Sicker, Fatter, Poorer, by Leonardo Trasande, M.D., M.P.P.
Book Report and Comment by David Schwartz, M.D.
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In previous articles I have written about environmental pollution and ways of detoxifying the accumulated poisons in our bodies, but the chemicals discussed by Fr. Trasande are often "hit-and-run" agents. They leave the body very quickly, and so they are hard to detect, but they leave the damage behind, which can last for 2-3 generations. We dare not be cavalier about assessing their safety, because small exposures are well below the standard toxicological evaluation of harm. Some of these chemicals exhibit hormesis, that is, one effect at a very small dose, and a different effect at a larger dose, with the smaller dose having a paradoxically greater effect. The other weakness of standard toxicology is the ignorance about the synergistic effects of small exposures to several toxic substances together. We are experimenting on the public by allowing these endocrine disruptors in our food, water, and air.

Dr. Trasande, a pediatrician and a parent, was deeply concerned about how children (as well as adults) are affected by these hormone-disrupting chemicals. He realized that in medical school there was little room for studying not only chemical pollution but also the political and economic forces that shape medicine, especially environmental health. He studied health policy and its economics at the Harvard Kennedy School of Government. He is professor of pediatrics and professor of health policy at N.Y.U., he serves on several committees that study the impact of chemicals on children, and he has been working in environmental health for 20 years.

Though many other groups of chemicals pose similar dangers, the evidence is strongest for this group of endocrine disruptors. So these are the ones he chose to discuss in this book. The studies about these endocrine disrupting chemicals (EDC's), have shown clear, irrefutable results, studies carefully designed and replicated by independent scientists. Yet corporate assault on the science abound, relentlessly trying to dissuade the public of the dangers of these chemicals.

These endocrine disruptors contribute to a broad spectrum of diseases, including brain disorders, diabetes, obesity, and reproductive disorders.

Dr. Trasande measures the economic costs to the public of inaction, because costs always come up in the discussion of public policy, as chemical companies and manufacturers inevitably will whine about the costs to the public of removing these chemicals, just as car manufacturers warned of catastrophic effects on the economy of requiring seat beats, air bags, pollution controls, etc. Monsanto and the food industry scared the public in California into believing that if people knew they were eating GMO's, the food industry would collapse. (All the while, they were selling non-GMO versions of those same foods to Europe.) Then the ballot initiative failed, which would have required GMO's to be labeled. (My comments.)

So Trasande does financial calculations of the dollar costs of many of these EDC's' effect on disease burden, disability, deaths, and medical costs. He tries to educate the public so that people can influence public policy through political action, but also so that we can vote with our purchases to avoid many of these dangers.

The four groups of EDC's with the strongest evidence for health effects are pesticides, flame retardants, plasticizers, and bisphenols, but we know of at least a thousand more chemicals that are endocrine disruptors, that he does not include in detailed discussion.

These 'hit-and-run" chemicals have life-altering, long lasting effects on almost every person, but especially babies and young children, whose organs are just developing. These effects include lower I.Q.'s, ADHD, obesity, type 2 diabetes, heart disease, birth defects, infertility, endometriosis, fibroids, testicular cancer, and breast cancer.

These varieties of diseases are a marker for a common factor causing all of them, the disruption of many hormones, linked to thousands of chemicals not even regulated by our government, and which are continuing to be produced and used in hundreds of commercial products.

In 2012 the World Health Organization published a report documenting the EDC's as a "major and emerging global public health threat. In 2015 the Federation of Obstetrics and Gynecology put out its warning, and the Endocrine Society documented 1331 scientific references showing the concern for their effect on human health.

Since 2003 Europe has banned 1800 chemicals from cosmetics known to cause cancer, birth defects, and other harms. The FDA in the U.S. has banned or restricted only 11 such chemicals. In 1958 and 1960, amendments to the Federal food, Drug, and Cosmetics Act banned from foods, pesticides known to cause cancer. Then in 1996 the Delaney clause, which banned chemicals from food if they caused cancer at any dose, was removed.

Endocrine disruption was brought to light in the diethylstilbesterol (DES) scandal of the 1960's. This synthetic estrogen was given during pregnancy to prevent miscarriage. The daughters from these pregnancies developed vaginal cancers, previously very rare. We now know that DES exposure is associated with breast cancer and ectopic pregnancy. Sons developed birth defects and cysts in the tubes that come from the testicles. And we do not know the extent of the epigenetic effects on the grandchildren and great grandchildren of DES mothers.

The term "endocrine disrupting chemical" was first described in 1991 by world-renowned scientists gathered in Wisconsin by Theo Colburn, who co-authored Our Stolen Future. This book chronicled many instances of chemicals causing gender changes, cancer, and genetic mutations in wild animals. The authors demonstrated that not just one, but many hormone systems were being interfered with, and they warned about coming effects on humans.

Since then the effect of chemicals on obesity (called obesogens) and diabetes, has come to light, with effects on grandchildren and great grandchildren. Study after study published by Bruce Blumberg and colleagues have continued to show that EDC's trigger epigenetic alterations in gene expression, causing the body to produce more fat cells, which cause hunger to make more fat. The organophosphate pesticide chlorpyrifos caused low birth weight and a 3-5 point loss of I.Q. in children. Currently the EPA, in collusion with the chemical company that makes it, still considers chlorpyrofos safe to be used in agriculture.

Dr. Pat Hunt, reproductive geneticist and professor at Case Western Reserve, discovered that bisphenol-A (BPA), a pervasive in food and beverage cans, caused chromosomal damage in mouse eggs, at very low doses, too low to consider meaningful by toxicologists. Since then research has shown that dozens of chemicals defy the usual dose – response curve,

and Dr.Tresande in 2012 found this non-linear association of BPA with obesity. Regulating agencies look at very small concentrations to be insignificant and do not recognize this nonlinear response. They still think in terms of "moderation in all things." The other anomaly in dose – response is that for some chemicals, hormones are affected in a U-shaped, or nonmonotonic curve. That is, small doses have a little effect, medium doses have a large effect, and high doses have less, and vice versa, a low dose having a large effect, a medium dose less, and a high dose, more effect. Laura Vandenberg and colleagues found 600 studies of 18 EDC's that have nonmonotonicity, including atrazine, a weed killer still used extensively on corn. The FDA refuses to recognize nonmonotonicity in spite of its own data demonstrating such.

Dr. Trasande worked with TV journalist Anderson Cooper on a series, "Planet in Peril." Cooper had his blood and urine tested and found over 100 chemicals. How many chemicals are lurking in our bodies now, that we don't yet know about?

The author describes several groups of hormones affected by synthetic chemicals. Organophosphate pesticides affect the brain by disrupting thyroid hormone. The panel of experts he assembled in 2014 estimated the adverse effects on cognitive function of prenatal exposure to organophosphates as 70% to 100% probability, as convincing as the evidence for lead poisoning. They estimated the average loss of IQ from 1.7 to 7.0 points. Trasande notes that each IQ point loss translates to a 2% drop in lifetime earning potential, about $20,000. Using Europe as an example, this would be a loss of $194 billion per year to the country, the same as if a brand new Boeing 747 were stolen every day. Tell that to the nay-sayers who complain that stopping use of organophosphate pesticides would be costly. Eating all organic produce would eliminate the organophosphates in the food.

Flame retardants also have overwhelmingly convincing evidence for thyroid function disruption and detriment to brain development from prenatal exposure. Flame retardants have very poor evidence for effectiveness in a fire. One category, the polybrominated dephenyl esters (PBDE's), interfere with binding of thyroid hormone to its receptor.

How many patients do we integrative medicine doctors see who have all the major symptoms of hypothyroidism, yet have normal blood levels of

thyroid hormone, because the effect of thyroid hormone is being blocked? I had wondered for years if there were environmental toxins causing the epidemic of hypothyroidism and the many patients with sub-laboratory hypothyroidism. Now this appears to explain some of that. Many people take thyroid hormone replacement supposedly at the proper dose and still have hypothyroid symptoms. There are other causes for this, but these toxins may play an important role.

Four studies correlated babies' umbilical cord blood PBDE's with negative effects on cognitive function. The evidence is as strong as for organophosphates for the decrease in IQ. The author estimates the cost as $266 billion in the USA per year, for the population's decrease in IQ. PBDE's can be found in sofas, chairs, mattresses, electronics, carpets, and children's toys and clothing. Some PBDE's are being replaced with organophosphates.

Other chemicals can disrupt thyroid function and adversely affect cognitive function. Perchlorate (rocket fuel) is found on plastic and paper packages. BPA, a synthetic estrogen, though not so strong as DES, blocks brain development by disrupting thyroid function. This is in the lining of food and beverage cans, thermal paper receipts, and polycarbonate (#7) plastic containers. Plastic water and baby bottles may say, "BPA-free," but may have other bisphenols such as BPP, BPF, BPS, BPZ, or BPAP, with the same or worse toxic effects than BPA. Another example of chemical "whack-a-mole," the game in which you knock one thing down and several others pop up to replace it. Phthalates are also thyroid disruptors, used to make plastic soft for food packaging and some bags and tubing for intravenous fluid. They are used in many personal care products, lotions, and cosmetics. Phthalates are one of the examples of the hit-and-run effect, having lasting effects long after they leave the body. Others are Perfluoroalkyl substances used in non-stick cookware, like Teflon. They are being phased out, but replaced by another chemical, GenX, that interferes with fetal growth and birth weight.

The obesity epidemic is in a large part related to sugar consumption, causing insulin resistance and altered metabolism, as reported in my previous articles, "Fed Up," and "Fat Chance." The issue of "calories in, calories out," has been thoroughly debunked in those articles. Now chemical "obesogens" are also a factor, changing people's metabolic rate, so they can eat less and yet gain weight.

One obesogen is tributyltin (TBT), banned for use on ship hulls because of its effects on marine life, and it is still used in plastic food packaging. Phthalates, mentioned previously, causes mismanagement of calorie processing, causing a meal to be diverted to fat instead of to muscle. Phthalates also contribute to heart diseases by creating oxidative stress and inflammation in the arteries, as well as by decreasing testosterone. The Nurses' Health Study showed that the more phthalate exposure, the more weight gain. Diethylhexylthalate (DEHP) is being replaced by DIDP and DINP, which still have the same deleterious effects on blood pressure and insulin resistance.

Air pollution can be considered an obesogen. Mercury can disrupt hormones. Polycyclic aromatic hydrocarbons (PAH's), from burning fossil fuels, can disrupt lipid and sugar metabolism, and some are estrogens. Increasing numbers of studies are suggesting air pollution as a cause for diabetes.

BPA is another obesogen, making fat cells bigger and counteracting adiponectin from fat cells, a hormone that cuts appetite. The author estimates that BPA exposure explains nearly 2% of the obesity in 4 year olds, leading to roughly $2 billion in health care costs annually.

A number of reproductive disorders have increased in recent years, such as testicular cancer and hypospadias (the urethral outlet formed on the underside of the penis instead of at the end). There is no credible explanation for this increase except possible chemical influence. BPA, a synthetic estrogen, can cause hypospadias, undescended testis, testicular cancers, and low sperm count. Several studies show strong association between PBDE's and cryptorchidism (undescended testicles). Between 1973 and 2011, men in Western countries had a 59% decline in sperm counts. Phthalates are capable of inducing testicular dysgenesis syndrome. (defective testicular development.). Several EDC's are known to affect the prostate gland, and prostate cancer occurs more in men exposed to pesticides.

Ovarian dysgenisis syndrome , with endometriosis, fibroids, and female infertility, has been increasing at epidemic proportions. Female puberty has been occurring at earlier and earlier ages. The actions of BPA are

remarkable similar to those of DES, and ongoing studies may show its relation to polycystic ovary syndrome and female infertility.

Fracking for extracting oil from the ground uses more than 750 chemicals, many of which are EDC's. Samples of surface water near fracking sites showed estrogenic activity. In 45 human and animal studies, miscarriages, reduced semen quality, prostate cancer, birth defects, and pre-term birth were at significantly higher rates near fracking sites.

Exposure to phthalates used in food packaging and soft plastics is correlated with endometriosis, and is known to affect ovarian development and embryo implantation. The author estimates that there are 86,000 additional cases annually of endometriosis caused by phthalates, and $14 billion in preventable costs due to phthalate exposures. He estimates that 14,900 cases of breast cancer in 2010, could have been caused by DDT exposures in the 1940's (banned in the U.S. since 1972).

Dr. Trasande's recommendations, besides political action to ban or restrict the release of these many chemicals, include many personal actions. Eating organic food, or growing your own food, especially decreases exposure to organophosphates and other pesticides and herbicides. Pay special attention to the Environmental Working Group's list of the "dirty dozen," or the "terrible 12," vegetables and fruit that have the highest pesticide exposure. Limit exposure to phthalates. Containers with the #3 on the bottom have phthalates that can leach into food. Don't buy personal care products or cosmetics that have phthalates or DEHP as ingredients. There are organic cosmetics and skin care products available. Never microwave food in plastic. Just because it is "microwave – safe," only means it won't catch fire. It doesn't mean it is safe for <u>you</u>. Limit exposure to BPA by avoiding food from metal cans or food in plastic containers with #7 on the bottom, and decline thermal paper receipts if you don't need them. Eat more fresh, unpackaged food. Limit exposures to flame retardants by getting products that are naturally flame retardant, like wool, or get organic furniture. Vacuum with HEPA filter, and wet mop uncarpeted floors. Eat a mainly plant based diet, as the PBDE's are concentrated more in meat. Another reason to limit fast food is the phthalates in the packaging. As consumers ask questions and make requests of retailers to provide less toxic products, changes are made. The medical school curriculum needs to include more education about EDC's and environmental pollution in general. Another book, <u>Clean, Green, and Lean</u>, by Dr. Walter Crinnion, is

an excellent guide to limiting exposure to many kinds of pollution, and for removing persistent pollutants from the body. Also see my article on Detoxification, A Vital Imperative. What about the hit and run chemicals? If we can't reverse the long term damage already done, we can at least reduce further damage, and maybe there are natural treatments that can help to restore hormone function to a more normal state, if the exposure is stopped.

This book is bombshell, revealing the urgency for stopping the relentless release of not only endocrine disruptors, but of thousands of other chemicals that have unknown but dangerous effects. It is an indictment on our public policy and our civic responsibility to protect our people. This issue seldom comes up in presidential debates, and we need to bring it up. It gets eclipsed by climate change issues, which are also urgent. Environmental pollution is not news, but this book shows many specific descriptions of mechanisms of how hormone systems in our bodies are experiencing long term harm, and makes the science more clear and the issue more poignant. The issues brought up need more ongoing discussion, and a mandate for change.