1878 mots = 16´10"

Fukushima: precious time has been lost

Michel Fernex

“What should WHO have done after Chernobyl ?” asked Dr Nabarro in 2002 when he was Acting Director-General of the World Health Organization. I replied immediately, and then confirmed it in writing: “Convene a Scientific Working Group on Ionising Radiation and Genetics” like the one in 1956, and add the words “and Genomic Instability”.

In 1956, in response to this question, WHO convened a study group in Geneva that included the Nobel prize winner in genetics, Professor Muller, and other luminaries of international repute in the field. Together, these scientists reminded the world that « The genome is the most valuable treasure of human kind. It determines the life of our descendants and the harmonious development of the future generations. As experts, we confirm that the health of future generations is threatened by the expansion of the nuclear industry and the growth of the quantity of radioactive sources. We also consider that the fact of appearance of new mutations observed in people to be fatal for them and for their descendants.” Since then, geneticists have been exploring a new area: genomic instability caused in particular by radiation.

Since 1959, an agreement signed between WHO and the International Atomic Energy Agency, and then a number of additional legal texts, prohibit WHO from intervening in nuclear accidents. But in 1986, the Minister of Health in the USSR asked WHO to set up an international Research Project and aid for the victims of Chernobyl. There was no response for eighteen months, because WHO had no authority to intervene. The IAEA, promoter of civil nuclear power, responded. In the project they designed, there was no mention of genetics, but they gave high priority to dental caries and this became the subject of investigations and research.

What genetic damage has been done to the population following the accident at Fukushima? Are the alterations already recorded in the cells of those workers who have exhausted themselves, over the last year, in an effort to reduce the dissemination of radionuclides into the environment. What about people who inhaled radioactive material and ate contaminated food ? Has this induced genomic instability? And the children that have been born since, or who will be born to fathers or mothers who have been irradiated. Have they inherited the fragile genomes of their parents ?Are they, perhaps, going to be even worse affected than their parents ?

In fact, researchers have been surprised to find that genetic damage, and above all perigenetic damage, which is responsible for genomic instability, to descendants is far worse than to parents; and this risk increases from one generation to the next. R.J.Baker and his colleagues, studying the DNA of genes transmitted from mother voles to their babies, found levels of mutation, from generation to generation, reaching 100 times higher than anything we have previously encountered up to now in the animal kingdom. The area in which these rodents live has seen its level of radioactivity decrease, because Caesium 137 is carried in rainwater and infiltrates deep into the soil, where it can be recycled by plants.

One might think that in forests far away from Chernobyl that these rodents would react positively to these improved radiological conditions. But the mutations and the genome fragility have increased over 22 generations in populations of voles studied by Goncharova and Ryabokon in Belarus. These geneticists have observed the opposite of an adaptation to radioactivity: an increase in genomic instability in all populations studied, from 30 to 300 kilometres away from the stricken reactor. In

the least contaminated zones, near Minsk, the genomic instability is slow, but it will persist and worsen up to 22 generations later.

The genetic effects observed in both humans and rodents has led Professor Hillis, at the University of Texas, to conclude in his editorial in the review *Nature*, 25th April 1996: « We know today that the mutagenic effect of a nuclear accident can be far more serious than we ever suspected, and the eucaryotic genome can present levels of mutation that, up to now, would not have been considered possible. »

At Fukushima, genomic instability needs to be followed up over generations, starting with grandparents and parents, then the children and grand children. After a year, the damage caused by the mixture of internal and external radiation to children should be measured, by comparison with data from before 2011 in the same areas, or by comparing data with communities further away, that were spared the radioactive fallout. Birthweight, incidence of stillbirth, perinatal mortality up to 28 days, birth deformities (heart problems should be investigated later), and among the genetic diseases, Down's syndrome, should all be studied. Brain damage with tumours, and developmental retardation which, like decreases in IQ, will become evident at school age. The sex ratio should also be examined, given what we know about Chernobyl, where the deficit in female births is manifested in the absence of thousands of girls from populations in countries close to Chernobyl, and even as far away as Germany, where the deficit was measurable.

Haemotologists and immunologists should study lymphocytes and immunoglobulins, and search for autoantibodies in particular to the endocrine glands, such as the thyroid and the islets of Langerhans in the pancreas. These glands can be altered because they tend to accumulate Iodine 131 and then radioactive Caesium.

The statutes of the International Atomic Energy Agency (IAEA) oblige the organization to take decisions that are politically imposed upon it. These may be less costly, but they are medically unacceptable. These statutes serve as a reminder that the principle objective of the IAEA, which is a UN agency, is « to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

In order to achieve its objectives, the IAEA cannot admit that these serious and common illnesses were caused by ionising radiation, because once known, it would prevent the development of the nuclear industry throughout the world.

The IAEA is therefore a poor source of advice for national health authorities; it denies the health catastrophe and gives priority to economic considerations; its statutes forbid attributing to, or associating serious illness with, radiation. Incorrect estimates delay the evacuation of communities that have been highly exposed to radiation. It was almost incomprehensible that at Fukushima there was no distribution of stable iodine to the population that would soon be under threat. Such a preventive measure would have been welcomed, as Keith Baverstock showed in Poland after Chernobyl.

The first victims of a serious nuclear accident are and will be children, with an increase in allergies and an aggravation of infectious diseases, which become chronic and involve serious complications. Professor Titov showed that in Belarus, the immune system was profoundly altered after the accident. Both white blood cells and gamma globulins were altered. This needs long term monitoring. Research needs to be done on the autoantibodies directed against beta cells in the islets of Langerhans in the pancreas, or against cells in the thyroid gland. Hashimoto's thyroiditis has the same aetiology as Type 1 diabetes, both of which increased after the nuclear accident. At Chernobyl,

this form of diabetes affected younger and younger children. This diabetes did not exhibit the same characteristics as the Type 1 we find in our countries. So it is an illness caused by ionising radiation. Other diseases of the endocrine system affect the sex glands, with problems occurring in young girls at puberty and with male sterility.

In equal doses, external radiation is ten to a hundred times less damaging than chronic internal radiation, which essentially results from the oral absorption of radionuclides. These concentrate in organs like the thymus, the endocrine glands, the spleen, the bone surfaces and the heart.

Bandajevsky showed in autopsies conducted after Chernobyl, that concentrations of Caesium 137 are twice as high in children's organs than in those of adults, having lived in the same areas. The highest levels measured in tissue were in the pancreas and thymus of new born children and in breast fed infants (Bandazhevsky, SMW 133: p.488-490, 2003).

In order to protect children, we must give complete protection to pregnant women. Children can avoid absorbing radionuclides, if we provide them with uncontaminated food and drink, at home and in school. Taking holidays in uncontaminated areas is also beneficial.

Pectin reduces the absorption of Strontium 90, of radioactive caesium, and of uranium derivatives. It also accelerates the elimination of radionuclides both in faeces and in urine. Bacteria in the colon manage to partly metabolize these long glucide chains, fragments of which can be absorbed; they then mobilize radionuclides in the organism. The food additive, pectin, is considered by scientists at the European Commission research centre at Ispra (Italy) to be very well tolerated and to have no contraindications.

A contaminated organism can be protected also by taking vitamins E and A, as well as carotenoids, that act as antioxidants. Carrots, beetroot and many red fruits contain these substances. Jersey cows produce milk that is very rich in carotenoids and in vitamin A, and is very good for children.

The dosimeters that have been given to children should be replaced by mobile spectrometers which measure the whole body, and these can be transported to schools periodically. These spectrometers measure the caesium 137 load in the body. If the load is above 20 Bq/kg of body weight, contact should be made with the family to eliminate the source of contamination.

Epidemiological and medical problems should be studied and treated from birth right through to puberty by paediatricians, geneticists and immunologists, in the communities that have been contaminated. They should compare the current situation in Fukushima with data from comparable areas that were not contaminated.

What should the authorities be doing ?

More contamination could exacerbate the genetic damage that has already occurred and with advice from geneticists this should be avoided. To reduce internal radiation, which forms 80% of the risk for the inhabitants of the contaminated regions, the industries responsible or the government authorities should provide uncontaminated food.

Where there is contamination of the organism by radionuclides, children should receive cures of chelators that accelerate the elimination of accumulated radionuclides. These are polysaccharides, like pectin from algae, vegetables and fruit.

In the long term, molecules with antimutagenic properties should be researched, selected and developed.

Dr. Michel Fernex
Emeritus Professor, Basel Faculty of Medecine
Former Consultant, World Health Organization