

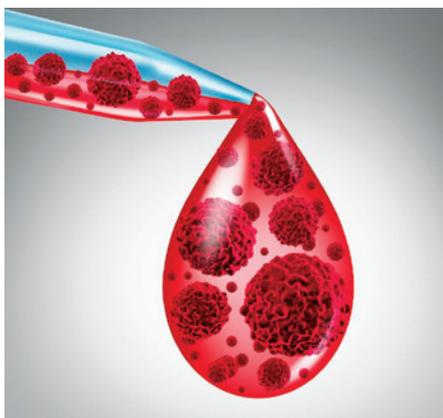


# Pesticides Tied to Widespread Health Threats

## ADDING TO THE BODY OF SCIENCE: HUMAN ILLNESS

The range of scientific studies in 2021 is a snapshot of the public health crisis associated with pesticides. The studies that are discussed and cited in this section, showing adverse health effects associated with pesticide exposure, are striking in scope. The life-threatening and debilitating effects captured in the scientific literature, subject to independent peer review, establish a range of adverse health outcomes, including the following: amyotrophic lateral sclerosis (ALS), blood and skin cancer, childhood brain cancer and leukemia, breast cancer, thyroid function and cancer, multiple myeloma (plasma cell cancer), bladder cancer, non-Hodgkin lymphoma, prostate cancer, adverse birth outcomes, uncontrolled bacterial infections, cardiometabolic disorder, endocrine system effects, gut microbiome

effects, heart and metabolic disorders, infertility, chronic kidney disease, nervous system effects, chronic lung disease, obesity, preterm births and low birth weights, Parkinson's disease, autism, and vulnerability to Covid-19. The studies document broad impacts and a later section includes studies that show elevated and disproportionate risk factors across society. (See Section IV—Disproportionate Pesticide Harm Is Racial Injustice, pp. 54–63.) Of note are the studies that document effects resulting from *in utero* exposure, effects to women's health, and effects carried to future generations (multigenerational effects.) The one year covered in this section adds to the body of scientific literature that serves as a dire warning that the widespread release of toxic pesticides presents a serious threat to survival.



## Study Finds Link Between Pesticide Exposure and Rare Blood Cancer Predecessor (MGUS)

**JANUARY 14, 2021** | Long-term exposure to permethrin and legacy organochlorine pesticides (aldrin, dieldrin, and lindane) increase the risk of developing monoclonal gammopathy of undetermined significance (MGUS), a blood disease that likely precedes multiple myeloma (MM)—a type of blood cancer, according to research in *Environmental Health Perspectives*. Globally, cancer is one of the leading causes of death, with over eight million people succumbing to the disease every year. Notably, the [International Agency for Research on Cancer](#) (IARC) predicts new cancer cases to rise by 67.4% in 2030. Although there is a vast amalgamation of research linking cancer risk to genetic and external factors (e.g., cigarette smoke), there is increasing evidence that pesticide exposure augments the risk of developing both common and rare cancers, including MM. Study researchers state, “Our findings provide important insights regarding exposures to specific pesticides that may contribute to the excess of MM among farmers... [T]he continued widespread residential and other use of permethrin and environmental exposure to organochlorine insecticides due to legacy contamination . . . could have important public health implications for exposed individuals in the general population.” [Hofmann, Jonathan et al.

Lifetime Pesticide Use and Monoclonal Gammopathy of Undetermined Significance in a Prospective Cohort of Male Farmers. *Environmental Health Perspectives*. 29(1), 2021.]

## Genetically Weakened Skin Barrier Allows for Easier Absorption of Toxic Chemicals

**JANUARY 21, 2021** | A Swedish study in *Environmental Health Perspectives* demonstrates that individuals with genetically weakened skin barrier protection experience higher rates of toxic chemicals (e.g., pesticides) absorption through the skin. Studies provide evidence that filaggrin genetic mutations can exacerbate the impacts of chemicals on dermal (skin) exposure, causing various skin diseases like dermatitis and other chemical-related effects, including asthma and cancer. Filaggrin (FLG) is a protein that is critical to skin cell structure or epidermal homeostasis. Just as excessive exposure to UV light can cause skin discoloration and cancer, excessive dermal contact with these toxic chemicals can cause a range of adverse reactions. Dermal exposure is the most common pesticide exposure route, comprising 95 percent of all pesticide exposure incidents. Furthermore, many pesticides contain chemicals that act as sensitizers. The study’s results demonstrate individuals with FLG null mutations (relatively common, especially among people of European descent) and low CNV (copy number variants) are more susceptible to increased

dermal uptake and absorption of chemicals. Researchers find that pesticide levels are two times higher in individuals with FLG null mutations. [Littorin, Margareta et al. Filaggrin Polymorphisms and the Uptake of Chemicals through the Skin—A Human Experimental Study. *Environmental Health Perspectives*. 129(1), 2021.]



## Vulnerability to COVID-19 May Increase with Exposure to Organophosphorus Pesticides

**FEBRUARY 4, 2021** | A review in *Food and Chemical Toxicology* suggests organophosphorus pesticides (OPs) may increase the ability of SARS-CoV-2 to cause Covid-19, especially among vulnerable individuals with underlying medical conditions. Organophosphorus pesticides have a wide range of biological uses that make these chemicals ubiquitous, significantly contaminating both terrestrial (land) and aquatic (water) environments. However, OPs are highly toxic, originating from the same compounds as World War II nerve agents. Moreover, OPs are one of the leading causes of poisoning globally. Therefore, it is vital to understand how OP exposure will impact human health in conjunction with other immunologically compromising diseases like Covid-19. Considering Covid-19 and OP exposure act similarly on the respiratory system, exacerbating adverse inflammatory responses, reviews like these highlight the significance of evaluating synergism between disease and toxic chemicals to safeguard human health. Researchers in the study note, “To curb SARS-CoV-2 infection, a



healthy immune system is obligatory despite potent vaccine to alleviate morbidities in patients. But unintentional exposure to OP compounds from several sources can rupture the antiviral defense against SARS-CoV-2. Moreover, respiratory ailments may also be fueled by OP compounds. Hence, SARS-CoV-2 mediated morbidities and fatalities could be backed by unintentional exposure to OPs in patients.” [Rajak, Prem et al. Immunotoxic role of organophosphates: An unseen risk escalating SARS-CoV-2 pathogenicity. *Food and Chemical Toxicology*. 149:112007, 2021.]



## Genetically Weakened Skin Barrier Allows for Easier Absorption of Toxic Chemicals

**FEBRUARY 18, 2021** | Research published in the journal *Toxicological Sciences* finds extended inhalation of the common agricultural herbicide [paraquat](#) causes male mice to lose some sense of smell, even at low doses. This study highlights the significance of understanding how specific chemical exposure routes can influence disease development. Olfactory (relating to the sense of smell) impairment is a [precursory feature](#) of Parkinson’s disease (PD), and [studies](#) connect paraquat poisoning to PD risk. The study’s researchers note, “These data support the importance of route of exposure in the determination of safety estimates for neurotoxic pesticides, such as [paraquat]. Accurate estimation of the relationship between exposure and internal dose is critical for risk assessment and public health

protection.” [Timothy Anderson et al. Paraquat Inhalation, A Translationally Relevant Route of Exposure: Disposition to the Brain and Male-Specific Olfactory Impairment in Mice. *Toxicological Sciences*. 180(1):175, 2021.]



## Pesticide Exposure, Agricultural Work Associated with Chronic Lung Disease

**MARCH 16, 2021** | Occupational and environmental exposure to pesticides and other contaminants in the environment increase the risk of developing a lung condition known as idiopathic pulmonary fibrosis (IPF), according to a meta-analysis published in *Nature Scientific Reports*. IPF is a chronic, degenerative disease with no certain cause or cure. It is estimated to affect roughly 13 women and 20 men in 100,000 adults worldwide annually, with onset averaging age 66. With the [scientific literature continuously finding new connections](#) between pesticide use and diseases that are all too common in today’s world, advocates say it is critical for residents and officials at all levels to embrace safer, alternative organic methods of addressing weed and pest issues. The results indicate cause for significant concern for the lung health of those who are working in the agricultural industry and/or applied toxic pesticides throughout their lives. A considerable body of literature links pesticide use to harmful effects on lung health. Previous reports have found that 78 agricultural pesticides are directly linked to wheezing—potentially the first step toward chronic disease. A 2017 study found pesticide exposure over one’s

life to be associated with another degenerative lung disease, Chronic Obstructive Pulmonary Disease (COPD). “[I]t is thought that long-term exposure to pesticides increases mucus secretion and muscle contraction in the lungs, causing breathlessness, cough and wheeze,” the lead researcher of that study told Reuters. A study published in July 2020 found pesticide use increased a person’s risk of lung cancer. A comprehensive literature review published in October 2020, focused on lung pathologies in general, found strong correlations between pesticide exposure and various respiratory diseases. [Park, Yeonkyung et al. Occupational and environmental risk factors of idiopathic pulmonary fibrosis: a systematic review and meta-analyses. *Nature Scientific Reports*. 11:4318, 2021.]



## Common Use Organophosphate Insecticides Pose a Greater Threat to Women’s Health

**MARCH 18, 2021** | A study published in *Environmental Toxicology and Pharmacology* finds chronic (long-term) organophosphate (OP) pesticide exposure increases adverse health and cancer risk for U.S. women relative to men. Organophosphorus chemicals have a wide range of biological uses—from insecticides to flame retardants—that make these chemicals ubiquitous, significantly contributing to ecosystem contamination. Furthermore, while organophosphates have less bioaccumulation potential, residues are [consistently present](#) in human and animal blood, urine, tissues, and milk. Although research demonstrates that OPs are highly toxic, there remains an

inadequate understanding of how OP exposure impacts the nonagricultural population in the U.S., especially women. Therefore, it is essential to investigate the sex-specific health effects chemical contaminants can produce to mitigate exposure among vulnerable populations. Study researchers note, "Given the higher burden of OP exposure and their significantly higher overall health risk, including cancer, reducing OP exposure in U.S. women needs to be prioritized." Study results demonstrate that non-smoking women with higher concentrations of OP metabolites are at greater risk of developing cardiovascular disease, bronchitis, asthma, and total cancer, including breast cancer. [Sun, Hongbing et al. Exposure to organophosphorus insecticides and increased risks of health and cancer in U.S. women. *Environmental Toxicology and Pharmacology*, 80:103474, 2020]

## Bacterial Infections Spread Due to Antibiotic Resistance; Becoming a Pandemic as Groups Sue

**APRIL 2, 2021** | Having raised the alarm for many years (and most recently in November 2020) on the dangers of the burgeoning antibiotic resistance crisis, Beyond Pesticides has joined a coalition of public interest groups in a lawsuit against the U.S. Environmental Protection Agency (EPA) for its use approval of the medically important antibiotic streptomycin on citrus trees. Beyond Pesticides executive director Jay Feldman comments: "It is past time to take urgent action to transition away from practices



in agriculture that are dependent on antibiotics, advance organic farm management, and avoid new deadly pandemics. This lawsuit is an important action to reverse the previous administration's decision to ignore the science and allow expanded use of an antibiotic

in agriculture." The wide use of antibiotics, especially for nonmedical use in agriculture, is driving antibiotic resistance to some human pathogenic bacteria. The antibiotic resistance (also referred to as antimicrobial resistance) or AMR crisis is one of human bacterial



## Living Within 2.5 Miles of Chemical Farming Increases Risk of Childhood Brain Tumors

**APRIL 6, 2021** | Pregnant women living within 2.5 miles of agricultural pesticide applications have an increased risk that their child will develop central nervous system (CNS) tumors, according to a study published in *Environmental Research* by a team at University of California, Los Angeles. The results are particularly concerning as they reveal that individuals do not have to be in close contact with pesticides for risky, health-harming exposures to occur. "This transition from farmland to residential neighborhoods is abrupt across California, and, of course, constantly changing as farmland is developed," said study coauthor Myles Cockburn, PhD. "The simplest way to mitigate these risks is by reductions in exposure to pesticides, through restrictions to aerial spraying and air blast that lead to increased drift, and by farming methods that decrease reliance on pesticides." Researchers note that the present study is unique in that it was able to pinpoint the specific pesticides related to the development of specific types of tumors. To make these determinations, scientists made use of California's Cancer Registry records. Diagnosed children ages 0–5 were matched to maternal residences where pesticide applications were made within 4000 meters (~2.5 miles). Pesticide application records were obtained from data recorded by California's public agencies, as California is one of the only states that require [pesticide use reporting](#) to a centralized database. Results show that some pesticides increase the risk of certain childhood CNS tumors by 2.5 times compared to an unexposed child. [Lombardi Christina et al. Residential proximity to pesticide application as a risk factor for childhood central nervous system tumors. *Environmental Research*. 197: 111078, 2021.]

infections becoming increasingly resistant to the antibiotics most commonly prescribed by health care professionals to resolve such infections. This causes infections to be much harder to treat, to last longer, to require increased medical intervention (incurring the costs that go with that), and increasingly, a complete inability to treat life-threatening infections. This crisis is caused, inevitably, by antibiotics' very use (and too often, over-use) because they exert strong selection pressure for bacterial strains that exhibit antibiotic resistance. Bacteria can mutate quickly and take rapid advantage of mutations that make them more resistant to antibiotics; thus, resistance develops and spreads as these resistant bacteria reproduce and "thrive." [Strathdee et al. Confronting antimicrobial resistance beyond the COVID-19 pandemic and the 2020 US election. *The Lancet*. 296 (10257):1050-1053, 2020.]



## Exposure to PFAS—the “Forever” Chemical—During Pregnancy Results in an Increase in Heart and Metabolic Problems Among Adolescence

**APRIL 15, 2021** | Gestational (during pregnancy) and childhood exposure to per- and polyfluoroalkyl substances (PFAS) increases cardiometabolic risk, or the risk of heart diseases and metabolic disorders, later in life, according to a Brown University study published



## Grandmother’s Pesticide Exposure Increases Granddaughters’ Breast Cancer and Cardiometabolic Disorder Risk

**APRIL 2, 2021** | Past maternal exposure to the pesticide dichlorodiphenyl-trichloroethane (DDT) during pregnancy increases the risk of breast cancer and cardiometabolic disorders (e.g., heart disease, obesity, diabetes) for up to three successive generations, according to a study published in *Cancer Epidemiology, Biomarkers & Prevention*. Although previous studies highlight early life or *in utero* exposure to DDT increasing breast cancer risk later in life, this study is the first to note generational effects on grandchildren’s health. DDT continues to adversely affect the health of the U.S. population, nearly 50 years after its ban. However, this ban is not global, as many countries still use or manufacture the chemical compound. [Cirillo, Piera et al. Grandmaternal Perinatal Serum DDT in Relation to Granddaughter Early Menarche and Adult Obesity: Three Generations in the Child Health and Development Studies Cohort. *Cancer Epidemiology, Biomarkers & Prevention*, 30(8), August, 2021.]

in *Environment International*. Past Studies associate exposure to chemical pollutants with increased susceptibility to adverse health effects during critical fetal and childhood developmental periods. Some of these health effects are cardiometabolic risk factors, including obesity, insulin issues, abnormal blood pressure, that increase the risk of developing cardiovascular disease (CVD) and metabolic disorders (e.g., type 2 diabetes). PFAS are of particular concern as these endocrine-disrupting

chemicals are common in non-stick cookware, cleaning/personal care products, food packaging, and other consumer products. They are now being found in pesticide products. Because of their ubiquitous use in many products, studies report that PFAS compounds are detectable in infants, children, and pregnant women. Furthermore, pregnant women can readily transfer compounds to the developing fetus through the placenta. Independent research by Public Employees for

Environmental Responsibility (PEER) finds the widely used insecticide Anvil 10+10 contains high levels of PFAS from contamination. Although EPA does not regulate PFAS in pesticide formulas, EPA still lists these substances in the inert ingredient database. Many companies have patents on file for pesticide formulations containing PFAS. [Li, Nan et al. Gestational and childhood exposure to per- and polyfluoroalkyl substances and cardiometabolic risk at age 12 years. *Environment International*. 147: 106344, 2021.]



## Pesticide Exposure Increases Susceptibility to Covid-19

**APRIL 28, 2021** | Evidence presented at the *Experimental Biology (EB) 2021* meeting finds that Gulf War Veterans and other individuals with prior pesticide exposures are more susceptible to Covid-19 infection. As the pandemic continues, it is critically important for researchers to better understand specific vulnerabilities in population groups in order to improve care and patient outcomes. Study coauthor, Prakash Nagarkatti, PhD at the University of South Carolina said, "This work sheds new light on exposure to pesticides and potential susceptibility to COVID-19 through altered immune response." [Mondal, Ayan et al. (R4434) Environmental organophosphate co-exposure in pre-existing systemic inflammation can increase susceptibility to SARS-COV-2 infection in human lung epithelial cells. *Experimental Biology* 2021. August, 2021.]



## Research Shows Adverse Impacts of Glyphosate on the Human Gut Microbiome

**APRIL 30, 2021** | A bioinformatics tool developed by researchers at the University of Turku in Finland, published in the *Journal of Hazardous Materials*, indicates that "54% of species in the core human gut microbiome are sensitive to glyphosate." Glyphosate is the active ingredient in the herbicide Roundup. This tool may help predict which microbes in the human gut could be negatively affected by exposure to the ubiquitous weed killer. Because damage to the gut biome is linked to a variety of diseases, this information could prove critical in recognition of the role(s) glyphosate may play in the development of human diseases. The researchers' paper states, "The widespread use of glyphosate may have a strong effect on gut microbiomes as well as on human health." Gut microbiota plays a crucial role in lifelong digestive, immune, and central nervous system regulation, as well as other bodily functions. With prolonged exposure to various environmental contaminants, such as glyphosate or other pesticides, critical changes may occur in the gut microbes, influencing adverse health outcomes. [Leino, Lydia et al. Classification of the glyphosate target enzyme (5-enolpyruvyl-shikimate-3-phosphate synthase) for assessing sensitivity of organisms to the herbicide, *Journal of Hazardous Materials*, Volume 408, 2021.]

## Breakdown Products (Metabolites) from Pesticides May Be More Toxic than Parent Compound, Study Finds

**MAY 6, 2021** | Nearly half of all breakdown products (transformation products) from four common-use pesticides produce stronger endocrine (hormone) disrupting (ED) effects than the parent compound, according to research published in *Environment International*. Over 300 environmental contaminants and their byproducts—from chemicals in plastics to cosmetic/personal care products—are commonly present in waterbodies, food commodities, and human blood/urine samples. These toxicants can alter hormone metabolism, producing endocrine-disrupting



effects that put the health of animals, humans, and the environment at risk. Many ecological and health risk assessments for pesticides focus on the effects of parent chemical compound products, overlooking the potential impacts of transformation products (TPs). The researchers note, "Since an increasing number of pesticide TPs have been detected in various environmental media, a more comprehensive understanding of the ecological risk of pesticide TPs is imperative for risk assessments more extensively and regulatory policy-making on pesticide restriction in the future." [Ji, Chenyang et al. The potential endocrine disruption of pesticide transformation products (TPs): The blind spot of pesticide risk assessment, *Environment International*. 137:1054901, 2020.]



## New Commercial Pesticide Toxicity Analysis Highlights Need to Shift to Organic Products

**MAY 20, 2021** | Beyond Pesticides and Friends of the Earth (FOE) collaborated to analyze herbicide products at two of the most popular home and garden retailers, Home Depot and Lowe's. This [Commercial Herbicide Analysis](#) highlights the adverse health and environmental effects of widely available toxic pesticides while encouraging retailers to expand on—and consumers to use—safer, least/non-toxic pesticide products. According to Akayla Bracey, Beyond Pesticides' science and regulatory manager and lead researcher on the review, said, "People generally aren't aware that the pesticides widely available in garden retailers like Home Depot and Lowe's are a threat to health and the environment, and that there are safer products that are available and used in organic land management." The analysis, conducted by Beyond Pesticides, reveals that approximately half of all Home Depot herbicide products (24 of 51) and Lowe's herbicide products (23 of 40) contain ingredients considered Highly Hazardous Pesticides (HHPs). The United Nations Food and Agriculture Organization (FOA) classifies HHPs as "pesticides linked with a high incidence of severe or irreversible adverse effects on human health or the environment." The following active ingredients pose the most harm to human, animal, and ecosystem health, including cancer,

reproductive harm, neurotoxicity, and hormone (endocrine) disruption: glyphosate, 2,4-D, dicamba, mecoprop, and pendimethalin. Of these five chemicals, all but dicamba are classifiable as HHPs. Only 29 percent of Home Depot (15 of 51) and 17 percent of Lowe's (7 of 40) herbicide products qualify as least-toxic or organic. [Bracey, Akayla et al. Beyond Pesticides and Friends of the Earth. 2021]

## More Evidence Documents Glyphosate's Link to Adverse Birth Outcomes

**MAY 25, 2021** | High levels of glyphosate in urine later in a pregnancy is significantly associated with preterm birth, according to research conducted by scientists at the University of Michigan and published in [Environmental Health Perspectives](#). While awareness of the [strong connection between glyphosate and certain cancers](#) is growing among the public, the chemical's link to adverse pregnancy outcomes is beginning to receive more attention. "Since most people are exposed to some level of glyphosate and may not even know it, if our results reflect true associations, then the public health implications could be enormous," said senior author John Meeker, ScD, professor at the University of Michigan School of Public Health. This latest study is part of a cohort dubbed PROTECT (Puerto Rico Testsite for Exploring Contamination Threats), focused on investigating environmental exposures leading to preterm birth in Puerto Rico. [Silver, Monica et al. Prenatal Exposure to Glyphosate and Its Environmental Degradate,



Aminomethylphosphonic Acid (AMPA), and Preterm Birth: A Nested Case-Control Study in the PROTECT Cohort (Puerto Rico). *Environmental Health Perspectives*. 129(5), 2021.]



## Exposure to Certain Pesticides Increase the Risk of Thyroid Cancer

**MAY 27, 2021** | Research by the U.S. National Institutes of Health (NIH), published in [Environment International](#), finds exposure to lindane and metalaxyl pesticides heightens thyroid cancer risk. Both incidents of nonaggressive thyroid tumors and advanced-stage thyroid cancer are on the rise. However, researchers speculate that environmental pollutants, such as pesticides, may contribute to this increase, especially considering the pervasiveness of pesticide exposure among the general population. This study is the first to show a direct association between thyroid cancer—rather than function or disease—and specific occupational pesticides. Organochlorine pesticides (OCPs) are well-known persistent organic pollutants (POPs) banned by the [Stockholm Convention](#) treaty in 2001. [Lerro, Catherine et al. Pesticide exposure and incident thyroid cancer among male pesticide applicators in agricultural health study. *Environment International*. 146:106187, 2021.]



## Women's Exposure to Environmental Pollutants Prompts Infertility and Low Egg Count

**JUNE 10, 2021** | Exposure to toxic chemicals decreases egg count and increases infertility risk among women, according to a study published in *Environment International*. Since 2014, U.S. fertility rates have been decreasing, with many attributing the decline to older age pregnancies. However, several findings demonstrate that exposure to environmental pollutants, like persistent organic pollutants (POPs) from the industrial and agricultural industry, contributes to a decline in fertility rates. Scientists and health officials already associate exposure to POPs, like pesticides, with adverse impacts on male fertility, including reduced sperm count, quality, and abnormal sperm development. The researchers note that these findings should urge government and health officials to reexamine chemical safety concerning reproductive health, and "strongly encourage [them] to study mechanisms behind POP-associated infertility in women in more detail." The study results find women of all reproductive ages with higher levels of POPs in serum samples also have fewer immature eggs remaining in the ovaries. The 2001 *Stockholm Convention* treaty bans POPs. These pollutants have a global distribution, with evaporation and precipitation facilitating long-range atmospheric transport, deposition, and bioaccumulation of hazardous

chemicals in the environment. The U.S. was a signatory to the treaty, but the U.S. Senate never ratified it, relegating U.S. officials to observer status. Some OCPs like *lindane*, although banned, remain active as pharmaceutical treatments for lice and scabies. Therefore, individuals can still encounter various POPs at varying concentrations. [Björvang, Richelle et al. Persistent organic pollutants and the size of ovarian reserve in reproductive-aged women. *Environment International*. 155: 106589, 2021.]

## Pesticides and Other Volatile Chemicals Cause Air Pollution Linked to Premature Deaths

**JULY 28, 2021** | Between 340,000 and 900,000 premature deaths each year can be linked to air pollution caused by the release of volatile organic compounds, such as pesticides, paints, and cleaning agents, from anthropogenic sources. The findings, published in



## Vineyard Pesticides Linked to Parkinson's Disease

**JUNE 30, 2021** | Vineyard farmers who spend more money on pesticide use are more likely to develop Parkinson's disease, according to research published by French scientists in *Environmental Research*. Although vineyards account for only 3% of French land, 20% of pesticides purchased are for vineyards. Among the pesticides used, 80% are fungicides. Fungicides have long been linked to the development of Parkinson's disease. A 2008 study by scientists at UCLA found that chronic exposure to dithiocarbamate fungicides like *ziram* contributed to the development of Parkinson's. A 2013 meta-analysis found that the fungicides maneb and mancozeb increased Parkinson's risk by two times. This was found to be in line with the incidence associated with *paraquat* herbicide exposure, which is currently the subject of an increasing number of lawsuits, due to that weed killer's strong connection to the disease. [Perrin, Laëtitia et al. Pesticides expenditures by farming type and incidence of Parkinson disease in farmers: A French nationwide study. *Environmental Research*, 197: 111161, 2021.]



*Atmospheric Chemistry and Physics*, were drawn from an international team of over 50 scientists, led by researchers at the University of Colorado, Boulder. Lead author of the study, Benjamin Nault, PhD, said. “[W]e’re showing that if you’re not getting at the cleaning and painting products and other everyday chemicals, then you’re not getting at a major source.” [Nault, Benjamin et al. Secondary organic aerosols from anthropogenic volatile organic compounds contribute substantially to air pollution mortality. *Atmospheric Chemistry and Physics*. 21(14), 11201–11224, 2021.]



## 296 Chemicals in Consumer Products Increase Breast Cancer Risk through Hormone (Endocrine) Disruption

**JULY 28, 2021** | Research published in *Environmental Health Perspectives* finds nearly 300 different chemicals, in pesticides, consumer products, and



## In Utero and Childhood Pesticide Exposure Increases Childhood Cancer Risk

**SEPTEMBER 1, 2021** | A study published in *Environmental Pollution* finds the risk of acute childhood leukemia (AL) increases with prenatal and newborn exposure to pesticides (i.e., insecticides and herbicides). The study results support the hypothesis that chronic environmental pesticide exposure increases childhood leukemia risk up to two times. Maternal exposure has a stronger association with leukemia than childhood exposure. Insecticides and herbicides are of particular significance in increasing leukemia risk, especially for acute lymphoblastic leukemia. Childhood AL remains the second highest cause of child mortality following physical injury. Furthermore, childhood leukemia survivors can suffer from chronic or long-term health complications that may be life-threatening. The study results identify 55 studies from over 30 countries pertaining to over 200 different pesticide exposures from over 160,000 participants. Regardless of pesticide type, leukemia type, exposure timeframe, and population group, methodological studies demonstrate pesticide exposure increases the risk of childhood leukemia, particularly for infants. Maternal exposure to pesticides during gestation results in a more elevated leukemia risk for children than childhood (postnatal) exposure. Whether pesticide exposure is occupational or mixed, parental exposure to pesticides has the highest association with AL risk, including paternal (father) exposure. Exposure during pregnancy results in a 1.5 times greater risk of developing AL, with a 2.5 times increase in risk for acute lymphoblastic leukemia. [Karalexi, Maria et al. Exposure to pesticides and childhood leukemia risk: A systematic review and meta-analysis. *Environmental Pollution*. 285: 117376, 2021.]

contaminated resources (e.g., food, water) increase breast cancer risks. Breast cancer is the most common cancer among women, causing the second most cancer-related deaths in the U.S. Genetic factors only play a [minor role](#) in breast cancer incidence, while exposure to external environmental factors (i.e., chemical exposure) may play a more notable role. Using [high throughput screening \(HTP\)](#) data from an *in vitro* ToxCast assay (test) developed by EPA, researchers identified chemicals that increase estradiol (a type of estrogen) or progesterone production in H295R cells responsible for hormone synthesis. [Cardona, Bethsaida and Rudel, Ruthann. Application of an *In Vitro* Assay to Identify Chemicals That Increase Estradiol and Progesterone Synthesis and Are Potential Breast Cancer Risk Factors. *Environmental Health Perspectives*. 129(7) July 2021]



## Study Finds Recently Banned, Common Insecticide Promotes Obesity Development, and Related Illnesses

**SEPTEMBER 2, 2021** | A McMaster University (Canada) study published in [Nature Communications](#) demonstrates exposure to the organophosphate insecticide chlorpyrifos promotes obesity development, even at low doses. Obesity generally occurs following a caloric imbalance between food intake, absorption, and energy expenditure. Although various factors can promote obesity, the study results indicate that

chlorpyrifos negatively affects metabolic function, playing a role in inhibiting calorie burning or thermogenesis. The suppression of thermogenesis allows calories to accumulate in the adipose tissue rather than convert to energy. Besides genetics, exposure to obesogenic compounds like pesticides can promote obesity development. These compounds routinely cause reproductive, cardiovascular, and endocrine (hormone) issues among exposed individuals, especially farmers. Bruce Blumberg, Ph.D., professor of Developmental and Cell Biology, University of California, Irvine, [defines obesogens](#) “as chemicals that inappropriately stimulate the development of fat cells or the storage of fat into those cells, either directly by fiddling with how the cells work, or indirectly altering appetites tied to metabolism.” This study is the first toxicological assessment to investigate obesity and obesity-related illnesses in rodents under thermoneutral conditions, or the temperature at which an organism does not need to regulate body heat. Thermoneutral conditions enable a better prediction of health effects among humans associated with chemical exposure. [Wang, Bo et al. The pesticide chlorpyrifos promotes obesity by inhibiting diet-induced thermogenesis in brown adipose tissue. *Nature Communications*. 12:5163, 2021.]

## Endocrine (Hormone) Disrupting Chemicals, including Pesticides, Also Affect the Nervous System

**SEPTEMBER 9, 2021** | A study published in [Toxicology Reports](#) finds the same chemicals that disrupt the endocrine (hormone) system also disrupt the nervous system. Endocrine disruptors are xenobiotics (i.e., chemical substances like toxic pesticides foreign to an organism or ecosystem) present in nearly all organisms and ecosystems. The [World Health Organization \(WHO\)](#), European Union (EU), and [endocrine disruptor expert](#) (deceased) Theo Colborn, Ph.D., classify over 55 to 177 chemical



compounds as endocrine disruptors, including various [household products](#) like detergents, disinfectants, plastics, and pesticides. Past research shows exposure to endocrine-disrupting pesticides adversely affects human health, from [reproductive function](#) to [cancer development](#), and effects can span generations. The researchers establish the novel concept that endocrine disruptors are neurological disruptors (neurodisruptors) and collectively refer to these chemicals as endocrine and nervous disruptors (ENDs). Neurological diseases include amyotrophic lateral sclerosis (ALS) and Parkinson’s disease, dementia-like diseases such as Alzheimer’s, and other effects on cognitive function. This is in addition to the effect of these chemicals on [reproductive function](#), metabolic/immune function, [hormone-related cancers](#), and [fetal/body development](#). [Seralini, Gilles-Eric, and Jungers, Gerald. Endocrine disruptors also function as nervous disruptors and can be renamed endocrine and nervous disruptors (ENDs). *Toxicology Reports*. Vol. 8:1538-1557, 2021.]

## More Scientific Evidence that Endocrine-Disrupting Pesticides Disrupt Thyroid Function

**SEPTEMBER 10, 2021** | Research conducted in Thailand and published in [Risk Management and Healthcare Policy](#), shows that exposure to pesticides, even at low levels, impact the human endocrine system and distort



thyroid function. The study looks specifically at interactions of genetics and environment: it investigates associations between variations in genes involved in pesticide metabolism and altered thyroid function in two groups: those working on organically managed farms (216 subjects), and those working on conventional farms that use pesticides (229 subjects). This research underscores some of the complexity and difficulty of determining human vulnerability to impacts of pesticide exposures, given genetic variables. [Sirivarasai, Jintana, et al. Genetic Polymorphisms of Pesticide-Metabolizing Enzymes and Transporters in Agricultural Workers and Thyroid Hormone Levels. *Risk Management and Healthcare Policy*. 14, 3435–3451, 2021.]

## Study Adds to 40-Year Analysis Linking Brain Cancer to Pesticide Exposure

**SEPTEMBER 23, 2021** | A study by Claremont Graduate University finds exposure to agricultural pesticides increases brain cancer risk up to 20 percent. This study, published in *Cancers*, expands on a 1998 study evaluating brain cancer risk among the farm population using epidemiologic studies. The study researchers note, “This comprehensive review and meta-analysis encompassing 42 years of the epidemiologic literature and updating two previous meta-analyses by 20 years supports an association between farming and brain cancer incidence and mortality.[...]Our analy-

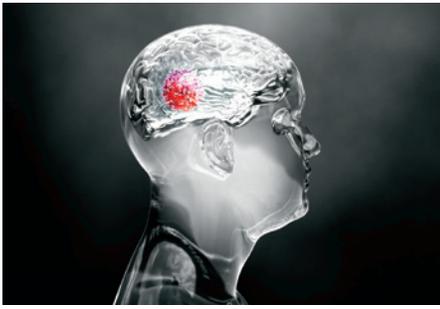
ses suggest that the elevated risk has been consistent over time, and the addition of newer studies (i.e., those published since 2000) does not change this conclusion.” Researchers conducted

a literature review using PubMed and Agricola databases to assess studies evaluating the relationship between farming and brain cancer. The researchers reviewed meta-analysis studies to



## Commonly Used Neurotoxic Pesticide Exposure Increases ALS Risk to Workers and Residents

**SEPTEMBER 30, 2021** | Individuals working or living in areas with frequent neurotoxic pesticide use experience a higher incidence of [amyotrophic lateral sclerosis](#) (ALS) than the general population. A study, published in *NeuroToxicology*, finds a positive association between sporadic (nongenetic, spontaneous) ALS incidents among individuals exposed to neurotoxic pesticides. Amyotrophic lateral sclerosis (or Lou Gehrig’s disease) is a neurodegenerative disease that affects the nerves in the brain and spinal cord. As many as 16,000 – 20,000 Americans live with this condition, which weakens muscle/motor function leading to loss of muscle control for walking, talking, eating/swallowing, and breathing. Severe ALS progression is fatal and has no current cure. Although research finds that genetic factors play a role in disease etiology (cause), most ALS cases do not result from genetic inheritance. Several research studies demonstrate exposure to environmental or work-related toxicants (e.g., pesticides) predispose humans to the disease. With researchers [predicting a global ALS incidence increase](#) of 69% by 2040, identifying ALS’s causal factors are important to future research. Researchers note, “[W]e identified pesticides applied to crops in the area of residences associated with risk of ALS in a large healthcare claims network. Our analysis identified several herbicides, insecticides, and fungicides that have been implicated in the literature as being neurotoxic as potential ALS risk factors.” [Andrew, Angeline et al. Pesticides applied to crops and amyotrophic lateral sclerosis risk in the U.S. *NeuroToxicology*. Vol. 87, pp.128–135, 2021.]



harmonize findings published between January 1997 and August 2019. In total, researchers evaluated 52 different studies. [Gatto, Nicole et al. Farming, Pesticides, and Brain Cancer: A 20-Year Updated Systematic Literature Review and Meta-Analysis. *Cancers*. 13(17): 4477, 2021.]

## Common Insecticide Malathion Linked to Chronic Kidney Disease

**OCTOBER 19, 2021** | Exposure to the insecticide [malathion](#) increases the risk



of developing chronic kidney disease (CKD), according to a study published in the *International Journal of Environmental Research and Public Health*. According to study coauthor Nicholas Osborne, PhD, CKD is on the rise in developing countries in Southeast Asia and Central America, and “[n]early one in 10 people in high income countries show signs of CKD, which is permanent kidney damage and loss of renal function.” Although CKD risk increases with age, and is associated with other health factors like smoking, heart disease, and diabetes, cases without clear cause are increasingly common, indicating that environmental factors are

likely playing a role. “When malathion was up for [EPA] reregistration, when the heads of the various divisions who were looking at health effects were sitting around the table and planning to address the issue, the science adviser poked his head in the door and said, ‘This is a big-ticket pesticide, and we don’t want to have any problems,’” Bill Hirzy, PhD a former EPA official told *The Intercept* (in its piece, “The Department of Yes: How Pesticide Companies Corrupted the EPA and Poisoned America,” June 2021). Despite strong links between malathion and a range of different cancers, EPA designated the chemical as having “suggestive evidence of carcinogenicity,” not the stronger “likely carcinogen” initially proposed by EPA staff. [Wan, En-Tzu et al. Association of Pesticides and Kidney Function among Adults in the US Population 2001–2010. *Int. J. Environ. Res. Public Health*, 18(19):10249, 2021.]

## Women in Agricultural Work at Increased Risk for Skin and Blood Cancers from Pesticide Exposure

**OCTOBER 21, 2021** | A study published in *Environment International* finds higher rates of various cancers among agricultural workers, with multiple myeloma (blood cancer) and melanoma (skin cancer) disproportionately affecting female farmers. Although research studies link cancer risk to genetic and external factors (e.g., cigarette smoke), there is increasing evidence that pesticide exposure augments the risk of developing common cancers like melanoma and less common cancers like multiple myeloma. The authors write,



“The results suggest that agricultural workers have a lower risk of various cancers and an elevated risk of prostate cancer, multiple myeloma (female), and melanoma of skin (female) compared to the general population. Those differences and the between-cohort variations may be due to underlying differences in risk factors and warrant further investigation of agricultural exposures.” [Togawa, Kayo et al. Cancer incidence in agricultural workers: Findings from an international consortium of agricultural cohort studies (AGRICOH). *Environment International*. 157: 106825, 2021.]



## 45 Different Cancers Associated with Work-Related Pesticide Exposure

**NOVEMBER 4, 2021** | A scientific literature analysis by the Federal University of Goias, Brazil, finds occupational (work-related) exposure to agricultural pesticides increases the risk for 45 different types of cancer. This analysis, published in *Environmental Science and Pollution Research International*, assesses studies from the last decade to identify cancer risk associated with occupational exposure by country, pesticide type, and methods used to diagnose disease. Many pesticides are “known or probable” carcinogens (cancer-causing agents), and widespread uses only amplify chemical hazards, adversely affecting human health. Multiple myeloma (plasma cell cancer), bladder cancer, non-Hodgkin lymphoma, and prostate cancer are the most prevalent forms of cancer. The study evaluated the scientific literature

# The Health and Environmental Effects of the 40 Most Commonly Used Pesticides

Health and environmental effects disclosed on factsheets to guide community decisions on lawn and landscape management that do not poison people and contaminate the environment.

## New Factsheets Alert Communities to Adverse Effects of Commonly Used Landscape Pesticides

**WASHINGTON, D.C. | OCT. 14, 2021** | In October 2021, Beyond Pesticides released health and environmental effects factsheets for “40 Commonly Used Lawn Pesticides,” updating and expanding on previous factsheets on 30 pesticides. These comprehensive factsheets document with scientific citations a wide range of diseases and ecological effects linked to pesticides. The underlying analysis supporting the adverse health and environmental effects identified in the factsheets are based on toxicity determinations in government reviews and university studies and databases.

**What do the factsheets disclose?** Of the 40 most commonly used lawn and landscape pesticides, in reference to adverse health effects, 26 are possible and/or known carcinogens, 24 have the potential to disrupt the endocrine (hormonal) system, 29 are linked to reproductive effects and sexual dysfunction, 21 have been linked to birth defects, 24 are neurotoxic, 32 can cause kidney or liver damage, and 33 are sensitizers and/or irritants. Regarding adverse environmental effects, 21 are detected in groundwater, 24 have the ability to leach into drinking water sources, 39 are toxic to fish and other aquatic organisms vital to our ecosystem, 33 are toxic to bees, 18 are toxic to mammals, and 28 are toxic to birds. [Beyond Pesticides, 2021.]

**THE EFFECTS OF 40 COMMON GARDENING CHEMICALS**

Studies show that hazardous lawn and landscape chemicals are drifting into our homes where they contaminate indoor air and surfaces, exposing individuals at levels 10x higher than pre-application levels. You can protect yourself and your family, pets, and neighborhood from toxic chemical exposure!

- HEALTH EFFECTS**
  - Cancer: 26
  - Endocrine (hormonal) Disruption: 24
  - Sexual/Reproductive Problems: 29
  - Birth defects: 21
  - Neurotoxic: 24
  - Kidney and/or Liver damage: 32
  - Sensitizers and/or irritants: 33
- ENVIRONMENTAL EFFECTS**
  - Detectable in Groundwater: 21
  - Ability to Leach into Drinking Water: 24
  - Toxic to Fish and/or Aquatic Organisms: 39
  - Toxic to Bees: 33
  - Toxic to Mammals: 18
  - Toxic to Birds: 28
- TOP 10 MOST CONCERNING CHEMICALS FOR HUMAN HEALTH**
  - 2,4-D (Herbicide)
  - Atrazine (Herbicide)
  - Carbaryl (Insecticide)
  - Dicamba (Herbicide)
  - Glyphosate (Herbicide)
  - Mecoprop (Herbicide)
  - Malathion (Insecticide)
  - Permethrin (Insecticide)
  - Thiophanate methyl (Fungicide)
  - Trichlorfon (Insecticide)
- TOP 10 MOST CONCERNING CHEMICALS FOR ECOLOGICAL HEALTH**
  - 2,4-D (Herbicide)
  - Carbaryl (Insecticide)
  - Chlorothalonil (Fungicide)
  - Dicamba (Herbicide)
  - Flupyrifluorid (Insecticide)
  - Glyphosate (Herbicide)
  - Mecoprop (Herbicide)
  - Malathion (Insecticide)
  - MCPA (Herbicide)
  - Imidacloprid (Insecticide)

See More: [bp-dc.org/lawns](http://bp-dc.org/lawns)

See infographic: [bp-dc.org/40-common](http://bp-dc.org/40-common)

from the Scopus® database between January 2011 and December 2020. The database contains scientific literature from over 20 nations, including the U.S., France, Brazil, and India. [Pedroso, TMA et al. Cancer and occupational exposure to pesticides: a bibliometric study of the past 10 years. *Environmental Science and Pollution Research International*. 1–12, 2021.]



## Pesticide Exposure Contributes to Preterm Births and Low Birth Weight

**NOVEMBER 18, 2021** | A study published in *Environmental Research* by researchers at King George’s Medical University, India, finds exposure to xenobiotic substances like pesticides during pregnancy increases risks associated with preterm birth, including a rise in cesarean section (C-section) deliveries, a decrease in fetal body weight, and chronic illnesses. **Birth and reproductive complications** are increasingly common among individuals exposed to environmental toxicants, like pesticides. The Centers for Disease Control and Prevention (CDC) reports that the preterm birth rate is increasing annually. The study notes, “To the best of our knowledge, this was a pioneering study, and it may help to increase our knowledge with regard to xenobiotic exposure in biological systems and the need for stringent guidelines for agricultural use of pesticides.” [Dwivedi, Naina et al. Assessment of genotoxicity and oxidative stress in pregnant women contaminated to organochlorine pesticides and its correlation with pregnancy outcome. *Environmental Research*, 204 (Part B):112010, 2022]



## ACTIONS OF THE WEEK

### Tell EPA to Reverse Approval of Highly Toxic Insecticide Aldicarb

**JANUARY 25, 2021** | Aldicarb is a highly toxic, systemic carbamate insecticide that is a fast-acting cholinesterase inhibitor that permanently binds to the active site of an essential enzyme for normal nerve impulse transmission, acetylcholinesterase (AChE), deactivating the enzyme. In doing this, the chemical causes damage to the central and peripheral nervous systems, interrupting neurological activity. Aldicarb is subject to regulation under the 2004 Rotterdam Convention, an international treaty established to reduce the trade of the most globally hazardous chemicals, with over 100 countries—excluding the U.S.—banning their use.

### Tell EPA and Members of Congress to Take Responsible and Immediate Action to Stop the Death of Dogs and Cats by Stopping the Sale of Seresto Flea Collars

**MARCH 4, 2021** | In the face of 1,700 pet deaths linked to Seresto's flea and tick collar—as reported March 2, 2021 by *USA Today*, based on EPA records—EPA has taken no action. This unconscionable inaction is defended by an EPA spokesperson who told the media that, despite these incidents, the agency has deemed Seresto collars “eligible for continued registration” based on best available science, including incident data.... No pesticide is completely without harm, but EPA ensures that there are measures on the product label that reduce risk.”

### Ban Endocrine Disrupting Pesticides Now to Protect People and Wildlife

**APRIL 6, 2021** | The failure of EPA to meet its statutory responsibility to protect people and wildlife from the dire consequences of exposure to endocrine disrupting chemicals must end. Over recent decades, evidence has mounted showing that many pesticides interfere with hormones—and are therefore endocrine-disrupting chemicals (EDCs). In 1996, the promise of screening pesticides for endocrine disruption generated support from environmentalists and public health advocates for the *Food Quality Protection Act* (FQPA), which traded the absolute prohibition of carcinogens in food of the *Delaney Clause* for a risk assessment standard that is subject to manipulation and an underestimation of real-life hazards. And now, 25 years later, we have yet to see EPA use endocrine-disruption findings in pesticide registration decisions.

### Tell EPA to Remove Risky Disinfectants from Its Recommended List; They're Not Necessary to Protect from Covid-19

**MAY 3, 2021** | Hazardous disinfectants are not necessary for protection against Covid-19, and the Centers for Disease Control and Prevention (CDC) agree. The EPA seems to now agree, but has not changed its recommendations and listing for the public.

### Advocates Call for Ban of Toxic Pesticides Linked to Deaths from Chemical Suicides

**MAY 13, 2021** | Scientists are advocating for stricter pesticide bans to lower deaths from deliberate pesticide ingestion. Studies demonstrate an increased risk of developing depression, especially among agricultural workers and landscapers who use pesticides. Acute exposure to chemicals, including organophosphate and carbamate pesticides, tends to put farmers at greater risk of suicide than the general population.

### Take Action: Tell EPA to Ban ALL Triazine Herbicides

**JUNE 28, 2021** | The endocrine disrupting herbicide pro-pazine (in the triazine family of frog-deforming endocrine disruptors) is set for cancellation by the EPA. The move would eliminate use of the hazardous herbicide by the end of 2022. However, all pesticides in the triazine class, including atrazine and simazine, have similar properties and should be eliminated from use. Tell EPA to finish the job by banning all triazines.

### Tell EPA to Finish the Job in Banning Chlorpyrifos

**AUGUST 30, 2021** | EPA's [decision in 1999](#) to ban “residential” uses of chlorpyrifos, and its 2021 agricultural phaseout continues to allow the following uses: (i) Residential use of containerized baits; (ii) Indoor areas where children will not be exposed, including only ship holds, railroad boxcars, industrial plants, manufacturing plants, or food processing plants; (iii) Outdoor areas where children will not be exposed, including only: golf courses, road medians, Industrial plant sites; (iv) Non-structural wood treatments including: fenceposts, utility poles, railroad ties, landscape timbers, logs, pallets, wooden containers, poles, posts, and processed wood products; (v) Public health uses: Fire ant mounds (drench and granular treatment); (vi) nurseries and greenhouses; and (vii) Mosquito control.