

## Show more determination, please !

**Les perturbateurs endocriniens, une menace pour le développement du cerveau (Endocrine disrupters, a threat to brain development) is the striking title of an article by Ludmilla Terres that was published in the French newspaper Le Monde, on March 7<sup>th</sup> this year.** I often ask myself whether exposure to chemical compounds affects our brain development; whether exposure to endocrine disrupting chemicals (EDCs) undermines our intelligence; and whether exposed mothers who are unaware of the threat deliver mentally retarded children.

Brussels is not in the clear yet. Very recently, the EU executive refrained from voting on the criteria for the identification of endocrine disrupters even though criteria are urgently required. Regulatory indecision is probably the last thing we need.

**It is general knowledge that omnipresent endocrine disrupting chemicals alter the subtle balance of the hormonal system.** Two recently published studies point to endocrine disrupters and their impact on brain growth and development. Fini et al. [2017] conclude that there are multiple impacts on brain development even when exposure times are very short. The authors put forward a twofold, alarming message: (1) obviously, exposures may have several effects (in the plural!) rather than one single effect, and (2) even very short exposures are not safe. Embryos of the species *Xenopus laevis*, the African clawed frog, were exposed for three days to a chemical cocktail whose concentrations were comparable to those commonly measured in the human amniotic fluid, commonly called a pregnant woman's water. The age of the embryos was selected according to the onset of the thyroid function, which releases the thyroid hormones essential for good brain development.

As thyroid hormone signalling is strongly conserved across all vertebrates, the results of the study clearly suggest that ubiquitous EDC mixtures exert adverse effects on foetal human brain development. There can be no doubt that the foetus can be indirectly exposed to toxic substances. This message had already been clearly expressed in *Losing Our Minds*, the book published by Prof. Barbara Demeneix [2014].

Granted, Fini et al. [2017] actually use the term “suggest”, meaning they cannot offer complete (100 %) certainty. No known test method can offer complete certainty. Uncertainty is intrinsic to science and all progress in the field of knowledge implies that scientists push back the boundaries of scientific uncertainty. Some however equate uncertainty with anomaly and transform it into doubt [Michaels 2008; Proctor 2012].

**The authors of the CHEMTrust report [2017] remind us how extremely complex the ~85 billion neurones of the brain are.** A delicate and elaborate development takes place throughout our lifetimes. But the early stages of our development, from the foetus to adolescence, are rapidly changing, and have a high sensitivity to toxic chemicals. In these early development stages, disturbance of thyroid hormones can lead to significant, adverse effects, such as reduced IQ or autism spectrum disorders. When exposure occurs after birth, the associated risks are usually decreased motor ability and concentration.

When the first exposure takes place during pregnancy, at a time when the human body is most vulnerable, when it is being shaped by the hormones, EDCs can have an irreversible effect. Then there is no cure!

Prof. Philippe Grandjean [2013] highlights the silent pandemic since industrial chemicals have begun to disrupt brain development. He confirms that we are only given one chance to develop a brain and that damage to the developing brain of a foetus or child is very likely to have lifelong effects. Besides listing 213 industrial chemicals that are able to reach the brain and cause brain toxicity — he refers to them as the “brain drainers” — he also provides detailed examples of the effects of lead, mercury, arsenic, polychlorinated biphenyls and pesticides in his book *Only one chance*.

**Haven't there been enough alerts already on the dangers of EDCs?** Many have raised the alarm and denounced the collusion that exists between industrial stakeholders and public health authorities when it comes to regulating pervasive chemicals in our daily lives and environment. For example, one hundred scientists appealed to Europe and the international community insisting that they act against EDCs. They blamed the industry for using doubt manufacturing strategies similar to those used in the fight against climate change [Kortenkamp 2016]. Industry has long understood that to debate the science is mostly easier and more effective than to debate the policy. The manufacturing of doubt has resulted in significantly delayed protective actions, with adverse consequences for the health of people as well as for the environmental quality [Michaels 2008; Proctor 2012].

Professor Andreas Kortenkamp is the lead author of several detailed reports on EDCs [Kortenkamp et al. 2009; Kortenkamp et al. 2011]. He underlines the general consensus that EDCs are very unsafe and require a specific approach in terms of chemical regulation. The ultimate goal of European regulation is to reveal the dangers before exposures occur. Kortenkamp et al. strongly believe we must anticipate the danger and ensure that humans are not exposed.

On 23<sup>rd</sup> December 2011, Kortenkamp and his team published their long-awaited report *State of the Art Assessment of Endocrine Disruptors*. The authors concluded unambiguously that EDCs justify the same consideration as the highly concerning carcinogenic, mutagenic and reprotoxic substances as well as the persistent, bio-accumulative and toxic products. Their toxicity is seen as extremely dangerous. They concluded that the European Commission should not only take into account the concept of potency. Instead, their report recommends a list of criteria that besides potency would include, e.g., the mode of action of the product as well as the severity and irreversibility of the effects. None of these criteria should be left out to ensure the approach is as broad and as open as possible. Considering potency alone should apply only when regulating and labelling acutely toxic chemical substances — poisonous substances that will kill you almost immediately after exposure.

Industrial stakeholders were none too happy with these conclusions. There were strong reactions and the European Commission dragged its feet.

The regulatory project was delayed following intensive lobbying by both the pesticide and chemical industries. Obviously, regulating ubiquitous chemical substances like endocrine disruptors is regarded as a sea change by the industries concerned, and a threat to their turnover.

**Other striking titles that point to a highly inconvenient truth!** Our intellectual climax dates back many years [Crabtree 2013 A & 2013 B; Woodley et al. [2013]. On the one hand, Woodley et al. [2013] computed the true correlation between simple reaction time and the g factor of intelligence by using a psychometric meta-analysis. The g factor — also known as general intelligence, general mental ability or general intelligence factor — is a construct developed in psychometric investigations of cognitive abilities and human intelligence [Wikipedia]. The approach of Woodley et al. [2013] yields a decline of ~1.16 IQ points per decade or ~13.35 IQ points since Victorian times. In other words, their findings demonstrate that with respect to g the Victorians were substantially smarter than modern Western populations.

On the other hand, Crabtree [2013 A & 2013 B] argues that the intelligence of human beings has been on a downward slope for quite some time. His study suggests that the human species has been stunned by involuntary changes in the human genetic code as well as by the technological developments that significantly facilitate our access to comfort. Crabtree concludes that our intellect is fragile.

This means we need to be extremely careful not to mortgage the future and more especially, the future of younger generations. Now, more than ever, all of us need real sound science. I deliberately use the term “sound science”. Years ago Philip Morris (PM) attacked “junk science” to discredit the evidence that second-hand smoke (and other environmental toxins) causes disease. PM used public relations companies and lawyers to organise a “sound science” programme that included disseminating its own (epidemiological) information about the health effects of tobacco products and getting decision makers on side [Ong & Glantz 2001].

Polluters are keen to tout “sound science”, but what they are really promoting just “sounds like science” but isn’t [Michaels 2008].

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