

Endocrine disruptors — tipping the hormonal scales

by Dixie Mills, MD

Recent studies of small groups of diverse volunteers (men and women) in Europe, the US and Canada showed that everyone, including the chief of a remote indigenous tribe in Northern Québec, had one characteristic in common: without their knowing, their bodies had absorbed a complex chemical cocktail of dozens of different synthetic substances.



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So how did these chemicals get there? Very simply, as the accumulated by-product of a modern life, of breathing industrial emissions, eating treated food, and using endless consumer products — plastic microwave bags, fast-food containers, nail polish, computer casings, to name just a few. None of these volunteers were living near a toxic dump or exhibiting any unusual behavior or disease.

Of all the manmade toxins in our environment, we now realize that the most ubiquitous (the ones used to create plastics, pesticides, cleansers, dyes, flame retardants and white paper, among other products) may be the most worrisome. We identify these as endocrine disruptor chemicals (EDC's), as they have been shown to mimic the action of hormones when absorbed by humans and wildlife.

These compounds interfere with the essential inner workings of our cells. Measuring how dangerous they are has been difficult not only because they interact in complex ways and at tiny concentrations, but also because literally every species has had some exposure — often *in utero*. Despite the fact that these chemicals are a relatively recent invention — over the past 60 years or so — endocrine disruptors are omnipresent and there appear to be no uncorrupted, or “normal” subjects for us to monitor as a control group.

Why are endocrine disruptors so important for us to understand? Your endocrine system is one of the most sensitive communication networks — it influences all aspects of your health and well-being, including your reproductive potential, cognitive function, thyroid and metabolism, digestion and hormonal balance. How an individual reacts to hormonally active chemicals varies, but one thing is certain: never before have there been so many diverse, manmade and unregulated synthetics at work in our bodies. Many now think that we are the guinea pigs in the largest uncontrolled science experiment in history.

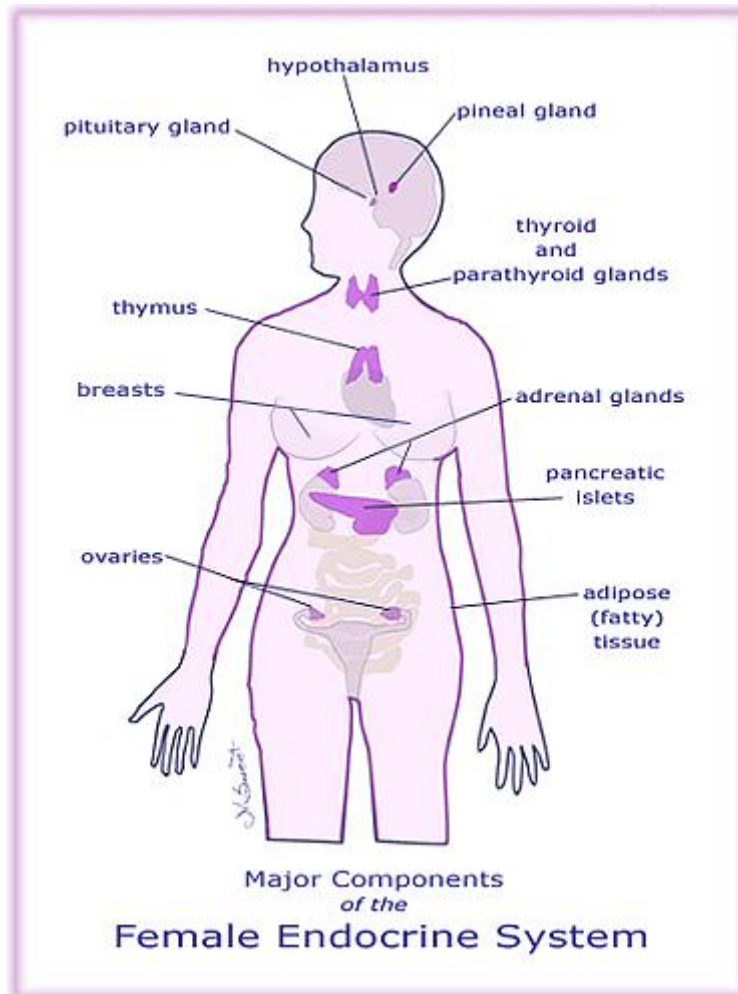
Coming to terms with this idea can be daunting, so I want you to know upfront that you do have some control over the outcome. By giving your body the tools that it needs to function well you can optimize your capacity to detox. On a larger scale, there are many simple, positive and easy things we all can do to protect our families, our neighborhoods and our future. At Women to Women, we want to empower you to influence the conclusion of this grand experiment; we want you to be informed and aware. So let's discuss the basics.

The endocrine system

The endocrine system is made up of a dozen or so glands, including the thyroid, pituitary, adrenal, thymus, pancreas, ovaries and testes, as well as pockets of tissue throughout the body, all of which secrete calibrated amounts of hormones into the blood stream. Hormones are chemical messengers that orchestrate many of the body's internal functions — including cell growth, development and division — and how organs behave. They also handle communication between organs.

Hormone molecules or compounds travel around in the bloodstream to other target body parts with certain receptors on them. To use the best analogy we have for this at present, this mechanism is akin to traveling a hallway of many doors with a ring of keys in hand; each hormone molecule or compound acts as a key that will fit only certain locks. Once it chances upon a corresponding door and the lock is turned, the molecule and receptor complex sends a signal inside the cell to take or halt a certain action, such as to produce a certain protein or to multiply. The endocrine system is one of the three

major networking systems in the body — the others being the nervous system with its electrical signals and the immune system with its antibodies.



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Estrogen, progesterone, testosterone, DHEA, melatonin, insulin, cortisol, and the thyroid hormones are just a few of the primary and secondary hormones circulating in our bodies. (Click here to view a list of [female endocrine glands and hormones](#).)

We now realize that all these hormones interact much more than originally thought. Highly evolved release, stimulating, and feedback mechanisms operate between all these molecules and their target organs as they circulate. We are also discovering that the hormone–receptor complexes are more intricate than originally thought and come in alternate forms (*alpha* and *beta*). This means that more keys can turn the lock than once imagined. While this all serves a valuable purpose in our bodies, it also makes endocrine disruption more potentially hazardous.

What are endocrine disruptors?

An endocrine disruptor is a synthetic compound that mimics a natural hormone when it is absorbed by the body. It can turn on, turn off, or change normal signals. It can have the effect of altering normal hormone levels, triggering excessive action, or completely blocking a natural response. Any other bodily function controlled by hormones can also be affected.

We are often asked about plant estrogens, “Aren’t they endocrine disruptors? Don’t they mimic estrogen?” Much research has shown that phytoestrogens, such as those found in soy, are not disruptive to the natural workings of the endocrine system. The reason behind this is that the human body has co-evolved over time with plants and generally moderates the impact of phytoestrogens through an adaptogenic response. Some plant estrogens are naturally neutralized, others are easily excreted, and most do not accumulate in body tissue (unlike synthetic compounds and heavy metals). The half-life of a phytoestrogen is measured in minutes, while the half-life of various synthetic compounds, like DDT, may be years or even decades.

Manmade chemicals that are known or suspected to influence the endocrine system are everywhere. All the latest and greatest, next-best-things that we now accept as “however-did-we-live-without-them” inventions are made with these chemicals. They make our plastic products softer and easier to handle, our cosmetic creams and lotions smoother and longer-lasting, and our clothes and furnishings inflammable. They are used in clothing dye (especially denim!), cars and computer casings, Teflon coatings, and disinfectant bleaches. They are diffused throughout the atmosphere by the burning of industrial waste and leach into groundwater from landfills. Scientists are concerned because these chemicals biomagnify in the food chain.

In humans, the natural level of circulating hormones needed to orchestrate bodily functions is relatively low. Synthetic endocrine disruptors are now being found in living tissue at dramatically higher concentrations than natural hormones. A CDC report from July 2005 found that the bodies of Americans of all ages contain an average of 148 synthetic chemicals.

Do these chemicals really have any effect, or are they inert? Why can't the body neutralize manmade chemicals? The good news is, we probably can, but the pace at which new chemicals are being introduced is outdistancing our body's ability to adapt. We have a rigorous detoxification system in place in the form of our blood, [lymph](#), liver, kidneys, intestines, lungs, and skin. But we are moving very quickly with manmade chemicals — experts estimate that 40 million pounds of hormonally active chemicals are produced in this country per annum, with 2000 new varieties introduced to market each year. Even the healthiest person may have trouble filtering this kind of load.

There are many unanswered questions regarding the long-term effects of endocrine disruptors. Because they are a recent phenomenon, studies are just beginning to show possible connections. Research into the link between pesticides and frog deformities, fish sex reversals, and bird infertilities is well-documented. How this plays out further with mammals seems to be highly individualized, relative to variables such as age at exposure, genetics, level and length of exposure, gender, and detox capability. Some humans seem to be better at dealing with these substances, but we suspect that the increase in chemical and medical sensitivities, childhood cancers, infertility rates, learning disabilities, autism and mood disorders may relate in some way to the sea of endocrine disruptors in which we all swim.

The hopeful aspect here is that these hormonally active contaminants do not seem to alter most people's basic genetic blueprint — although our understanding of DNA and protein changes is expanding daily. We understand that what one inherits can be molded, and that while a person cannot change his/her eye color, certain genes directing metabolism can be changed — for good or bad. It is all too soon to tell just what the next generation will inherit, but in looking back, we now realize that DES affected not only daughters but sons as well, and in more ways than just genital abnormalities. New evidence points to *epigenetic* possibilities, meaning that we can pass along certain effects without actually changing our offspring's DNA. In addition, not all genes will be expressed under all conditions — that is, some effects may only get turned on generations from now, or only under certain circumstances.

The most common endocrine disruptor chemicals

While we realize that the alphabet-and-number soup of all these chemicals can be quite confusing, even for those of us with a science background, we thought we would list some of the major offenders. Please feel free to skip this section if you prefer not to dwell on the negative. We include it because we believe information is power.

- **Bisphenol-A:** A synthetic substance widely used to make polycarbonated plastics found in food and drink containers, the lining of tin cans, toys, baby bottles, dental sealants, flame retardants, and plastic wraps. This chemical easily leaches out into food and water.
- **Phthalates:** Synthetic substances added to plastics to make them softer, more flexible and resilient. They also extend staying power. They are found in IV tubing, vinyl flooring, glues, inks, pesticides, detergents, plastic bags, food packaging, children's toys, shower curtains, soaps, shampoos, perfumes, hair spray and nail polish. For more information, please refer to our article on [holistic skincare](#).
- **Parabens:** Compounds used as preservatives in thousands of cosmetic, food and pharmaceutical products.
- **PBDE's (polybrominated diphenyl ethers):** Found in flame retardants used on furniture, curtains, mattresses, carpets, television and computer castings. Categorized as a [persistent organic pollutant \(POP\)](#), this substance is stored in animal fats and thus found in dairy products, meat, fish, and human breast milk, and has been banned in several countries. It has also been detected in house dust.
- **PCB's (polychlorinated biphenyls):** Another group of highly toxic synthetic chemical compounds found on the list of [POP's](#), once used widely as insulation fluid in electrical transformers, lubricating oil in pipelines, and components of plastics and mixed with adhesives, paper, inks, paints and dyes. Since 1976 PCB's have been banned in new products, but they are highly stable compounds that degrade very slowly, and these chemicals still persist.
- **Dioxin:** Dioxin is a general name applied to a group of hundreds of chemicals that are highly persistent in the environment. The most toxic compound is 2,3,7,8-tetrachlorodibenzo-*p*-dioxin, or TCDD. Dioxin is formed as an unintentional by-product of many industrial processes involving chlorine such as waste incineration, chemical and pesticide manufacturing, and pulp and paper bleaching. Small molecules are diffused into the atmosphere, then land on soil, where they are eaten by soil microbes. From there they pass up the food chain into meat, fish, and dairy products and breast milk. We absorb 90% of the dioxin in our bodies through food sources, though you won't find it listed on any label. Levels have been decreasing since the 1990's with environmental measures, but it is still probably the most prevalent toxic chemical in our environment.

- **Pesticides and herbicides:** In particular, atrazine, simazine, and heptachlor and other organophosphates and organochlorines have been found to be toxic to the nervous system and to show damaging reproductive (e.g., decreasing sperm motility) and developmental effects.
- **Heavy metals:** Cadmium and arsenic are two heavy metals in widespread use whose endocrine disrupting mechanisms of action have been described. Mercury and lead are also implicated, and more studies are underway on heavy metals.

Endocrine disruptors at work in the body and the world

In her prophetic book [*Silent Spring*](#), Rachel Carson drew attention in the 1960's to the effects of manmade hormonally active chemicals, particularly pesticides such as DDT, on birds and wildlife. DES (diethylstilbestrol), the medication given in the 50's and 60's to prevent miscarriages (and for other misguided reasons), turned out to be a tragic mistake, as the daughters of women who took this medication developed vaginal cancers and other reproductive abnormalities. It is an interesting coincidence that DES and DDT were first synthesized at around the same time and both originally declared miracles of modern science.

Some 40 years later [Theo Colborn](#) and her associates continue the story in their book, [*Our Stolen Future*](#). (Visit stolenfuture.org for updates.) This provocative book documents how synthetic chemicals are not only affecting reproduction in wildlife but having effects on humans. Breast cancer activists in the early 1990's started asking questions about the environment and the rising incidence of breast cancer. The answers have not come easy, but the 2006 edition of the [State of the Evidence by the Breast Cancer Fund](#) documents many connections between environmental toxins and breast cancer.

Labeling these potent chemicals as simply “disruptors” may be understatement because their effects are quite insidious and the chemicals ubiquitous. The effects are often described as a “loss of potential.” We now know that these compounds have effects on thyroid function and brain development as well as reproductive potential. While early on they were referred to as *estrogen disruptors* or *xenoestrogens*, we now realize they play a much broader role.

In addition, cellular disorder can be manifested at quite low doses, perhaps lower than accepted toxic doses. These chemicals can have synergistic and additive effects upon each other, and some can even cancel others out — but in most cases one small bit of

two different EDC's used together, as in many pesticides, do not add up to two small bits, but rather five or six times the effect.

Also critical appears to be the timing of exposure to these chemicals. Many of these compounds are *lipidophilic* — they “like fat” and accumulate in fat tissue. They are not easily detoxed or cleansed from the body and thus are stored up over decades, particularly in women's bodies — we just have more fat naturally. These contaminants can be transferred across the placenta to a growing fetus. We know that there is a critical window of time for fetal reproductive development as well as for the behavioral, nervous and immune systems.

And while I as a woman dislike singling out mothers to shoulder more responsibility, the facts can no longer be denied. Gestational exposure for the fetus reflects this critical window of time and perhaps even the mother's entire lifetime of exposure before she gets pregnant. This means that your tissues and breast milk are like a warehouse for all the synthetic compounds you've ever been exposed to. All the more tragic is that women are often unaware of their exposure and cannot avoid these ever-present chemicals in their environment.

But the news is not all bad. The first step in fixing any problem is to understand that there is a problem.

What's being done about **endocrine disruptors**?

The federal government is funding research into the effects of these industrial pollutants. Check out the [Environmental Protection Agency](#) and the [National Toxicology Program](#) websites for more information. There is still uncertainty about exact causes and effects in humans, and testing and assaying chemicals on people is obviously difficult. Comparisons with effects on animals are helpful but not perfect. Dosage levels, exposure times, and combinations of toxins make the work very complicated.

Risk management programs have only just gotten started, with some states being more progressive than others. The European Union is perhaps the most progressive in taking action on identifying and reducing the most offensive agents. In June 2005, over 100 research scientists actively involved in research on endocrine disrupters from 15 countries issued a joint, signed statement raising concerns about endocrine disruption:

In view of the magnitude of the potential risks associated with endocrine disrupters, we strongly believe that scientific uncertainty should not delay

precautionary action on reducing the exposures to and the risks from endocrine disruptors.

For the entire report see the [Prague Declaration on Endocrine Disruption](#).

For decades scientists have been quantifying and analyzing the impact of chemicals on living organisms, and have known for many years of manmade chemicals on the market that are harmful to both small and large life forms. Unfortunately, countless such chemicals have never been thoroughly tested for human safety, and we simply cannot assume that because a chemical has been approved for use that it is necessarily “safe.” More recently developed *biomonitoring* techniques have become available for sampling human tissues and fluids, helping us gain a better sense of our *body burden*, or the amount of stress our detoxification systems are under due to the presence of these chemicals in our bodies. This has helped to land the issue of endocrine disruptors onto the radar screen of the mainstream media and the political arena. Both Health Canada and the CDC in the US are conducting biomonitoring testing programs. Biomonitoring, however, is quite expensive and has not been standardized — and, perhaps most important, it only measures exposure. It cannot describe the full effects and consequences of these amounts of chemicals. A direct link from a dose of one chemical to one disease can rarely be made.

Nor do we have the time or desire to test them on each other. No one would ethically expose fetuses or young children to different doses of toxic chemicals and watch them over their lifetime. We are also realizing that an individual’s DNA and genes make an important contribution, known as individual susceptibility. There are people who show no effect from exposure, then others who are exquisitely sensitive, and most of us lie somewhere in-between.

For the most part, scientists are left to make assumptions based on animal and lab data. Many are questioning prior assumptions and seeing that these endocrine disruptors not only affect the estrogen receptors but all signaling mechanisms that make our body function. It’s no wonder so many scientists are alarmed.

But how does this affect your health on a day-to-day basis? How does it affect perimenopause and hormone balance? We can only make conjectures at this point but feel that endocrine disruptors must make a significant contribution to why some women are experiencing such severe symptoms.

What can you do about **endocrine disruptors**?

Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.

– Margaret Mead

We counsel all of our patients to become aware of endocrine disruptors in their daily lives. This means assessing the potential load of contaminants you come into contact with each day, including plastics, pesticides, housing and clothing material, cleansers, bleach and cosmetics.

Additionally, an understanding that the health of your air, water, and earth has an effect on your health is also relevant. Just as the functions within our bodies are all connected, we are all connected to the world around us. And while it can seem overwhelming, small changes add up to significant improvements, personally, locally and globally. To get started, we recommend the following.

For yourself and your family...

1. Choose your food intelligently — eat as organically as possible, and watch animal fat and fish consumption. Because endocrine disruptors and heavy metals magnify in the food chain, the higher your protein source the greater the potential toxic load. Large deep water “fatty” fish like tuna may contain high levels of synthetic chemicals and heavy metals, so eat them in moderation. For specific advice on consumption, see the [DHHS/EPA advisory](#).

2. If you can't buy all-organic food, try to pick and choose. Certain crops are more heavily sprayed than others. Data on the worst offenders vary, but the following 12 fruits and veggies are among those with the highest pesticide residues: peaches, apples, bell peppers, celery, nectarines, strawberries, cherries, lettuce, grapes, pears, spinach, and potatoes. Wash all fruits and vegetables thoroughly before consuming, or peel them if they are not organically grown. We recommend a fruit wash, but you can also use dilute soap — it's better than nothing. (See our article on [food safety](#) for our easy veggie wash and spray recipes, plus additional tips on avoiding food contamination.)

3. Take a wide-spectrum daily multivitamin with essential fatty acids to ensure rich nutrition and support your body's optimal functioning. In today's world this is no longer an option but a mandate. You must equip your body with the essential tools it needs to

do its job, particularly when it is embattled on a daily basis by so many toxins. Unfortunately, much of our food supply is contaminated and lacks the necessary nutrients, even if you think you eat well.

4. Support your body's natural ability to detox by exercising and sweating on a regular basis. Try a gentle detox program a few times a year. Use a sauna or steam bath. Get regular sleep (you detoxify at night) and drink plenty of filtered water. If you are on a lot of medication, it could influence your body's ability to detox. You may wish to have a toxic screen to identify your current detoxification capabilities. These are not widely available, but you can contact [Doctor's Data](#) or [Genova Diagnostics](#) for more information, or consult a functional medicine practitioner for an individual work-up. For more information, see our articles on [detoxification](#).

5. Eat plenty of fiber and take a daily [probiotic](#) with bifidobacteria and *Acidophilus* strains in the billions. Certain foods and beverages like green tea contain flavonoids, which help the body rid itself of toxins. Pomegranate juice, blueberries, and red wine are also good choices — but be cautious of drug interactions — and everything in moderation!

6. If you are planning on getting pregnant and breastfeeding, be vigilant about chemicals. Don't worry about what you can't control but put your energy into becoming the healthiest you can right now!

7. Investigate the chemicals in your cosmetics, bug spray, lotions and toiletries. Visit the [Campaign for Safe Cosmetics](#) website for a list of chemical-free alternatives.

8. Know your water supply. Find out whether your local community's water testing program checks for hormone-disrupting chemicals and heavy metals. Not all household filters work effectively on chemicals and, unfortunately, not all bottled water is checked either. Read your water quality reports. If you drink purified water out of plastic bottles, do not leave the bottles in your car or the hot sun for any length of time; heat activates the molecules in the plastic, which increases the rate at which the polycarbons leach into the water.

For your community...

9. For Mother's Day this spring, don't just Think Green. Act Green and Be Green by using safer, greener household products. Newer products have undergone substantial improvements, are more attractive and more affordable, and perform just as well if not

better than many conventional name-brand products. Some may be a bit more expensive, but one can compensate by using more baking soda and vinegar for cleaning. Check out the many great websites — including [Annie B. Bond's Home Enlightenment](#) and [Debra Dadd's List](#). Both women have been called the Queen of Green and also have books on the subject. Open your windows to air the house out instead of spraying air freshener. Avoid unnecessary uses and exposures while gardening, swimming, cleaning, and removing rubbish. Remember that all your trash, fertilizer, and wastewater goes back into the ground — there simply is no flushing it away when it comes to endocrine disrupting chemicals. Look for “green” lawn products and garden services. If you swim or own a hot tub, pick a facility or service that uses non-chlorine based disinfectants.

10. Avoid using certain plastics. The safest plastics are marked with the recycling codes 2, 4 and 5. Never let infants chew on soft plastic toys and never microwave food in a plastic bowl or covered in plastic wrap. A good rule of thumb is that the softer the plastic, the more chemicals. Buy in bulk and store foods in glass jars. Reuse hard plastic tubs. Limit use of plastic bags and wrap to absolute necessity. Assess the amount of plastic in your life and try to reduce it by five. For example: Bring a reusable mug to your local coffee stop. Buy a refillable glass or earthenware water jug. Invest in glass food storage containers that can be washed and reused for a lifetime. Hand-wash your sweaters instead of dry-cleaning. Use reusable cloth totes for groceries.

For the future...

11. Exercise your rights as a consumer — never doubt the power of consumer demand. Ask for green products when you don't see them in your neighborhood stores. If you have a talent for organizing and recruiting people, use it to develop community ordinances regarding the use of chemicals in public places. It took us a while to legislate no-smoking areas; hopefully “chemical-free” will not be far away. Encourage our youth to learn more about environmental issues and to pursue research into redesigning our future. My 18-year old son, who is right-brain dominant (artistic), admits that his AP Environmental Science class — which he took because he had to — is quite fascinating. In looking over his review materials, however, I didn't find much on endocrine disruptors, and when I quizzed him on this he replied that I am just obsessed with hormones!

12. Get politically active. Support local and federal clean air and water initiatives. Write to your local and state representatives and encourage them to vote for a healthy future. Support elected officials who make a clean environment their priority. The [National Resources Defense Council](#) and the [Environmental Working Group](#) are two public watchdogs that can help you get informed about upcoming debates and legislation.

A healthy future for all

We are not advocating living in a bubble or regressing to a pre-WWII lifestyle, but we are posing a general challenge to redesign the future. The full effects of endocrine disruptors are still a long way from being understood; they have only been around a short time. During this span, however, there can be no denying that we seem to be witnessing a spike in infertility rates, autism, chronic disease, childhood cancers, chemical sensitivities, allergies and ADHD. While it may be too simplistic — or early — to view endocrine disruptors as the primary source of this increase, the evidence points to a clear connection. Most experts agree that the experiment is still in play. No one knows how long it will take for us to finish making our hypothesis — or come to our conclusion.

This is actually a good thing. It means that the game isn't over yet — we can influence the outcome. We need to find better, safer, more clever ways to continue to progress and advance — ways that work with nature, not against it. Time will tell whether or not changes made in reaction to Rachel Carson's predictions will prevent much of the "silent spring" she envisioned. Humans are an amazing species; we can socially adapt and learn at a breathtaking pace — it just takes knowledge, leadership, and commitment. And the best way to begin is by implementing changes in your own life. Not only will you feel better, but your actions may have a ripple effect throughout your community. Never underestimate the power of one!