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Glyphosate: part of a eugenics model?

El glifosato: ¿es parte de un modelo eugenésico?

The concern of the intellectual
is by definition the conscience.
Rodolfo Walsh (1)

THE EXPERIMENTAL STUDIES

Our study of the effects of glyphosate on embryonic development emerged from an personal necessity to open dialogues around the stories and reports of diseases like repeat miscarriages, malformations, autism, behavior disorders, and cancer in areas subjected to intense sprayings of herbicides like glyphosate (the herbicide of choice to which Monsato's genetically modified soybean is resistant).

At the same time, the study was a way to give body to the existing information, applying experimental models not typically used in toxicology to evaluate toxicity and collateral effects; and to fill a void created by the lack of information on the effects of the toxins used in the agricultural industry on complex biological processes. Finally, it was a way to invite new debates on scientific knowledge in contrast to the superficial and insufficient information generally provided by corporations that have long controlled the chemical market and now control the new technologies applied in agribusiness.

The use of 200 million liters of glyphosate in 20 million hectares where millions of Argentines live makes this substance a threat to nature's balance. The lack of control in Argentina over the last 15 years regarding the constant increase in concentrations of glyphosate, in addition to other chemicals, continues to be a challenge to that medical science which upholds the precautionary principle in the face of risk or suspected harm.

Glyphosate alters the cell cycle and DNA reparation mechanisms (2), induces apoptosis (3), passes the placental barrier (4) and induces genotoxicity (5). Malformations produced by glyphosate have been observed not only in Xenopus and chickens, but also in mammals (6). In Paraguay, an increase in malformations in humans has been detected in relation to the distance to soy-producing regions with intensive (although not exclusive) glyphosate use.

It is important to highlight that the higher concentrations used to combat increasingly resistant weeds makes it crucial to reassess the toxicity (DL50) and the partition in the tissular distribution (8) of each compound, as the extensive use in millions of hectares makes impossible any experimental predictions regarding the potential impacts in human and environmental health as well as in biodiversity. If we admit that we as human beings are not only products of the genes of our species, but rather their interaction mediated by the environment – something that modern science cannot deny – it is imperative that we establish new criteria prior to initiating the use of chemicals on the land. The situation additionally invites reflection regarding the technologically-based model of agribusiness (like that of the mining industry) and of food sovereignty (a fundamental part of social medicine), as well as issues of food security, as various studies throughout the world have begun to show (9). Not only have we made food a commodity produced by multinational corporations that destroy the soil and sabotage biodiversity, but we

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now have evidence that these genetically modified foods do not have properties equivalent to those of their natural counterparts (9) (substantial equivalence).

Experimental models based on animals are used regularly in medical research. In particular, vertebrates are used because, despite their differences, they all indisputably conserve the basic pattern of embryonic development. Since the 80s, with the discovery of the *Hox* genes (10), vertebrates have been used not only to understand how the body is formed, but also to study and understand the genetic and epigenetic regulations of malformations in neonatal medicine. These considerations must form the base of research into contaminants that lead to increasingly frequent problems of infertility, miscarriage and birth defects.

The discovery of the conservation of the body plan that forms the embryo provided evolutionary studies with a significant theoretical renewal, making possible associations between embryonic development and environmental factors that had been previously overshadowed by the hegemonic reductionism of molecular biology.

The factors responsible for 90% of development failures are not clearly understood, however epigenetic and/or environmental explanations are resisted by the celebrated genetic determinism and the technification it lauds.

The investigation carried out in two experimental models (amphibian and chicken) showed that both an herbicide based in glyphosate (48%), in dilutions of 1/5,000, as well as the injection of pure glyphosate in embryos – equivalent to a 1/200,000 dilution – produce severe cephalic malformations (microcephaly and alterations of the facial structure, even to the point of cyclopia) and alterations in the cardiac area and the embryonic trunk. These malformations are consistent with alteration in the expression of genes that intervene in the formation of the embryonic midline, the cranium and the brain, among other structures. The inhibition of the regulation of the expression of the genes studied (*shh*, *otx2*, *pax6*, *slug*, among others), explains the morphologic alternations described.

This explanation was confirmed by studying one of the most important regulation mechanisms in the early stages of development. The embryos subjected to the herbicide showed a significant increase in the concentration of a derivative of vitamin A: retinoic acid, a known regulator of gene expression central to the construction of the embryonic axes, cephalic morphogenesis, etc. It is also a teratogen amply described in clinical medicine when the levels or points of action in the embryo are altered due to variations in its synthesis or metabolic degradation (11,12).

In summary, the results obtained are consistent with the malformations observed due to the cephalic inhibition of *shh* and *otx2* and the Caudal regression syndrome caused by an increase in retinoic acid during the early development of vertebrates. These effects are generated during the gastrulation of vertebrates, corresponding to weeks 3 and 4 in human development (13).

THE REACTIONS

This evidence of malformations in embryo development caused by glyphosate, produced by the increase in retinoic acid levels, unleashed in agricultural and government sectors unusually harsh defamations, putting in evidence the interlocking political and corporate interests that dominate the public discourse. One example, among many, of this interdigitation is the project of the company Arteriocyte Research to generate human blood using directed cultures of stem cells, financed by the US Department of Defense through the Defense Advanced Research Projects Agency (DARPA). Such strategic interests – as the universities involved in this joint venture with Arteriocyte call them – respond to a growing demand for blood due to the proliferation of conflicts, preventive wars and increasingly frequent military interventions.

Here the two faces of this model come into view. One puts science to the service of the mass production of commodities with technologies that, rather than respond to human necessities, respond

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to market logic, be it in agribusiness or in war. The other refuses to accept that this same science from a critical perspective can and should question technological advances, whether because of their lack of consistency, because of their collateral effects, or because of ethical aspects that threaten the peace and well being of human society.

SCIENTIFIC REASON AND EUGENICS

This conflict becomes evident when excellent scientists otherwise capable of resisting any blow to their academic integrity compromise themselves in million-dollar studies that blur ethical limits in benefit of a technocratic rationality headed by an uncritical and narcissistic scientific system. A discourse in which the "harmony and preservation" of nature are rejected in favor of the Faustic idea of "replacing" nature and "addressing the collateral damage" with more technology.

History, the ideological substrates of modern science, and the development of the academic disciplines show us that the consolidation of capitalism during the 18th and 19th centuries was built on a conception of science based in modernity. One example is genetics: a science developed in order to improve the species, in particular the human species, founded in the mid-19th century by Sir Francis Galton in Victorian England.

Sir Galton founded eugenics in the heat of Darwinism as a discipline to legitimatize the Victorian social order; it was quickly applauded and adopted by the "progressive" rationalism of the United States and Europe and set the precedent for the elements of systematization in the new field of genetics and the rediscovery of Mendel's Laws. With Nazism, the prestige of eugenics was dealt a blow and the world of genetics shrouded its shared precepts in silence. But despite this eclipse, eugenics remained alive in the unconscious of the scientific corporation and the power that sustains it, receiving reinforcement with the discovery of DNA and the human genome sequence that revived the feverish hopes of Victorian determinism. It was and is the renewal of an aspiration to see man "improved" biologically, psychologically and socially. Improvements reflected in the resolution of human conflicts through a technology that overtakes politics.

The episteme of eugenics ideology returns not as a justification of the social structure but rather as an instrument of power and social control, with a self-referential scientific discourse that seeks to give techno-science an exclusive centrality in the game of politics. For this reason the eugenics paradigm now expands to food production, biomedicine, pharmacology, nanotechnology, engineering and all disciplines that contribute to the fantasy of a chimerical nature dominated by a prosthetic, technologically designed man. In this desperate search for perfection and the quest to become superhuman, all limits and all reluctance to progress without first measuring the consequences disappear. Not only health and nature, but also human behavior, social sciences, and politics must be explained in the language of this techno-biological tale.

Lewis Mumford, in his analysis of technology and art, writes:

> Our technics has become compulsive and tyrannical, since it is not treated as a subordinate instrument of life [...] the machine has become our main source of magic, and it has given us a false sense of possessing godlike powers. Although we have broadened our powers through technological development, we have not developed the ability to control those powers and the remedy we adopt for this situation is only a symptom of the sickness itself. We have become technological gods and moral devils, scientific supermen and esthetic idiots. (14) (Own translation from Spanish text)

All of this in service to the concentrated power of the corporate world system. Capitalism, in its chameleon yearning, appeals to a "reflexive modernity" in which scientific knowledge resolves any disaster that progress may cause in nature. Or, alternatively, to a "natural capitalism" that produces nontoxic inputs.

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There is nothing more perverse than to suggest that the undesirable effects of capitalist modernity can be remedied with more technological development, without any need to question the means of appropriation, accumulation and distribution of human production.

It is time we ask ourselves with seriousness and urgency if the production models based in technology that the large global corporations propose to the world – with their hegemonic aspirations of global control of social behavior, the economy, and cultural narratives – and their devastating consequences are not new forms of a more subtle, but also more terrible, eugenics than that which man has known until now.

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