the definitions imply that any collaboration may take place in the best of understanding and with mutual respect between citizen scientist(s) and professional researcher(s). Within the Open Science policy of the European Commission (European Commission, 2020), every citizen scientist should have the right to access and contribute to research and be credited for it. In this regard, the aspect of valorization is an important tool to facilitate and support excellent research by citizens. In summary, we can say that the facilitation, respect and valorization of scientific contributions made by citizen scientists should also be incorporated in a future version of the official definition. Consequently, the definition of citizen science is not a static concept, but rather a dynamic translation of a society in change, striving for inclusion, openness and scientific integrity.

Citizen Science In Belgian Paleontology

Within the natural sciences, the input and involvement of non-professional researchers contributing to various aspects of scientific research has been a long-time standard (Frigerio, 2021). From fieldwork and preparations to erecting collections, identifications and researching new taxa to the publication of results, we often find active citizen scientists involved in all steps of the scientific method (Bonney *et al.*, 2009). Moreover, some have acquired the unspoken status of international experts within their respective fields of research, such as experts in Belgian paleontology. Quite a number of citizen scientists have obtained such a high level of expertise that they can be regarded as reference investigators within their scientific domain. Although these citizen scientists work together with their professional counterparts, they are often fulfilling the majority of all research on an individual basis, from observation to publication. Despite collaborations with professional researchers and/or research institutions, These expert citizen scientists tend to collaborate far more often with scientific associations where other citizen scientists, collectors and enthusiasts with whom they share the same interest (Hellemond, 2019). The approachability of these independent scientific organizations certainly adds to the comfort zone of expert citizen scientists. A second reason why a vast number of citizen scientists prefer to work by themselves could also lie

in the fact that, within paleontology and natural sciences in general, research can easily be performed without relying on costly laboratory equipment, consumables or long experiments. Nevertheless, the incentive to proactively contact and collaborate with professional colleagues is thus somewhat lost. As a result, the exchange and cooperation between academia and citizen scientists as well as independent scientific organizations is not synchronized, despite the fact that intense collaborations could provide mutual benefits. To address this disequilibrium, two awards (The Louis de Pauw and Palaeontologica Belgica award) were presented in Belgium for the first time in 2021 to bring the parties closer together, while valorizing expert citizen scientists' research in paleontology. The laureates are chosen by the whole of the Belgian paleontological community in order to validate the decision and its significance (Hellemond, 2022). An annual scientific board meeting democratically votes upon the winner and legitimates the existence of the award. To this day in Belgium, this is the only award that is given to citizen scientists and to professional researchers engaging in citizen science (and the promotion of Belgian paleontology). In 2024, the concept will be extended to the mineralogical community who will join the same ceremony to honor their citizen scientists. This concept may inspire other sciences to engage in making citizen science accepted as a valid/respectable way to contribute to science.

Restrictions and obstacles

The gap that currently exists between traditional professional and nonprofessional researchers (citizen scientists) is maintained or enhanced by a number of tenacious obstacles. Firstly, the lack of information and awareness on the official definition of citizen science and how it can be applied or incorporated on different levels in academia and society is a first important obstacle discussed earlier in this paper. Secondly, the predominantly introspective and self-focused mindset of both parties standing in the way of initiating joint collaborations, was also mentioned. An additional number of other obstacles encountered by both citizen scientists and professional researchers in their struggle for collaboration are listed hereafter:

1) Closed scientific communities

Modern day academia is often a very closed and restricted realm when it comes to conducting research. Outside interference is usually carefully planned to avoid the theft of intellectual property in the course of ongoing research. This protective mindset is perfectly understandable in the context of the exclusivity of important research and the prestige associated with it. However, this implies that for citizen scientists it is a bold step to engage in joint collaboration and fully enter this rather closed community. Moreover, the same problem may occur in the opposite sense, with professional researchers experiencing difficulties joining in expert citizen scientist research because they are very protective about their work. Citizen scientists might therefore not be motivated to share their findings with professional researchers out of fear of losing the scoop of their original contributions.

2) Non-prestigious academic results?

Another obstacle lies in the assumption that citizen scientist collaboration(s) would not bring about the necessary academic prestige for the professional scientist. Early career researchers who want to establish an academic reputation might be hesitant towards setting up collaborations with expert citizen scientists. The choice of either collaborating with highly reputable international colleagues who have the power to broaden the young researchers' professional network and enhance one's *curriculum*, or choose to team up with unknown citizen scientists without any or non-specific academic credentials, is often a difficult choice. Consequently, collaborations with citizen scientists are often conducted by slightly older researchers who no longer have to carefully choose their projects in order to settle their academic career.

3) Top-down approach for project calls and grants

As previously discussed, citizen science projects within academia do not develop organically. They are usually induced by the opening of project and grant calls on behalf of governmental funding bodies or the board of academic research institutions. This top-down approach where citizen science is imposed on professional researchers by means of financial support is a rather inconvenient way to facilitate collaborations. Although this strategy might be used as a first top-down incentive to promote and introduce citizen science projects to different research facilities, it would be best not to make this a standard practice. Project calls for citizen science should preferably not impose too many top-down restrictions or dictate certain political or sociocultural agenda items on professional researchers. Inclusion, valorization, open science and good

ethics should always be at the heart of any citizen science project and in the long term encourage a more organic genesis of joint collaborations.

4) *Restricted access to information, collections and archives*

For an independent citizen scientist, accessing the latest information and research papers online poses a challenge. Online platforms such as ResearchGate^[2], Academia.edu^[3] are only accessible for professional researchers connected to an official research institute, and various websites of scientific publishers (journals) hide a great number of their published studies behind paywalls. Gaining access to these documents by registering as a user without an email address associated with an official research institution is not possible or expensive. Fortunately platforms such as Google scholar^[4] and the more illegitimate Sci-Hub^[5] are providing an alternative answer to access these publications. Similar restrictions or denials of access can be found during requests to visit collections or archives as an independent researcher. The association of a citizen scientist with a research institution is often a gateway to access protected information, collections and archives.

5) *Cognitive bias*

Cognitive bias or intellectual under- or overestimation represents a fifth obstacle. A professional scientist may unconsciously assume that a citizen scientist still has to learn everything and therefore refrain from setting up a collaboration. Conversely, a citizen scientist does not dare approach a professional scientist because he or she assumes that the latter already knows everything, devaluing his or her observations or contributions on a specific topic. These types of preconceptions/presumptions and similar forms of pigeonholing are also at the root of the difficulties which both parties might encounter when initiating a joint research project.

6) *Costly fees to attend symposia and international meetings*

Another obstacle are the fees associated with attending conferences and symposia as a layperson/outsider are considerable. Scientists often benefit from reimbursements to attend these conferences, and registration fees are often lower for bachelor, master and PhD students. A citizen scientist cannot take advantage of these reimbursements or reductions. Therefore, he or she pays the maximum price to attend an international conference. However, it is precisely at these events that an important exchange of ideas and knowledge on a given subject may take place. It might also be a good forum to talk about and promote the benefits of collaborations between professional and non-professional researchers.

7) *Skepticism and rejection*

Finally, as discussed by many other authors in different scientific fields, some journals and editorial boards are skeptical and hesitant to publish research conducted by or in collaboration with citizen scientists. (Baum *et al.*, 2006; Ottinger, 2010; Bammer, 2016; Gadermaier *et al.*, 2018). The fear of flawed data and overall quality makes it harder for expert citizen scientists to publish results in certain journals. This skepticism and discrimination towards the quality of research is merely based upon the discriminatory fact that research is conducted by or in collaboration with citizen scientists, and not upon the content or quality of the research (Lewis, 2022).

Benefits in collaboration

All initiatives which promote collaboration between citizen scientists and their professional peers are good incentives to stimulate long term partnerships. Award ceremonies, like the aforementioned Louis de Pauw and Palaeontologica Belgica awards in Belgium, can be one way to valorize these collaborations. In order to truly promote collaborations, it's important that everyone knows and is thoroughly informed on all the perks that working together in close partnership might bring. In this chapter, a number of major benefits of joint cooperation from the point of view of both parties are discussed.

From the perspective of the professional scientist

1) *Obtaining larger datasets*

Working together with one or multiple citizen scientists will generate more data which will support or disprove hypotheses, give rise to clear trends, and in the end will result in more meaningful conclusions. The time, efforts and logistics which can

be invested by citizen scientists into data collection or extensive fieldwork within the project would be difficult to compensate financially or logistically within the context of an academic research setting with professional researchers.

2) *Enriching research*

Working with citizen scientists provides an opportunity to tap into undocumented knowledge which may be useful to the study. The exchange of knowledge is not a one-way street, both sides may learn from each other in the course of a collaboration. The transfer of knowledge might be an important source of motivation or inspiration for both parties. (Dowthwaite & Sprinks, 2019)

3) *An economical method to develop research*

The time and effort devoted to the project by the citizen scientist need not be compensated financially. Nevertheless, it would be respectful if a budget was provided to cover small expenses made by the citizen scientist(s).

4) *Networking opportunities with other citizen scientists and scientific organizations*

For the professional scientist, a joint collaboration is an excellent opportunity to get to know citizen scientists in the field. A professional researcher has the opportunity to learn about regional or local associations and to persuade these organizations and their members to contribute to the research project.

5) *(Additional) funding opportunities*

Based on the type of research, special funds may be requested to encourage or facilitate collaboration with citizen scientists. This type of funding can be requested on a regional, national or European level, depending on the type of research or project calls.

6) *Facilitating outreach*

Many citizen science organizations have extensive experience in translating research results into an understandable and educational format which could be of interest to a broad section of society. By doing so, the results of a study may be published in popular media.

From the perspective of the citizen scientist

1) *Obtaining a sense of appreciation through respectful cooperation*

By being engaged in a joint research project, citizen scientists feel that their work and efforts are appreciated by their professional peers. Experiencing a genuine interest from the scientific community provides an extra stimulus to engage in deeper involvement and additional study.

2) *Receiving credit as a contributor*

Working in a joint collaboration implies that contributor credits may be shared with professional colleagues during the publication of results. Being acknowledged in the publication of results or being cited as co-author can be an incentive to continue working or establish long term (international) partnerships. From being acknowledged in a publication to becoming co-author or first author can become a stepping stone to leading one's own research.

3) *Obtaining access to specialized research equipment*

Within a collaborative setting, citizen scientists are given access to expensive and often otherwise inaccessible research equipment to complete or expand their research.

4) *Receiving learning opportunities*

Besides the theory, certain soft and hard skills can be learned and acquired by the citizen scientist, more specifically in regard to operating specific laboratory equipment. Furthermore, work ethics within the scientific community will also be adopted or (un)consciously transmitted. These experiences will allow the citizen scientist to grow as a researcher.

5) *Networking within academia*

The citizen scientist will be able to expand his or her research network considerably through this type of close and individual collaboration(s). Occasionally, the citizen scientist may fulfill the role of a mentor for the students he or she works with.

6) *Functioning as an example for the citizen science community*

Citizen scientists who are actively engaged in collaborations will inspire other citizen scientists within the community to look for similar opportunities. As pioneers they can become a respected role model for other citizens to contribute to scientific collaborations on different participatory levels.

7) *Obtaining access to information and collections items which were previously inaccessible*

Being part of a joint research project grants access to the latest publications and important archives, collections and specimens. In theory, many of these collections should be accessible to the public as they are often curated with the help of public funds. However, access is not easily obtained by people who are not connected to a research institution. Information and publications are often hidden behind paywalls which are a lot easier to access whilst working in close collaboration with an official research facility.

Enabling factors

In order to facilitate collaborations, large-scale initiatives could be installed or established, allowing for a favorable climate and fertile environment in which citizen science can develop into an inclusive and beneficial form of research. This poses a challenge, as a lot of these enabling factors have to be applied and established on different administrative levels of academia, government and society. On a national scale a knowledge hub or dedicated citizen science organization could promote, facilitate and centralize all knowledge and information on citizen science and citizen science initiatives. Its function could be similar to the task^[6] which the ECSA fulfills on a European level, but oriented more towards the general public and media. This knowledge hub could be the prime lobbyist institute for citizen science towards academia, (regional) government(s) and the general public. Moreover, it could be an extension of the views and policies propagated by the ECSA. Organizations and lobbyist groups which advocate citizen science on different levels could promote favorable legislation that allows citizen science to be accepted and supported on a legal level.

An example of the current need for such legal representation, is the unilateral and unbalanced regulations regarding fieldwork as well as the extraction and transportation of for example fossils, shells, stones and minerals. To avoid excesses of mass tourism, commercial pillage and illicit trade, several countries have very strict laws in order to protect much of their unique natural and historical heritage sites and landscapes. By establishing a network of protected sites and penalizing any infractions the rate of destruction caused by (mass)tourism, commercialism and pillage may be lowered. However, this implies that research and access to vulnerable sites becomes a purely academic exclusivity, as independent scientific organizations and citizen scientists are frequently forgotten within the legal framework (Hellemond, 2023).

As previously discussed, another potential enabling factor could be rewarding citizen scientists for their research in accordance with the many awards which exist in professional research. From the Nobel and Turing prizes over the Fields medal and countless other professional awards which exist, few awards are currently dedicated to citizen scientists in very specific fields. This enabling factor might motivate future citizen scientists to start up collaborations or continue their research. This sense of appreciation from within academia and society is an important factor to open and democratize sciences among the general public. Although, within academia itself there should also be a supportive culture, proactively motivating citizen scientists and researchers to engage in partnerships. It is important to emphasize that opening up research for joint collaborations does not merely materialize within the scope of a funded citizen science project call. The opening up of academia may be taken quite literally by for example granting access to research facilities, laboratories, collections, archives and research infrastructure to citizen scientists and the general public on specific dates. On these

(citizen) science days, enthusiastic citizens, citizen scientists and scientific organizations engaged in scientific research can meet PI's, PhD. and postdoc researchers within different domains and see to what extent an exchange of talent, ideas etc. can take place. This could equally be an excellent opportunity for early career researchers to train themselves in outreach activities and present their research to a broad audience. Physically opening up the research field might be a complex enterprise, but it could also take place in a more subtle way. An example might be to credit citizen scientists for their efforts within publications. Fieldwork contributions, data collection and the discovery of new species for example are regularly credited to citizen scientists within the acknowledgements but not as co-author (Allen *et al.*, 2014; Ward-Fear, 2019). This position is often reserved for (international) colleagues who contributed to a paper as a reviewer, by performing analysis or as a supervisor, but not necessarily as a writer. One possible solution would be to follow the Vancouver recommendations as proposed by the ICMJE journal on authors and contributors, implying that citizen scientists are included as co-authors only if they meet all four described criteria^[7]. Alternatively, the standards of what makes a contributor to scientific research co-author or a person mentioned in the acknowledgements could be redefined. A final enabling factor is the role of independent scientific organizations, where enthusiasts, citizen scientists and citizens in general can unite outside of an academic framework. These organizations withhold an often unexploited source of knowledge and expertise generally unknown by professional researchers. Enhancing communication, exchanging activities, joint projects and agreements, financial support and between academia and these organizations could facilitate joint projects and collaborations in the long term.

Future challenges

In an equitable scientific landscape, inclusiveness of citizen science in academic research is a key factor. But what exactly does academic inclusion imply? Firstly, it could be beneficial to change the current culture and tackle all the aforementioned restrictions and obstacles preventing a full inclusion. For instance, on behalf of the ECSA, an official 'expert citizen scientist' status could be instated. This status could allow experts-or skillful citizen scientists to take part in research in collaboration with an official research facility and allow them to be recognized as independent researchers working on a joint project. It could come with a declaration of the ECSA and could be co-signed by the collaborating research organization. While this certificate may help citizen scientists to obtain acceptance within an academic setting, it poses a problem, more specifically upon which specific selection criteria citizen scientists would be picked to be granted these certificates. After all, the aim should never be to establish an intermediate level that creates an additional barrier for citizen scientists wishing to contribute to research or worse, have these criteria indolently based upon measurable parameters such as the number of publications, citations, etc. However, it could be initiated in places where tenacious prejudices towards citizen science exist, in order to establish a first form of acceptance in rather hostile environments which in this manner can gradually open up towards joint collaborations. If carefully designed and reasoned, this concept could be rolled out and monitored as a small-scale experiment in order to witness its effects.

A second factor which could be discussed is how far this concept of inclusion should be pursued. The main goal of inclusion and open science is not to eradicate the individual personalities and identities within the scientific field. An open and inclusive science implies that all those who are involved in the scientific field should share their knowledge and support one another in their work and research. Good scientific research should always strive to be impartial. Whoever contributes to good research should never lead to discrimination. In other words, the ultimate goal is to conduct good research, regardless of who produced it.

In a future perspective, a number of other features/elements could be liberalized with the purpose of facilitating the inclusiveness of citizen scientists in traditional academia. For instance, why can't a citizen scientist be included as an official member of a jury during a doctoral defense (both private and public)? Secondly, why is it that the application for funding should be reserved exclusively for certified academic personnel, shouldn't it instead be possible to apply for it as a citizen scientists (in collaboration with an official research institute). Thirdly, shouldn't citizen scientists also be represented within the various (national) academies of sciences. These factors and many more on how citizen scientists could be included in research or official educational functions requires us to rethink certain practices which over time were taken for granted. Arguably, a double standard currently exists in how expert citizen scientists are being included and perceived in society. For instance, passionate expert citizen scientists often volunteer as non-paid guides and educational personnel in museums, yet often do not find their expertise validated when applying for an official teaching or educational job. These observations should be included in future research. Self-examination should be a central element in this exercise to attain a fair and inclusive scientific world.

Conclusions

Within a European framework, every country has different engagement, acceptance and inclusion rates of citizen science within its scientific landscape (Vohland *et al.*, 2021b). Gradual yet meaningful changes are deemed as having the most impact on a long term basis, starting with spreading information (and education) as a first step. When society and the academic world would be thoroughly informed and educated about the true meaning, benefits and methodology of citizen science, a gradual change towards the valorizations of its results and the contributions made by citizen scientists could take place. If citizen science days and award ceremonies would become a standard practice, a general acceptance of citizen science would likely establish itself organically. This could in turn become a foundation upon which an open and free environment could be built, where citizen science could be included as an integral part of the scientific landscape and within society. Only when this liberalization has been fully achieved, we would be able to reach full inclusion. To summarize, the different steps in the inclusion process are listed below:

- 1) *information & Education*
- 2) *Valorisation*
- 3) *Acceptance*
- 4) *Liberalisation*
- 5) *Inclusion*

Though it may seem somewhat idealistic to reach/establish full inclusion, this should never become an argument not to strive for it as a society. However, in the run-up to this goal, we need to remain aware of the pitfalls along the way. It would be highly unbecoming should science be presented systematically in a childish or paternalistic way to the general public and within the media. The perspective of science being presented merely for its entertainment value impedes citizens to connect with the other-worldly community of scientists and researchers. Bringing science to society and society to science is a complex road, filled with obstacles, prejudices and challenges acting on different levels. However, all the obvious advantages which could be gained from joint collaborations should provide enough motivation for all involved parties to pursue lasting beneficial partnerships.

Contrary to what defamers claim, citizen science is not an outgrowth of traditional science in crisis, but rather the inspiration and thirst for knowledge which we intrinsically carry within us. Therefore, it should not be hidden, penalized or ridiculed, but rather encouraged, praised and supported, in order to include it as a fundamental part of the scientific landscape. By sharing knowledge we can evolve as a society and tackle future challenges as a united scientific community.

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