


# Genetics/Toxics

# STOPWATCH



## *The Journal of the Center for Ethics and Toxics (CETOS)*

### Can Cancer be Stopped?

By Marc Lappé

Over a decade ago, I warned in my book *Chemical Deception* (Sierra Club Books, 1991) that a number of cancers appeared to be increasing unrelentingly: these included melanoma, brain cancer, non-Hodgkin's lymphoma, kidney, liver, lung, breast and testicular cancer. While no one wants to be proved right about such disturbing news, the latest statistics on cancer incidence appear to bear this prediction out: seven of the eight cancers that were increasing the fastest in the period 1973-1987 again increased the most in the period from 1983-1999, based on National Cancer Institute/National Tumor Registry data. Melanoma, with a 155% increase tops the list, followed by prostate and liver cancer (105 and 103%, respectively), non-Hodgkin's lymphoma (87%), testicular cancer (67%), brain cancer (50.2%) and breast cancer (41%). Perhaps most disturbingly, in spite of overall leveling of increases overall (largely because of declines in lung cancer), childhood cancer was up a disturbing 26% between 1975 and 1999.

So what is going on? Are these increases simply due to an aging population? No, they are "age-adjusted," meaning they are corrected for the age of the people who get cancer. Some of the increase for breast cancer is attributable to a 10% increment in new breast cancers among women who are less than 50 years old. And the childhood tumors that are included in the registry data are also increasing. While numerous factors almost certainly come into play in setting when and how cancer arises, certain exposures to known or suspected carcinogens are almost certainly implicated in these tumor types. For instance, some 21 agents are listed by the National Toxicology Program as being able to produce breast cancer in animals: another 29 are suspected of being mammary carcinogens. Many of these same agents are encountered in the workplace—by over a million women. While some carcinogens have been eliminated, such as the toluene diamine based hair dyes, others are now recognized as being harmful and likely human carcinogens, such as diethylstilbestrol (DES). A disturbing number of chemicals capable of producing cancer remain in commerce. These include methylene chloride, benzene, ethylene oxide and phenylenediamine dyes.

Overall, the common denominator in the major cancers increasing in incidence today is that they all have strong environmental links to chemicals or other agents. Non-Hodgkin's lymphoma for instance is linked to chemical solvents that are unusually prevalent in drinking water near Superfund and other haz-

*Continued on page 2*

### Protecting Biodiversity and the Quality of Human Life

By Britt Bailey

We inherently know that protecting biodiversity is a valuable endeavor for the world's species. And while it is obvious that safeguarding biodiversity benefits species at risk, we often overlook benefits to ourselves derived from maintaining a diverse planet. It is essential we recall the value it provides to our psychological and physical well-being. Protecting biodiversity by involving oneself in actions at home is one of the most important environmental measures we can adopt.

#### *The Importance of Our Wild Space*

Our wild spaces and wild lands represent the pause between our breaths, words, and thoughts. It is here that we can deeply know that biological life is existing untarnished by human action. Merely thinking about an open space provides a respite for our often encumbered and paved activities. For example, we find solace in staring towards an open sea, witnessing the magical rooftops of untrammled mountain ranges, and gazing at a vast expanse of red desert undulating and careening in its deep modeled cuts. Chartreuse glades filled with the pastels of wildflowers reaching towards an alpine lake chisel smiles into our cheeks and remove furrows from our brows. We relax when witnessing large salmon within deep pools and are peacefully assured knowing they are awaiting a large rain to move towards reproduction.

It is these captured moments in time that comfort the wild places within ourselves. It is the observation of vital dynamism within such stillness where we become rejuvenated, refreshed, wild, dynamic, and vibrant. It is in these open and wild spaces that life happens—unscripted.

#### *Biodiversity: Good for Nature, Good for Us*

Biological and ecological health presents a mirror into our own well being. While it is possible that we could persist in a greatly simplified biological world, a world devoid of the plethora of natural species that now inhabit it, our quality of life in such a biologically monotonous world may be significantly diminished. Therefore, understanding what impacts biodiversity and learning to protect it is of utmost importance to our health. And, safeguarding those organisms already identified as endangered or threatened (as well as their habitats) could be a good starting point for our own protection.

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## In this Issue...

The California rains have finally arrived to cleanse and saturate our parched hills. The first big storm always tilts my thoughts towards the new rage in our nearby rivers. I wonder how many salmon are beginning their journeys inland, how many amphibians are dancing in the cascade of water. I wonder what the inland reaches will bring to the fish and other aquatic organisms. I wonder if they will find a habitat that will serve to perpetuate or if they will find that we have all but obliterated their lands leaving them swimming in decimation. Winter does not only bring needed rains but also chains of deliberation and reflection designed to bring opportunities to witness the changes as we build fires and welcome friends and family for cheer. It is the winter that arrives year after year. Its routine shakes new thoughts, new

hopes, and calls out for resolve. It begs us to greet the annual occasion for resolution with a brief inquiry—what will we do differently this upcoming year?

In this issue, we bring you articles which encourage consideration of endangered species and the need to increase and protect biodiversity. Marc also provides a wonderful article on cancer and the ways in which our interaction with chemicals may increase the risk of its development. We encourage you to reflect on these words and find ways in which you can better protect the planet, ourselves, and our loved ones. May your season be filled with health and joy! Happy Holidays. **Enjoy your StopWatch!**

—Britt Bailey, Editor

### **Can Cancer be Stopped? Cont. from Pg. 1**

ardous waste sites. Similarly, brain and testicular cancer are associated with work in the chemical industry and to exposure to certain pesticides and related chemicals.

Of course, diet also plays a role as suggested by data that show women of Asian ancestry have only a fraction of the cancer that affects some 1 of 8 Americans. (The age-adjusted incidence overall for breast cancer is 139 per 100,000 women, taking into consideration the young average age of the population). When Japanese women move to Hawaii and adopt American diets their incidence rate rises to a point between Asian and American levels.

But the real picture behind these increasingly disturbing and common cancer patterns likely reflects certain basic truths about carcinogenesis. Repeated episodes of cell growth can put tissues at risk for becoming cancerous. Diets high in fat and calories predispose animals to cancer, as do naturally occurring hormones like insulin-like growth factor that may be present in excess in milk from hormone stimulated cows. Pregnancy in some animals increases breast cancer risk dramatically. But paradoxically, if human pregnancy is followed by nursing, the breast cancer risk plummets. Why?

Some researchers believe that at-risk cells may be shed in the milk. Others, that the cycling of hormones is somehow protective. But the real difference may be in the type of agent associated with breast cancer in animals. A form of virus distantly related to the HIV/AIDS virus called the mammary tumor virus causes

breast cancer in animals. And it does so in an insidious way. It is transmitted from mother to offspring in the milk. Once in the body, the mammary virus targets the immune system and depresses possible reactions against it, just as the AIDS virus does. It then travels to the breast ducts and their lining where it sets up shop and creates the conditions the predispose the animal to cancer. A few drops of milk passed to a nursing pup sets in train the cancer process anew. If extra chemicals which themselves can cause cancer are added to such breast tissue, cancer occurs with alarming frequency. This model provides a tantalizing clue to some forms of cancer in people.

My own view is that the key to understanding breast cancer and other rapidly increasing tumor types is linked to understanding the dynamics of the tissue itself. Chemicals that induce cell proliferation can "set up" the breast for chemical or viral damage and lead to mutations that result in cells with deranged metabolism and lost growth control leading to cancer. It has long been noticed that cancer is more likely in rapidly cell-dividing tissues than in quiescent or resting ones. Breast cancer risks may increase as cells in the breast epithelium, especially the lining of the milk ducts, proliferate. This cellular growth occurs late in adolescence and during the early stages of pregnancy, and can be exacerbated by prior treatment with dioxins and the presence of estrogens. If the hormone stimulation proceeds unabated, cells are progressively at higher and higher risk of carcinogenic transformation, especially if chemicals in the environment that concentrate in the fatty tissues of the breast impact on the dividing cells.

This latter likelihood is underscored by findings that proliferating tissues are at greatly increased risk of DNA or genetic damage from ionizing radiation or chemical mutagens. But there is an evolutionary model at work here as well. If cancer occurs early and life and kills its host (as it is now doing in an inordinate number of children in developed countries), any genetic predisposition to getting cancer will "die off" with the cancer patient. But, if people live long enough to pass along their genes—or the viruses that cause cancer—to their offspring or their spouses (as may occur in the human papilloma virus that causes some types of cervical cancer), the genes that "cause" or at least predispose to cancer will proliferate in the population. This phenomenon is par-

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### Impacts to Biological Health

Many modern day activities extend without limits into areas and reserves that jeopardize species and their necessary habitats. For example, air filled with fossil fuel burning sulfur oxides, heavy metals from mining activities, and drift from agricultural pesticides can impact an otherwise integrated habitat teeming with life. To the extent we can begin to understand and curb our harmful activities in areas needed to sustain biological diversity—including endangered and threatened species habitats—we can better learn how to ensure key species' survival and recovery, as well as our own.

### Protecting Biodiversity

A key element in protecting biodiversity generally and endangered organisms specifically, is maintaining the organism's capacity to successfully reproduce. Successful reproduction encompasses a broad definition that includes protecting the animal's natural behaviors, such as their ability to feed properly, as well as their physiological components (e.g., the unmodified production of sperm and eggs) to ensure genetic and physiological fitness of its progeny. For example, when an adult fish comes into contact with a contaminant that disrupts its ability to smell, it can affect homing and alarm responses. This disruption could have negative consequences for survival and reproductive fitness.

It is also quite possible that organisms of reproductive age could undergo mutagenic changes after coming into contact with low levels of contaminants. Many widely used chemicals are known to exert reproductive harm and may alter DNA in offspring. For example, bisphenyl-A, an element of polycarbonate plastics and a contaminant found in many rivers studied by the US Geological Survey, is a weakly estrogenic compound that may also exert changes to the genome of organisms undergoing development. More and more evidence is surfacing that implicates the widely used herbicide, atrazine, to many amphibian deformities. While it is high doses of atrazine that create problems for amphibians, low doses of the herbicide can apparently affect the immune systems of the organisms.

### Why is Biodiversity Difficult to Protect?

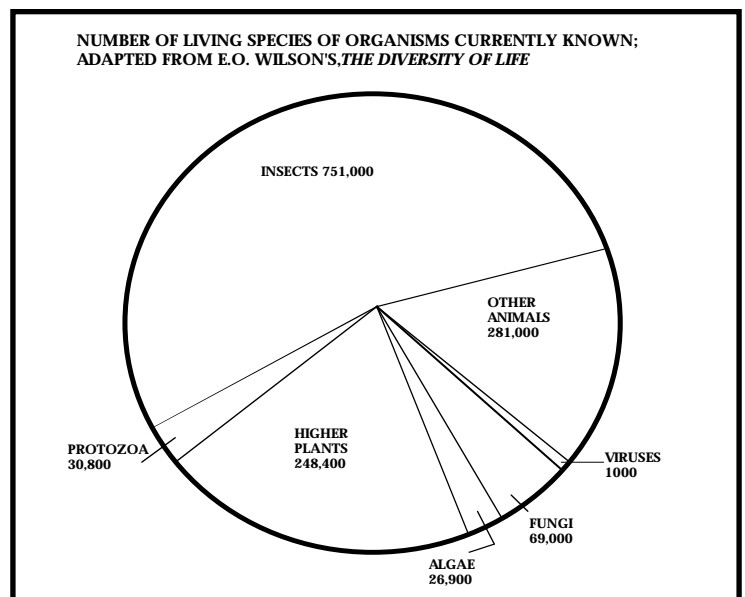
Protections from environmental contaminants arise as a result of court decisions, policies, and personal actions. Court decisions involving protecting open spaces and endangered species are often mired in controversies surrounding land use and development. The acclaim of biodiversity runs directly counter to development. Recent Endangered Species Act rulings have favored developers over animal's habitat. For example, in the 9th Circuit Courts, the habitat designation for the Red-legged Frog has been significantly reduced to favor large development by the Homebuilder's Association.

Broad national policies swing with the pendulum of elected opinion. For example, where the Clinton administration set aside large tracts of national forest for the northern spotted owl, President Bush has amended land and resource management plans to meet projected timber sales within ranges of at least two endangered species. In the red rock desert of southern Utah, the Bureau of Land Management has been advised to increase the oil exploration leases permitted in fragile habitats containing threatened and endangered species.

### What You Can Do

Supporting broad protective policies including the Endangered Species Act is not the only way to protect endangered or threatened species and their habitat. How we interact with our local environment can portend the success of recovering species. A first step would be to begin to examine the type of ecosystem where you live. Then begin to assess the way in which you manage your property. Do you use broad spectrum herbicides which do not differentiate between rare and threatened plants and the weeds chosen to be removed? How does altering the landscape either by removing vegetation or adding it change the hydrology or microclimate? Using natural and organic fertilizers and pesticides, while not benign, could better protect organisms. Certainly using specific instead of broad spectrum controls would permit greater diversity. Allowing portions of your yard or land to act as a corridor for wildlife is protective against fragmentation of ecosystems which is an ever pervasive problem.

Look at your personal ecosystem either on your land or your community in the same way you would look at a marvel like the Grand Canyon, with a perspective of its beauty as well as with an eye towards the details and striations which augments its exquisiteness. When we can begin to feel and see the presence of nature in our own yard, we may be able to find daily comfort and reassurance about our place in the environment as a whole. When we are able to take pride in minimizing our own biological and ecological impact, we may reach that place of wonder and amazement in our backyard. Bringing nature to your home and soul may offer a new found hope for all of nature. Ecological health and our personal health depend on it.



# Poetry



## Gifts of Life

By Marc Lappé

The shortfall in leaves, blossoms and gifts tells us  
The season is near when the Magi will come,  
When we will give our Christian gifts of love.

This Season, when we rejoice with the swell  
Of life, of seeds and pollen carried on the slime  
Of snails, in the feathers of ducks falling from the sky,

When we greet this new life in our modern Manger,  
What will we find in the gifts of the Magi?  
Will we find the soil rich and verdant, awash

With new life? Will we still find pearl-  
Lucent gems, the kernels of corn that made the  
Maya worship maize as the goddess

Of all goddesses? Or will we find the Earth  
Vandalized, sacked, studded with new life forms  
Not of this place or of this time?

What will we do now that the far-distant  
Hills of Oaxaca where the Yaqui and Spaniards  
Mixed their blood, the mestizos find their

Native crop, here in the heartland of corn,  
In the center of all corn, in the very heart of all  
That makes maize holy, the mestizos awake

To find the taint of distant America staining  
The lifeblood of their Holy Maize. Ah, but it is  
Only just, we say, to have again extended the

Caring hand of the Conquistador into the heart of  
Middle America. Perhaps the corillo corn and soon  
Even teosinte herself will be better off with the torn

Remnants of the besotted seed that made Monsanto  
Famous. Yes, we say, be grateful, for we give these gifts  
Of life freely—our modern miracles for some primitive

Yellow baubles of an ancient culture. Surely the Magi  
Would nod sagely, as this Season we offer our trinkets for  
Life everlasting, our glass for the golden genes of the gods.



# Creature Feature



## Future of Red-legged Frogs Uncertain

By Ira Smith\* & Noah Chalfin

The California Red-legged Frog (*Rana aurora*) is a threatened species that inhabits the west coast as far inland as the Sierra Nevada Mountains. Currently, this species is experiencing significant pressure from competitive species intrusion and habitat scarcity. In addition, recent evidence has been mounting that pesticides from agricultural and forestry industries are posing a multiplicity of adverse reproductive and survivability outcomes. Because breeding usually takes place in stagnant (many times ephemeral) water sources, and the larval maturation period is four to five months, the breed is extremely vulnerable to these pressures. The decimation of this species is simply one example indicative of the overall decline in native plant and animal populations in California.

The specificity of water sources needed to support the Red-legged Frog predisposes them to a reduced habitat range. To successfully reproduce, the frogs require calm, shallow, plant inhabited water that is of a specific temperature; leaving the frog a very limited area in which to breed. With the decline of areas offering such distinct habitats, this delicate species has become particularly susceptible to exclusion by intrusive non-native species. Bullfrogs, (*Rana catesbeina*) originally introduced to California in the late 1800's as a food source, have posed the largest predatory threat to the California Red-legged Frog. Additionally, there are several introduced predatory fish that also endanger the fortitude of the frog, as well as small amphibians generally.

As if natural habitat and predation pressures weren't considerable enough, a mounting volume of chemical pollutants is contaminating many of their critical aquatic habitats. Because of this frog's tendency to live in dormant water, (that doesn't cleanse itself quickly) even minor contamination can create a concentrated level of toxicity throughout the water. High concentrations of synthetic chemicals can lead to severe health problems for amphibians, ranging from reproductive incapacitation, genetic damage, physical deformities, behavioral deficits and ultimately death. Recent research has indicated the capacity of lower concentrations to cause nervous system damage and numerous reproductive disruptions from external hormonal stimulation.

Like most living things, amphibians play a more important role in the food chain than the recognition for which they are generally given. While the Red-legged Frog is only one small piece in nature's vast puzzle, it is important for all aspects of a habitat to be complete in order to function properly. And, this dwindling population represents a facet of nature that is merely indicative of an overall disruption well under way. Until a widespread respect for these natural systems (in their entirety) is broadened, creatures like the Red-legged Frog will soon be a memory, and more likely than not, simply forgotten.

\*Ira Smith is a new contributing author to Stopwatch.

He is a student at Sonoma State University in the "Environmental Conservation and Restoration" program.

# Toxics & Genetics News

**One hundred and fifty three (153) textile workers in the Dominican Republic were poisoned when paraquat was sprayed on nearby grounds.** The exposed workers were admitted to several hospitals throughout Santiago because no single facility could handle the large number of victims. Hospital officials confirmed that the workers had been exposed to paraquat, and that they experienced headaches, nausea, dizziness, exhaustion and dehydration.

Paraquat is a broad spectrum and acutely toxic herbicide that is banned or severely restricted in 11 countries. A recent report, "Paraquat: Syngenta's Controversial Herbicide," documents the effects of chronic paraquat exposure among agricultural workers. Skin contact alone can cause systemic damage, as well as skin irritation, blistering, ulceration, and cell death. After repeated use, paraquat breaks down natural skin barriers, resulting in higher absorption and skin penetration of the herbicide. Over time, inhalation of paraquat can severely damage the lungs.

Sources:

El Caribe, "Intoxicacion masiva en una industria de Villa Gonzalez" 10/23/02; See PANUPS of October 1, 2002.

Call on Syngenta to Stop Production of Paraquat, [www.panna.org](http://www.panna.org).

**ProdiGene-Modified Pharmaceutical Based Corn Plant Nearly Gets Into U.S. Food Supply.** U.S. authorities said an experimental ProdiGene Inc. plant genetically modified to make a pharmaceutical product (a vaccine for pigs) nearly slipped into the nation's food supply. A grain elevator in Nebraska was placed under quarantine because 500,000 bushels of soybeans may have been contaminated with kernels from a genetically engineered corn plant. The corn had been grown in the same field the previous year and was only experimental. The corn kernels were not intended or approved for human consumption.

The "biopharming" industry is in its infancy. The 35 field tests conducted in the U.S. by the industry this year required just 120 acres of land. But biotechnology officials have high hopes for these plants that are purported to make medically important proteins ranging from human monoclonal antibodies to vaccines and enzymes.

The problem in this case started last year when ProdiGene contracted with a Nebraska farmer to grow an experimental corn crop on a small plot of land. When the test was completed, the same farmer planted conventional soybeans on the land. However, some seed left over from last year's experiment grew into plants in that soybean field, officials said. The contaminated soybeans, worth about \$2.7 million, may now have to be destroyed.

Source: Scott Kilman, The Wall Street Journal

**Los Angeles Unified School District Embraces "Precautionary Principle."** California Safe Schools Coalition (CSS), having successfully worked with Los Angeles Unified School District (2nd largest district in USA) is implementing a LEAST - TOXIC, LOW RISK pest management policy, whose preamble includes the "PRECAUTIONARY PRINCIPLE". The policy mandates the use of preventive measures and least toxic methods in schools. Only when preventive measures fail does the district turn

to pesticides on the approved list. Pesticides on the approved list cannot contain products known to cause cancer, neurological disruption, birth defects, genetic alteration, reproductive harm, immune system dysfunction, endocrine disruption, or acute poisoning, which stops the routine use of the most hazardous pesticides in our schools. "Every parent knows that it is smart to keep children away from toxic chemicals." said Harvey Karp, MD, Assistant Professor of Pediatrics, UCLA School of Medicine, American Academy of Pediatrics. "That's why I salute California Safe Schools Coalition. The coalition has helped the Los Angeles Unified School district to adopt the best solution in the country for getting rid of pests while protecting children."

For more information, contact:

Robina Suwol, Executive Director, California Safe Schools

818-785-5515; [schoolipm@yahoo.com](mailto:schoolipm@yahoo.com)

Web site: <http://www.calisafe.org>

**High Amounts of Phthalates Still Being Found in Children's Toys.** Testing by the National Environmental Trust has found that some US manufactured soft plastic toys still contain harmful levels of plasticizers with linkages to liver and kidney damage. The chemicals which make plastic flexible have been banned in nine European countries, and last year the Consumer Product Safety Commission requested US toy makers eliminate the chemicals. The request applies to teething rings, bath toys, and squeeze toys. While toy makers did remove the phthalates from teething rings, bath and squeeze toys still contain reproductive toxic the chemicals that can leach into children's bodies when sucked or chewed.

**Red-legged Frog Critical Habitat Designation Eliminated by Bush Administration.** In April 2001, the US Fish and Wildlife Service designated 4.1 million California acres as critical habitat for the frog made famous by Mark Twain—the Calaveras County Jumping Frog (Red-legged Frog). After an appeal by the Home Builders Association, claiming that Fish and Wildlife Service had not shown the vast acreage to be essential for the frog's survival and did not weigh the economic costs of designating such broad habitat, federal judge Richard Leon is requiring the agency to redraw boundaries by 2005. The previously designated critical habitat area will be eliminated until such time as boundaries are redefined. Critical habitat is an area occupied by the species and found to be essential to the survivability and recovery of the species. Exclusion will permit development that will likely diminish habitat still further.

**Governor Davis extends waivers permitting Central Valley farmers to pollute in the form of agricultural runoff.** Waivers for non-point source pollution were recently extended despite outcry from the environmental community. The Davis administration abandoned its plan to force growers to reduce their runoff of pesticides and other pollutants into the Central Valley's streams and rivers. Known as non-point source pollution, the runoff accounts for the greatest threat to clean water and remains outside the purview of the Clean Water Act. The new waivers provide a loophole to the regulatory plan would have ended agriculture's 20-year-old exemption from state water pollution controls that other industries must follow.

# ANNOUNCEMENTS

• Announcing the arrival of Engineering the Farm: The Social and Ethical Aspects of Agricultural Biotechnology. Edited by Britt Bailey and Marc Lappé (Island Press, June 2002). Engineering the Farm offers a wide-ranging examination of the social and ethical issues surrounding the production and consumption of genetically modified foods. Contributors include; Dr. Paul Thompson, Lori Andrews, Dr. Peter Rosset, Frances Moore Lappé, and other critical thinkers in the field. Call 1-800-828-1302 to order or visit [www.islandpress.org](http://www.islandpress.org)

• KZYX 90.7 and 91.5 FM Ecology Hour has moved to Tuesday nights! Join host Britt Bailey for a special New Year's Resolution Show! Listen and learn about ways to make environmental improvements—be inspired to make personal resolutions that will conserve energy, better protect species, and promote cleaner air and water. Decide to get involved in making the world more peaceful and environmentally sound. Listen in December 31st from 7- 8:00 PM. Britt will be playing great music and filling your ears with helpful environmental facts.

• CETOS is looking for **NEW MEMBERS!!** Your membership supports our outreach efforts and provides educational materials for the general public. We are an independent non-profit, 501(C)(3), dedicated to protecting public health and the environment. Please make checks payable to TIDES/CETOS, PO Box 673, Gualala, CA 95445. Basic membership is \$30.00 though additional donations are welcome. All contributions are tax-deductible to the full extent permitted by law.

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## ***Can Cancer be Stopped? Cont. from Pg. 2***

ticularly likely if people are simultaneously ingesting or being exposed to chemicals in their diet or environment that increase their vulnerability to cancer by depressing their immune system—or by setting up their tissues for further damage, as is likely the case for estrogens that can induce or accelerate breast cancer.

The creation of environmentally "at-risk" tissues is likely to extend back to the womb. Researchers have shown that early exposure to potent toxicants like dioxin at extremely low levels can increase the number of proliferating end-buds in the milk ducts of breast tissues. While the dioxin itself does not necessarily "cause" a resulting tumor, it can increase the likelihood that one or more cells in the breast tissue will react with a chemical agent that will cause genetic damage—precisely because there are so many more cells available for being harmed by that chemical after adolescent breast development has proceeded.

A case in point is the increase in breast cancer now being seen among younger women. While an age-related increase in breast cancer risk is well known, no one expected or predicted that younger women would be getting breast cancer at an increasing rate. Whether or not this is due to exposure in early adulthood to suspect environmental agents such as the dry cleaning fluid known as perchloroethylene, or if it is the result of estrogens or estrogen-like substances in the diet or drugs women take, or some entirely unknown factor is still a mystery. Many such substances, like dioxin, have as their secret power, the ability to induce unexpectedly high levels of cellular turnover and division. During cell division, as we have seen, such cells may be more vulnerable to attack by chemicals with gene-damaging ability.

While the true cause (if there is any single one) of the increase in cancer rates among our population remains unknown, the common denominator of damage, cell growth and replacement provides a general backdrop against which to gauge the vulnerability of our tissues and organs. Almost any potential cancer site is usually one that is vulnerable to stimulation and excessive cellular growth and proliferation. For instance, the damage done by the ultraviolet rays in sunlight to skin will increase cell proliferation and likely genetic damage.

An additional factor to "successful" skin cancer induction is depression of the immune system—which ultraviolet also does. If we consider skin cancer as a model, the following sequence can be observed: damage, cell growth and replacement, excessive proliferation if the stimulus remains, and ultimately certain genetic mutations that predispose to freeing up a cell to become malignant. This model may be found to be applicable to other organs in the body and may help explain why so much cancer occurs in populations of well nourished and chemically-dependent populations such as those in the United States and the developed world generally. It is probably no accident that the rise in cancer incidence follows a trajectory that mimics the curve of increasing chemical production generally and pesticide production specifically, in the last four decades. If these and all of the remaining factors that impinge on the vulnerability of children and immunologically damaged people generally are not considered, it is unlikely that a solution to the cancer problem will soon be found.

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