

## Scientific truth and political opportunity

Corrado Lodovico Galli

President of the Italian Society of Toxicology (SITOX)

The scientific method aims to achieve the knowledge of an objective, reliable and verifiable reality, that consequently can universally be shared. It is based on a rigorous analysis of experimental data, as stated for the first time by Galileo Galilei, associating the "reasonable knowledge", the "indispensable evidence" and the systematic, empirical critical scientific analysis of assumptions about the relationships between different phenomena.

Today, more and more often, the application of the scientific method clashes with the ease of "Believing" rather than "Knowing".

The result is that the "risk perception", to which the population is exposed in relation to certain biological, chemical and physical phenomena, is linked to a "communication of risk" that, nowadays, too often, supports its own news business with interests not strictly related to the scientific method. A partisan "risk communication" can lead to a state of anxiety that makes individuals more dependent, easily influenced, and insecure.

The scientific method is not determined by misplaced human "Beliefs", but from indisputable objectives of scientific evidence. That is, something is truthful because it is established as truthful by a scientifically recognized authority on which those who have the responsibility to govern our society must rely with undisputed trust.

It is with great "*intellectual agony*" that scientists do notice that certain scientific realities are "manipulated" to reach political objectives.

A typical example is the controversial use of animals in scientific investigations related to the efficacy and safety of new drugs, or to define safe doses of exposure to synthetic or natural substances present in the environment and in the food chain. The population at large does not "Know" that studies involving animals are prescribed by many European and International Regulatory Agencies because they are necessary and beneficial for the management of chemical risks; instead they "Believe" that they are the result of acts of sadism by certain researchers. The scientists who really want to reduce the use of animals know that *in silico* and *in vitro* methods are available today. These methods are definitely considered useful complementary methods, but they are not yet suitable to provide a conclusive answer regarding very complex biological phenomena such as carcinogenic, immunotoxic and reproductive effects.

And how can one believe the statements of European political authorities who continue to ban the use of Genetically Modified Organisms (GMOs) because there are those who "Believe" that foods might be contaminated with the hazardous GMOs (it's as interesting as the media insinuations which go beyond the scientific evidence).

Those who do not "Know" ignore, or surreptitiously fail to communicate that animal feeds containing GMOs are often also used in Italy. So even those who strongly argue the toughest opposition to use of GMOs, daily eat food from breeding animals fed with GMO feed without any evidence of adverse consequences to the consumer.

The fact that GMOs are not hazardous should not be surprising since all the organisms in the world, both plants and animals, have shared genetic material. One gene does not necessarily represent a factor of uniqueness in an organism. Indeed, human beings share 30% of the genes with the tomato, 50% with the banana, 90% with the cat and 60% with most fruit.

Therefore, it should be clear to consumers that in the management of risk there are motives beyond science and faith, which are replaced by elements that are mainly tied to politics.

In conclusion, the media speculations, driven by certain determined self-interests, negate the efforts made by scientists, or even by international agencies all over the world, such as the European Food Safety Authority (EFSA) and the USA Food and Drug Administration (FDA), which have repeatedly stated that, at certain doses of exposure, both aspartame, an artificial sweetener, and glyphosate, a herbicide, do not represent any risk to the health of the population.

### **Poor competence, wrong numbers, and misleading messages**

*Board of Directors of the Italian Society of Toxicology (SITOX)*

In an article six years ago, entitled "La comunicazione scientifica: il delicato rapporto tra scienza, media e pubblico" (Mem. Descr. Carta Geol. D'It. XCVI, 2014, pp. 387-390), G. Bevilacqua notes that the media, the link between scientists and population, often receives criticism from the scientific community that "denounces the carelessness and their tendency to sensationalism" **just** to provoke public interest.

Without going too far into the debate that for years has generated extensive sociological literature; but unfortunately, without adequate attention by the scientific community, it can be noted that things have not changed much to date.

The recent and prolonged *lockdown* following the pandemic COVID-19 resulted in many hours of broadcasted debates in which exquisitely scientific issues were being addressed by journalists, politicians, and celebrities with dubious appropriate skills. Often arguing topics lacking both scientific basis and common sense, but mainly based on subjective "Beliefs", not robust scientific "Knowledge". A sort of performance which lacks scientific and social information and only creates confusion and mystification.

However, it must be stated, that scholars and scientists also heard, and the community heard and listened to them. Consequently, there was extensive

involvement of the medical and scientific experts in the COVID-19 debate, valuable in many cases, even if oftentimes experts were urged to engage in discussions of topics with very limited information available or nothing known about them - that is, they were pushed to answer questions which were not always possible to answer.

Perhaps this has not been the best way to communicate sound scientific information to the community. On the other hand, it was possible that, in a period of great fear and confusion, people were looking for safe directives and, perhaps, elements of reassurance. It was positive and reassuring that television hosts and newspaper reporters have often turned to competent presenters for help.

We can therefore recognize the validity of the efforts to communicate science in the correct way, which at least avoids transmitting information to the community that tends to superficiality and sensationalism, which Bevilacqua observed six years ago and which continues to occur now days. It is disappointing, in fact, to recognise that also credible journalists of rank sometimes find it difficult to communicate rigorous scientific information (based on objective evaluations and reliable analyses), and need to rely on the essential contribution of the experts with better skills than other parties.

The consequence has been to emphasize a separation with the recent past where important issues, like those of animal experimentation, GMOs, vaccinations, etc., have been argued irrationally rather than by engaging in any type of scientific arguments or investigations.

The distressing search for sensational information, together with some selected subjective "Beliefs", is often part of a process of elaboration of a false truth and may seriously undermine the reliability of the newspapers or television from which this information is broadcasted. A typical such case was provided in a television episode and newspaper article in which the problems associated with the use of pesticides and other chemicals in agriculture were addressed. A topic that should be approached with great attention, rigour and scientific competence, to avoid the potential of consumers drawing conclusions based only on emotional and irrational considerations, as indeed happened in the past in the debate on the above topics. Unfortunately, the information provided during the broadcast was incorrect. For example, the inaccurate reference to the total quantity of pesticides and fertilizers used annually in Italy.

To provide correct information, these data should have been reported separately, since pesticides and fertilizers are completely different products for uses and characteristics or properties. Above all, it is important to note the use of plant protection products is at least 50 times less than that of fertilizers (0.12 million tons

of pesticides per year compared with 4.6 million tons of fertilizers – reported by the National Institute of Statistics - ISTAT).

By presenting the information in these terms, the listeners assume that such a large proportion include only pesticides (a category which in turn includes herbicides, insecticides, fungicides, etc.).

The numbers to which the broadcast referred were grossly incorrect and most misleading. By inappropriately adding up the annual consumption of these agricultural products, the quantity of pesticides and fertilizers was 4.72 million tons per year. This number is orders of magnitude lower than the 1,300,000,000 tons broadcasted by the media. A serious and certainly not negligible error.

A tendency towards sensationalism and a lack of a correct, objective communication also occurred during the discussion of a very sensitive topic about the herbicide glyphosate. The hazard assessment was referenced by researchers with a bias as if it were an encompassing single thesis, without engaging in scientific debate about the relative health problems or informing the community that there is an extensive quantity of scientific information and debate concerning the safe use of this herbicide.

In fact, reference was made mainly to the opinion expressed by the International Agency for Research on Cancer (IARC), without however providing the necessary information regarding the assessment methods followed by IARC. Above all, without reporting that the major international regulatory agencies, such as the European Food Safety Authority (EFSA), the Joint FAO/WHO Meeting on Pesticide Residues (FAO/WHO JMPR), the European Chemicals Agency (ECHA), the USA Environmental Protection Agency (USA EPA), Canadian Pest Management Regulatory Agency (PMRA), the Japanese Food Safety Commission (JFSC), the Australian Pesticides and Veterinary Medicines Authority (APVMA), all unanimously, stated that glyphosate does not pose a risk of carcinogenicity, and its residues in food do not pose any risk of toxicity at the doses established to be safe for consumers.

In other words, about 20 International Regulatory Agencies have deemed it appropriate to attest to the lack of any health risk for the consumer or operators, in conjunction with the use of glyphosate in agriculture. Oddly, there was no clarification to explain the reason why IARC listed glyphosate in Group 2A (limited evidence of carcinogenicity in humans and sufficient evidence in experimental animal).

The IARC evaluation is only based on the intrinsic hazard of a chemical and does not calculate a specific level of risk which is a function of hazard and exposure. With this approach, relying only on the hazard not the risk, asbestos and processed meats

were paradoxically listed in Group 1 human carcinogens (sufficient evidence of carcinogenicity in humans). Undoubtedly even less informed listeners/readers would have better seized the meaning of the opinion expressed by the IARC if they had more information on the procedure of the Agency assessment. In other words, everyone would have better understood that the risk does not depend only on the intrinsic hazard, but primarily on the level of exposure.

This is perfectly in line with a concept enunciated five centuries ago by Paracelsus that is still fundamental and definitely current. Its application required the rigorous enforcement of the equation for calculating risk, i.e. *risk is a function of hazard and exposure*. At international level, there is no alternative to the application of this postulate. Paracelsus has provided an example even more convincing - he said that water in extremely large quantities can be toxic, and even lethal, because it dramatically alters the salinity balance of the body when taken in large quantity.

Nothing else needs to be said.

Despite the delays in the communication due to the well-known phenomenon of the COVID-19 that plagued us in the recent weeks, the broadcast elicited an animated reaction from many experts in the toxicological field and some of them have sent an articulate letter to the newspaper to request an apology for providing incorrect information in the article. The letter was not published in the newspaper, nor was a public apology given in print. An inconspicuous short note was added to the web page of the broadcast, stating:

“The first version of this article reported 1.3 billion tons. It was a mistake and we are sorry”!

This anecdote does not promise much hope for the media providing correct information in the scientific area the future. This story is of great concern and worries scientists in general, but particularly Toxicologists and the Italian Society of Toxicology (SITOX).

The various purposes of SITOX includes providing the correct information about chemical risks to the community, using different forms of direct communication and through social media. Above all, by making its skills available for an open debate aimed at contributing to the accuracy and value of the information distributed through the media channels. SITOX can only criticise forms of scientific communication by the press, and other media as described, that creates alarm by providing partial, misleading, and inaccurate information to the community.

Completeness of information and clarity is necessary for appropriate and common-sense behaviour.

## FOCUS FROM THE WEB

### **Chemophobia: the irrational fear that all chemicals are harmful**

Post published on the SITOX Facebook page on November 27, 2019

*Curated by Frida Bushati*

*Italian Society of Toxicology (SITOX)*

The word "chemistry" is often associated in the mind of individuals with something dangerous and harmful, different from the "natural" which is considered instinctively healthy and free of risk in the public imagination. This distrust of chemistry has become so widespread that a term was coined to describe it: "chemophobia".

Fear of chemistry is an irrational bias, a learned aversion associated with erroneous preconceptions that have no scientific basis nor a notion of the meaning of safety. The journal *Nature Chemistry* recently published the results of a further research by the *Institute for Environmental Decisions* (IED) about chemophobia. It is a large-scale, mixed methods survey conducted in eight countries (Switzerland, Austria, France, Germany, Italy, Poland, Sweden, and the United Kingdom). The goal of the study, funded by the Swiss government, was to study consumer knowledge on the principles of safety assessment and the correlation of this knowledge and trust in regulatory bodies at the level of chemophobia experienced. In this perspective, studying the reasons for a distorted perception of chemical risk can help facilitate communication between industry experts, regulatory agencies, and the public.

An important outcome of the study is that 40% of people interviewed do everything they can to avoid contact with chemicals in daily life, though they clearly form a primary part of it which cannot be ignored. The completely irrational aversion to chemistry induces disproportionate reactions, so much so that 39% of people would even like to live in a world where there are no chemicals and consequently, however absurd, not even human beings, who are constituted (made of) and survive thanks to the chemicals without which life on earth would not exist. Overall, in all countries, chemophobia is correlated with a limited knowledge of the international regulatory principles of safety assessment in the use of chemicals in the various fields of use.

This association is most marked in Sweden, Germany, and Italy where there are large gaps in the knowledge of the implications of chemistry in the real world and in everyday life. In some countries, as in France, chemophobia, on the other hand, is strongly correlated to a lack of trust in public authorities and in the regulatory bodies in charge of risk evaluation. The survey provides interesting food for thought for all those who are engaged in teaching and in the disclosure of the strict rules for which they are internationally responsible for evaluating the safe use of chemicals.

For the scientific community to respond effectively to ancestral persistent fears are difficult, but not impossible. Consumers can make consciously informed decisions by assessing safety of synthetic and natural substances in a more responsible way only through a continuous, objective flow of information on the safe use of chemistry and of toxicology, based on solid scientific information.

Consequently, it becomes fundamental to reduce the unconscious fear towards everything that is chemical by education and dissemination and communication of risk evaluation. It is important to emphasize that the hazardous properties of one chemical is not dependent only on procedures used to synthesize it; but are dependent only on the intrinsic characteristics of the chemical. And what is more fundamentally important is that exposure (dose) is the principal factor in tandem with the hazard to determine the biological response, hence risk, and not whether the chemical is natural or synthetic.