Our hormonal system under chemical attack

We are surrounded in and out of the workplace by more than 1,500 chemicals that can interfere with our hormonal system. They are called endocrine disruptors. The damage they can do to human health is well documented and policies to eliminate these chemicals are wanted.

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Pesticides made Mari Carmen ill and unfit for work.

Image © Javier Melian
The ability of some man-made chemicals to alter human hormonal systems has been known since the 1940s when diethylstilbestrol or DES first came into use for preventing spontaneous abortions. The term "endocrine disruptor" – strictly "Endocrine-Disrupting Chemical (EDC)" – is much more recent, having been coined at a 1991 scientific conference in the United States to refer to chemical pollutants that interfere with the hormonal system and essentially alter people's reproductive health. A varied group of experts' meeting in Wispread (Wisconsin) to consider the causes of the adverse effects found in epidemiological studies of humans and wildlife in the Northern Hemisphere zeroed in on damage to the reproductive and immune systems and cancers of hormone-dependent organs. They developed the hypothesis that the disruptions were due to impaired embryo and foetus development after exposure to chemical pollutants, which they dubbed endocrine disruptors.

The term "endocrine disruptor" therefore encompasses a wide variety of exogenous chemical compounds capable of modifying the functioning or elimination of natural hormones in the body. Their health impacts, modes of action and levels of exposure of the population and the environment have been the focus of European Union research programmes over the past sixteen years. The effects on human health of exposure to endocrine disruptors include:

- **risks to the male reproductive system**: cryptorchidism (undescended testicle), hypospadia (malformation of the penis), and diminished sperm quality;
- **risks to the female reproductive system**: menstrual cycle disorders (constant bleeding), menstrual period disorders, lowered IQ;
- **metabolism**: metabolic disorders, diabetes and obesity;
- **neuro-immune system disorders**: chronic fatigue syndrome, fibromyalgia, and multiple sclerosis.

It is clear from observing these effects that endocrine disruptors are linked to the major societal diseases like cancer, reproductive problems, diabetes, obesity, neurological diseases, and so on, where the numbers affected have reached epidemic proportions. Furthermore, research findings show that endocrine disruptors have particular characteristics which call for new policies to protect human health and the environment (see Box).

### The scale of exposure

More than 1,500 substances have been identified that may affect the hormonal system. They are found in everyday products like pesticides and biocides, products used in industry and environmental pollutants. Endocrine disruptors include conventional pollutants like Persistent Organic Pollutants (POPs) (PCBs, dioxins, hexachlorobenzene, organochlorine pesticides, perfluorooctane sulfonate, polybrominated diphenyl ethers, etc.), solvents (styrene, perchloroethylene, trichlorobenzene), metals (lead, cadmium, arsenic, nickel, mercury), pesticides (organochlorines, organophosphates, pyrethroids, etc.), plastics and plastic compounds (phthalates, bisphenol A), ingredients in cosmetics and hygiene products (parabens, triclosan), UV filters, detergent ingredients (phenols), environmental pollutants (tobacco smoke, diesel exhaust), and the list goes on.

Environmental pollution exposes the entire population to EDCs. Occupational exposure to chemical pollutants is also widespread and easily detectable if a rigorous chemical risk assessment is done. Riddling workplaces of endocrine disruptors also has significant environmental benefits, making action on occupational health a priority. A recent project developed by ISTAS, the Institute of Work, Environment and Health linked to the Spanish trade union CC.OO, has documented cases of occupational exposure to endocrine disruptors and their health impacts. Risk elimination through substitution schemes have also been successfully implemented.

### Among wind farm employees

Guascor, a subcontractor for one of the biggest world wind turbine manufacturers, the Spanish group Gamesa, hired 45 mostly female employees in the Palencia region (Castile and Leon) to work six days a week making fast-paced repairs to turbine blades. It was well-paid work (2,000 euros per month) but put their health at risk. Their job was to repair cracks in turbine blades by injecting special sealing resin, sanding them down and finally painting them. To do that, they used bisphenol A, epichlorohydrin, bisphenol diglycidyl ether, a range of resin hardeners, additives and various solvents.

At least seven of the workers soon noticed that their monthly periods had stopped and began to suffer from severe headaches, nosebleeds, nausea, irritation of the throat and nose. Two even needed an oxygen tank at home to assist breathing, but that seemed to ring no alarm-bells. Neither the company nor its prevention service noticed what was happening until the CC.OO became aware of the situation and took action.

Did the company know the dangers its employees were running? "They must definitely have known something because curiously, they didn't want to hire breastfeeding workers and insisted that they all work six-day weeks to get the job done as quickly as possible", said Roberto Garcia, the CC.OO official handling the matter. Some employees were cautioned by doctors not to get pregnant for at least two years, while others were warned of the possibility of having children with birth defects.

### Sick of tending plants

Mari Carmen worked as a hotel gardener in Fuerteventura (Canary Islands) in charge of tending balcony plants until health problems forced her to stop work. For three years, she worked virtually exclusively every day from 7 am to 3 pm applying neurotoxin- and endocrine disruptor-containing pesticides completely unprotected. After three years working for the firm, Mari Carmen began to suffer menstrual cycle disorders (constant bleeding),
body-wide pain, persistent fatigue and steadily worsening chronic skin conditions (psoriasis). She consulted a gynaecologist and several GPs none of whom ever asked what job she did or if she was in regular contact with chemicals.

The hotel owners never told her what chemicals were in the products she used every day, nor provided her with a protective mask or personal protective equipment to stop her breathing in pesticide vapours. Mari Carmen was finding it increasingly hard to apply the products especially at the hottest times of the day and put two demands to the employer: to be supplied with appropriate masks, and to have her working hours reorganised so as to apply pesticides from 9 to 10.30 am and then not again until the following day. “I decided to tidy up the planters one day, and apply the pesticides the next. That way I managed to avoid treating the plants in the full glare of the sun, which I just couldn’t take”. “I noticed that it got worse in summer, and I now think that might be due to the heat causing the chemicals to give off more vapours”, she explains.

At work, Mari Carmen was accused of being “a bit delicate”: “When I asked for masks, they said I wasn’t up to the job. My colleagues were all men, but they weren’t applying respiratory insecticides like me, they were doing other things. They left the room balcony planters to me because they didn’t want men going into the rooms. The assumption was that because I’m a woman, I’d be more careful and to be honest, I did love my job and I always made sure that there was no trace of me having been in the rooms”, says Mari Carmen.

The chambermaids would sometimes complain about the pesticide smells lingering in the rooms that Mari Carmen was dealing with. What some found annoying she saw as a sign that she was running a risk. A sign that she could not interpret: “The first time anyone asked me about the chemicals I was handling was only a few months ago. I went on a hunger strike for 19 days outside the social security office and some victim support groups heard about my case. It was through them I met Dr. Sergio Sánchez Suárez of the Canarias biomedical medical centre”. A quick check on the ISTAS Risctox chemical hazards database would have turned up the fact that many of the products Mari Carmen was using unprotected in her job are neurotoxins and endocrine disruptors.

After many set-tos with her employer, and not long before she fell well and truly ill and applied for sick leave, Mari Carmen finally got appropriate masks: “The firm was trying to get a quality label, and that’s when they gave us appropriate masks and protective equipment and put up fact sheets on the products where all employees could see them”. Too late for her. “I was no weakling, but by the time we got the masks, I couldn’t even get up in the morning, and I was going to work zapped out on painkillers to ease the pain I felt everywhere in my body. But the painkillers turned me into a zombie, and I couldn’t get to the end of the street without falling asleep”. By dint of consulting doctors, trekking from one hospital to the next and after lengthy sick leave, Mari Carmen was fitted

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Endocrine disruptors: unlike other chemicals

They act at very low doses. Very low dose exposure to endocrine disruptors can harm human health. The general public are exposed to them at these levels through air pollution in homes, food and consumer goods.

The age at which exposure occurs may be even more important than the level of exposure. Foetuses and young babies are especially sensitive to exposure to endocrine disruptors. Some developmental stages are particularly vulnerable to hormone disruption, resulting in life-changing health problems.

The dose-response relationship is not linear – so health damage can result at very low exposure or high exposure but not necessarily at intermediate exposure levels.

The cocktail effect: endocrine disruptors may act jointly and cumulatively or synergistically and exposure to low doses of a mix of EDCs can cause adverse effects at exposure levels considered safe for the individual ingredients in the mix. This is why EDCs have to be looked at in combination rather than each chemical in isolation.

Multi-generational effects: endocrine disruptors can affect several generations by altering the mechanisms of gene expression.

Latency: the damage done by endocrine disruptors may not show up for years after exposure; also, the consequences of in utero exposure mainly show up in adulthood, so any action taken today will also improve future public health.

Ubiquitous exposure: follow-up studies on endocrine disruptors in humans show contamination of the population at all ages. The presence of EDCs was detected in the umbilical cord blood, hair and urine of babies and children and in the blood and fatty tissue of adults. Analyses of food, consumer products, air, water, house dust, etc., show multiple exposure to EDCs – hence the need to eliminate the sources of exposure to them.
with an IUD with daily medication to prevent bleeding, had to be operated on for breast cysts and was diagnosed with fibromyalgia, nerve root damage, osteoporosis, osteoarthritis and multiple degenerative herniated cervical and lumbar discs that meant she had to walk with a stick.

Making this ordeal worse, she had to put in multiple claims to get her rights recognized. The National Institute of Social Security (INSS) did not consider that her case qualified for recognition as an occupational disease. At the end of her tether, Mari Carmen went on a 19-day hunger strike outside the social security office in Fuerteventura. Finally, the High Court of Justice of the Canary Islands recognized her as being totally work disabled in December 2012. "I was declared unfit for the work I was doing but fit for other employment, so I get paid a monthly pension of 600 euros". She wonders what job she might be fit for, as she can’t sit for more than an hour in front of a computer or talk for more than a quarter of an hour on the phone: "Sometimes I can smell a scent seven metres away and have to cross over the street; how can I find work in that state?", asks this woman who lives on her own and whose rent takes up half her pension.

The risk can be eliminated

The CC.OO (Workers’ Committees) occupational health unit set up the Reprotox project coordinated by ISTAS some years back. They identified chemicals hazardous to reproduction, pregnancy and breastfeeding present in workplaces where endocrine disruptors were being used and put forward schemes for substitution showing it to be the best prevention policy.

One of these schemes was run in an orange storage facility in Valencia. The workers had no idea that the wax they were using to make the fruit shine contained chemicals classified as endocrine disruptors and reproductive toxins. Where they were found to be present, the CC.OO proposed non-EDC alternatives like organic fungicides, physical treatments, etc. After a dialogue and consultation process, the company finally agreed to replace one of the products – octamethyleneclotetrasiloxane, a wax that contains endocrine disruptors and is toxic for reproduction – by a different wax with lesser health risks. This substitution helped protect the health of employees - specifically pregnant women – and was easily done - all it took was the will: the alternative product was even supplied by the producer of the replaced product.

Similar action was taken in an old people’s home in Cantabria (western Basque Region). The product to be replaced was a room disinfectant used in residents’ rooms after a death. The chemical was dispersed by an automatic spray that released doses into the air at regular intervals programmed in the dispenser unit. When using it, the employees wore the same ordinary latex gloves as cleaning staff, not gloves appropriate to the job or respiratory protection equipment.

One employee complained of health problems including sore throats and breathing difficulties when using the product. The CC.OO union rep for the company and the Cantabria Department of Occupational Health took the matter up with the employer and started looking for alternatives. After looking at various options, the product was finally replaced with a didecyldimethylammonium chloride and alcohol ethoxylate-based disinfectant called Germosan-Ter which does not present a serious risk to health.

In Aragon, workers managed to get epoxy resins replaced in paint for vehicles. When a vehicle – a bus in this instance – is being assembled, the body may suffer slight knocks or scratches and has to be touched up afterwards. For this, the assembled body was painted outside the cabin in the company’s repair shop by a worker with a compressed air paint gun, exposing him to dangerous toxic chemicals. To avoid this risk, it was proposed to change the manufacturing process to replace the resin-based primer (the undercoat for the coats of paint) by a water-based primer similar to that used in car garages. The replacement was cost-neutral for the company and improved manufacturing efficiency while protecting the employees’ workplace health.

"The firm was trying to get a quality label, and that’s when they gave us appropriate masks and protective equipment."

Down the generations

The effects of exposure to endocrine disruptors are handed down in the family. Dr Nicolás Olea and Dr Marieta Fernández of the University Hospital of Granada have for several years been documenting the link between maternal exposure to EDCs and birth defects: "There is a significant link between the chemical compounds we have identified in maternal placenta and the probability of childhood cryptorchidism (undescended testicles at birth). The take-away message is that it is not one single chemical that is responsible for the condition, but the combined action of all the chemicals".

The researchers are currently collecting evidence on the link between EDCs and other life-changing conditions beyond reproductive health: metabolic disorders like obesity or diabetes and cognitive development problems in children like attention deficit disorder or hyperactivity. "The question now is whether by altering the endocrine system, these disruptors are also causing the massive epidemic of diabetes and obesity that we are seeing", queries Dr Nicolás Olea. Dr Marieta Fernández is seeing a rise in brain development problems related to learning difficulties and hyperactivity in children whose mothers had been exposed to these toxins.

More information

The Reprotox project: http://istas.net/web/abre-texto.asp?idtexto=3450
Other examples of substitution: www.subsport.eu
List of endocrine disruptors: http://www.istas.net/risctox/en/