



Discovering Invisible Truths

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ABSTRACT The rise of populist movements worldwide is challenging science and motivating scientists to join the debate and enter politics. Based on my experience, taking a public stand will not come without slanderous personal and institutional attacks as an attempt to shake scientific credibility. The virology community is at risk of similar misrepresentation; reflection on this topic, particularly on how to address such challenges, should be a priority, given we are in the "post-truth" era.

KEYWORDS credibility, influenza, populism, slander, vaccination

INTRODUCTION: GIVING VOICE TO SCIENCE

Several years ago, I was a leading influenza scientist (1). I headed a fantastic team at the Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro, Italy. There, I was very fortunate to lead at least two impactful projects. First, we developed a vaccination system for avian influenza in poultry that successfully controlled and eradicated subsequent epidemics of the disease in Italian farms (2). Second, we ignited an international debate on sharing avian influenza virus genetic sequences in an open-access environment to boost research and preparedness in a pre-pandemic phase (3,4). The latter challenged an existing paradigm on data sharing across disciplines and organizations and was covered broadly in the popular press (5, 6).

However, scientific research and the efforts of scientists are not often fully recognized or appreciated by the general public, stakeholders, and policymakers. In the current environment, some believe that standing up and fighting for science has become part of the responsibility scientists hold and is a moral imperative. I had that opportunity and I grasped it. The Italian Prime Minister in office in 2013, Mario Monti, asked me to run for a seat in the Italian Parliament "to populate the Italian Parliament with members who understand the complexity of science policy and who can defend and promote science to make Italy more competitive" (M. Monti, personal communication, 6 January 2013). I accepted (7).

MATERIALS AND METHODS: CONSPIRACY THEORY AND SLANDER

I was elected to the House of Representatives of the Italian Parliament and then selected as Vice Chair of the Science, Culture and Education Commission of the Chamber. I was motivated to make a difference. I was the speaker for the nation's research budget (Fondo Ordinario per il finanziamento degli Enti e istituzioni di ricerca; FOE), and I achieved a unanimous vote on my proposed modification of part of the nation's €1.7 billion research funding scheme. It was a complicated and challenging task and I was respected and appreciated for how I was managing the process.

One year after my election, an Italian weekly magazine, *l'Espresso*, published a cover article entitled "Virus traffickers: scientists have agreements with 'Big Pharma' to sell their vaccines and create epidemics" (8). The magazine cover was bright yellow and pictured a scientist in a biosafety level 4 (BSL4) lab suit with subheadlines screaming "Commercial agreements between scientists and pharmaceutical companies to manufacture and sell vaccines for their own profit," alleging that bird flu strains were being "smuggled through the mail," and referring to epidemics as "big

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business" (8) (the publisher declined a request to reproduce the image here). The article summarized a secret investigation led by the Rome Deputy District Attorney into a purported criminal organization that was selling influenza field viruses to pharmaceutical companies to enable them to produce vaccines for contemporary strains. The investigation also clearly alleged that there was evidence of deliberate spread of pathogenic viruses into the environment, with the criminal intention of establishing avian influenza epidemics in poultry and in humans in Italy between 1999 and 2008. The magazine cited me as the criminal mastermind behind an organization of approximately 40 people (8, 9).

I learned about the accusations with horror and dismay by reading the 6-page article, which also included distasteful pictures from layer poultry farms and infected sites during culling operations. The story was based on an absurd distortion of real events occurring between 1999 and 2007 that had been extensively reported in the scientific literature by myself, my collaborators, and external observers in review articles. To exemplify the level of inaccuracy of the investigation, investigators and prosecutors had confused outbreaks occurring in different years and caused by different viruses in different countries. As an example, they stated or believed that highly pathogenic (HP) A/H7N3/Pakistan/1995 (A/H7N3/PAK/95) was the causative agent of outbreaks caused by low-pathogenic viruses, such as A/H7N3/Italy/2003. These two viruses were addressed generically as H7N3 and then were additionally confused with an A/Italy/H7N1/HP/2000 virus. The "subtle" genetic, pathogenetic, and antigenic differences between H7 viruses were not taken into account in the narrative, and relevant scientific literature was completely ignored by the investigators (10). According to their reconstruction of events, I had taken personal advantage of the avian influenza vaccination campaign for my own profit, through royalties and contracts with pharmaceutical companies. A simple fact-checking exercise would have clearly shown that all intellectual property rights related to the DIVA (Differentiating Infected from Vaccinated Animals) test had been transferred to my home institution (9,11). Another accusation was that I had actually promoted sharing of influenza virus sequence data globally so that I could create "killer" viruses in the lab. Further, conversations with colleagues, captured through phone tapping, in which I discussed my commitment to provide strains held in our repository to other scientists worldwide, were used against me as proof of misconduct. My words were repositioned in space and time and misrepresented to support a conspiracy theory between scientists and Big Pharma. I was accused of a dozen crimes, one of which was punishable with life imprisonment (9).

RESULTS: VISIBLE TRUTHS

Justice is never fast enough, and certainly it is particularly slow in Italy. For over 2 years, I was shamed in the media and violently attacked in the Italian Parliament. I was asked publicly and repeatedly to resign and was the subject of multiple interrogations by populist parliamentarians. But the worst was the personal shame—neighbors' and acquaintances' slippery looks and abrupt shifts on the sidewalk left me in great distress. I was also shamed in the scientific community. The story was covered by both *Science* and *Nature* (12-16). The personal and professional alienation was paralyzing (9).

Notwithstanding my status in Parliament as a full-fledged lame duck, I continued to advocate for science and for greater attention to emerging threats, including antimicrobial resistance, Ebola preparedness and response, and *Xylella fastidiosa* infection in olive trees. I also was dedicated to maintaining a balance and institutional representation during the Commission sessions I chaired.

But a new challenge had begun. I had to provide evidence for my innocence, and to prove that members of my team had nothing to do with this. I spent endless days and nights assembling a 400-page dissertation to defend my professional work—digging out old papers, reviews, emails, calendars, presentations, and records of trips and meetings. I had to recover and document everything that happened in my professional life between 1999 and 2008, compiling evidence to nullify the accusations.

Those were years of fear—fighting for science and my reputation against a system that is highly bureaucratized and scientifically incompetent.

A little over 2 years after the leak to the press, the judge for the preliminary investigation reviewed the case and dropped all charges against me and others because "there was no case to answer" (17). My 400-page defense had convinced the judge of our innocence. After being completely cleared, I resigned as a Member of Parliament (9).

DISCUSSION: THE INVISIBLE TRUTHS

The series of events that have triggered this rather devastating experience are irrelevant to the argument I would like to make. The detail is just an example; the context is instead very concerning. This happy-ending horror story is not only about me—it is about all of us and it holds multiple invisible truths.

The winds of anti-science ideology are now strong on both sides of the Atlantic and Pacific Oceans. The rise of populist movements and the dawn of the post-truth era are a threat to the values we cherish as scientists and to scientific competence. The populist movements generate oversimplified solutions to complex problems, and the post-truth era contributes to this framework by giving more value to sensationalism and opinions than to facts. The combination of these effects is destructive and should be of great concern to all, as it has the power of undermining basic scientific tenets, such as the efficacy of vaccination.

Scientists are entering or approaching politics in record numbers to stand up for and defend science and science-based investigation. In the current environment, this is both important and necessary. From my experience, it is a calling that comes with personal and professional sacrifice and risk, especially in a populist and post-truth setting. It is possible that increased exposure of scientists in the political arena might elicit stronger anti-science campaigns from populist movements. Anti-science movements often support Big Pharma conspiracy theories and include extremists of the anti-vaccination movement or of animal rights activist groups. As a community, we must be vigilant and prepared.

Microbiologists and molecular biologists have easily become among their targets. Some of us work with pathogens that elicit fright with even a mention. Terms such as "cloning," "mutation," and "virulence" are a small part of the peculiar verbiage we use to describe daily work and ordinary challenges. Snippets of these conversations can be easily misconstrued and interpreted incorrectly or deliberately taken out of context, especially by people who are motivated to do so from a political point of view.

We should be mindful that we are in an era in which competence and truth are devalued. Certain groups may go beyond demonstrating against some of our activities and may try to attack our credibility. This is an asset we cannot afford to lose.

We do science because we want the world to be a better place. But we cannot take for granted that science stands on its own. Some of us have taken on the challenge of fighting for science to defend its place in society, and more and more scientists are expected to join in. Perhaps as a community, we should reflect on how to proactively manage the challenges to come before they manifest themselves with the destructive force of slander.

Inappropriate reactions to slander could nullify important achievements of the past and weaken our strength in battles we are called to fight, such as tackling antimicrobial resistance or continuing our work on developing novel vaccines. As scientists, we have the moral responsibility to support the advancement of science rather than its devaluation and decline. Hard times seem to be approaching, and we cannot be caught unguarded, unprepared, or unable to respond to attacks fueled by anti-science movements.

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