



What Role Should Toxicology Play in a World Become Overloaded by Pollutants and Pathologies?

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Editorial

Currently, everyone knows that we live in a world of pollution and we wonder in a very pragmatic way about the known, unknown, suspected or simply considered effects between environmental pollutants, technologies, scientific advances and pathologies that we have, for half-century of the industrial era intensification. So, should we be open-minded about our responsibility not only as scientists but even more so as "Human" citizens who want to preserve a fertile and clean land for our children to be safe and in good health. Indeed, by modifying the natural environment, at its convenience, especially since the beginning of the industrial era, the man has radically modified his way of life and makes suffer the beautiful blue planet. So, earth sick of all kinds of pollution (air, water, soil, plants, animals), because of man unconsciousness, his greed, his egoism and his stupidity. In addition, our civilization and our overconsumption, while they provide us with a certain material well-being, are responsible for the degradation of our environment by various biological and physical agents or chemical substances, which beyond a certain threshold and under certain conditions, cause the destruction of ecosystems, climate change by global warming and the increase of storms, floods and droughts, ending up with an upheaval affecting our safety and our health as well as that of our children.

More than five million manufactured chemicals have been released into the environment without recycling, as if the ecosystems were infinite! These products have often been designed so that their actions are often stable because they are rather insoluble (plasticizers, phthalates, PCBs, various oil residues, inks, insulating or industrial residues, heavy metals) and can be penetrating, bioconcentrated and active on the physiology of organisms (drugs, food additives, pesticides including herbicides, insecticides, fungicides, rodenticides). In addition to its anthropogenic products, there are natural toxins such as phytoestrogens, mycoestrogens and cyanotoxins. All these pollutants become excellent candidates for the disruption of the regulatory systems including the nervous and endocrine system and induce in man more dangerous and complex pathologies.

The mainly food-borne contaminants act significantly on the gene expression, synthesis, storage, production and transport of hormones, but also on their metabolism, fixation, elimination and action by having mimetic effects or antagonists. In addition, their endocrine or nervous disruption can be *via* the epigenetic aspect which affects several generations and describes transgenerational effects. Moreover, the problem of 'low doses', as it appears today with these contaminants such as Bisphenol A (BPA), for example, or the fact that some 'mixtures' are toxic while, when taken individually at the same doses, each of the compounds is not toxic, urges the greatest attention and the implementation of the precautionary principle in the concept of good evaluation and risk management to stimulate scientific research and adapt toxicology. As defined, 'toxicology' is a very old science that studies toxic substances and poisons. This is tantamount to asking a very pertinent question about the characteristics of a better and effective role that toxicology must play today in this world which becomes troubled by several sources of pollution and encumbered by many pathologies.

Most scientific sites define toxicology as a science that focuses on the sources and modes of contamination, the effects of toxic substances on organs and organisms. Toxicology is also in charge of demonstrating and characterizing the toxicity or safety of molecules individually prior to their use and marketing. This concerns drugs as well as natural products, cosmetics, food and other chemical products (phytosanitary, paints, solvents, additives...). This risk-based definition reflects a necessary but insufficient role to address the current problem. In addition, in the National Institute of Environmental Health Sciences website, it is reported that some scientists refer to toxicology as "safety science" because, as a field, they have moved from a science-based to study of poisons

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and adverse effects of chemical exposures to a science devoted to risk management and consequently to studying 'safety'. Albert Einstein cited: "Man and his security must be the first concern of any technological adventure". Therefore, the role assigned to current toxicology is to predict "what and how" chemicals may cause harm and then shares that information to protect public health while going through research programs to better appreciate their dangerousness to human, animals and the environment.

Toxicology today is given a more complex role in detecting, managing, controlling and striving against the effect of a whole soup of pollutants, of which three main points that deserve further attention are:

1. Dose to which a person is exposed: the toxicology tries to have a better understanding of the 'dose' by determining its mechanisms of action and to identify the effects of low doses but also by what exposure a substance presents a risk, the route and duration of exposure (short or longer) and critical period of exposure (in utero, childhood, adult...). 'Low-dose' exposures that may seem insignificant may have biological meaning or lead to an adverse health effect if the exposure is continuous or happens during a critical window of development.

2. Not everyone will respond to substances in the same way: many factors, including the amount and duration of exposure, an individual's susceptibility to a substance, and a person's age, all

impact whether a person will develop a disease or not. There are times in a person's life when he may be more susceptible to chemicals. These moments may include periods of 'active cell differentiation' and growth in the womb and in early childhood, as well as during adolescence, when the brain is continuing to develop. Just because someone is exposed to a harmful substance, does not always mean that he will get sick from it.

3. Detoxification, elimination and decontamination: the toxicology is just beginning to study the mechanisms of detoxification in organisms and to investigate the means of the decontamination of environment (water, soil, air). Some scientists appreciate the potential of medicinal plants and recommend the solution to the current pathologies may be the medicine of grandmothers when certain botanists seek to demonstrate the efficacy of depolluting plants.

4. In conclusion, toxicology must nowadays play an increasingly complex role with more precise scientific data and requires the communication of this data to legislators and politicians because it is up to them to put in place the 'safety' of citizens. However, current scientific knowledge and data are neither acceptable nor accurate, which makes the task of the toxicology, within a principle role of "safety science", very difficult to highlight the limitations and gaps in legislation and then to suggest faster improvements and stricter prohibitions to protect the citizens.