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TALES OF OCCUPATIONAL CANCER

(Adapted from *The Secret History of the War on Cancer*)

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Abstract

Cancer, once rare, is now the biggest killer of humans. Its rising incidence triggered President Nixon's declaration of war on this still-dreaded diagnosis in 1971. Far less well-known is the coalition of moneyed forces, sometimes corrupting the most eminent of epidemiologists. This coalition has acted effectively to suppress and undermine this war – the secret war on the war on cancer.

The rise in cancer is not due solely to the ageing of the population, but in part to large-scale population exposure to a wide range of carcinogens, many of which are occupational. Once, all carcinogens were naturally occurring, but in the last century, an increasing range of synthetic molecules have been manufactured; some of which are also highly carcinogenic.

This chapter, drawn from *The Secret History of the War on Cancer* (Davis, 2007) gives a taste of many cases in which occupational health has been placed well below the interest of corporations, enabling lower consumer prices.

In some cases, tentative industry sympathy to the worker has given way to active suppression, but in most cases, industry and employers have refused any liability or responsibility. Particular attention is paid in this chapter to the relationship between vinyl chloride and cancer.

From Hippocrates to Percival Pott

Hippocrates depicted, 2,500 years ago, a tumour as a muddled irritable cavity with spindly legs flaring out of control in all directions. Fascinated with its evil, animal-like appearance, he termed it *karkinoma*, the Greek word for *crab*. Like Hippocrates, we are drawn to things of menacing beauty.

In the 1920s, cancer was rare. Nobel Laureate, Andre Cournand, recalled how, during his medical training in Paris, he and his colleagues rushed to see their first case of lung cancer. Today, however, cancer claims one in four persons in most industrial countries. In heavily industrialised areas of China, half of all deaths are due to cancer.

To prevent cancer, the 12th-century Jewish polymath, Moses Maimonides, counselled balanced nutrition, regular exercise and restraint from dust and dirty air. Occupational links with cancer have been recognised for half a millennium. Georgius Agricola noted young miners with chest tumours in the Erz Mountains. His 1556 magnum opus, *De Re Metallica*[1] (with 289 woodcuts) included some of the earliest reports on the ailments of underground work. Those who entered the mines the youngest, fared worst. If they survived trauma, they succumbed to lung diseases and tumours.

Sometimes, it takes centuries to get the message. In 1912, Herbert Hoover[2], then a top mining engineer, and his wife, Lou, a Latin scholar, published the first English translation of Agricola's work in *Mining Magazine* (Nash, 1983). The Hoovers explained that the 16th-century work remained relevant in the 20th century.

By 1714, the Italian physician, Ramazzini, had documented more than three dozen cancerous professions, including mining of coal, lead and iron. Ramazzini recognised many other risky occupations, including smiths, glassmakers, painters, tanners and mirror makers. So, too, were cleaners of privies and cesspits, farmers, fishermen, printers, midwives, wet-nurses and corpse carriers. For each trade, he explained agents or conditions he thought associated with classes of illness. His major work, *De Morbis Artificum Diatriba* (*Diseases of Workers*), showed that the things men and women did in their working lives played major roles in determining their ailments. It laid the foundations of occupational medicine.

1 *See The Secret War on Cancer for full reference details.*

2 Later a U.S. President.

Ramazzini also noted that nuns tended to be free from cervical cancer, then one of the most common fatal tumours of women. Celibate women more often developed breast cancer, and he speculated both were causally related; something now well accepted.

Ramazzini also believed that those who learned of workplace hazards had a moral duty to warn workers of the risks of their employ, and he extended Hippocrates' ancient advice to doctors by advocating an occupational history (Hunter, 1973, p. 35).

In 1775, the English surgeon, Pott, reported that chimney sweeps exposed to soot had an increased risk of scrotal cancer (known by sweeps as 'soot wart'). German sweeps, who wore leather trousers or bathed more often, had a lower incidence. This illustrates four points still relevant. First, workers often know their occupational risks. Second, risk differences can be associated with workplace practices. Third, uncommon events, like cancer of a male reproductive organ, get noticed. Finally, even as clear-cut an association as soot and scrotal cancer reflects multiple causes. Soot is not one chemical but hundreds. Its complex chemistry means that chimney sweeps would have trouble collecting damages in a modern U.S. court. If any were to sue the coal companies for damages, he would be asked to show exactly which of the hundreds of chemicals in coal tar had caused his cancer. The true answer – 'all of them' – is no longer considered acceptable.

New Technologies, New Chemicals, New Risks

Diagnostic radiation, which revolutionised cancer detection and treatment, turned out also to increase disease risk. X-rays damaged erythropoiesis – the capacity of bone marrow to make red blood cells. Girls who hand-painted clock dials with luminescent radioactive paint licked their brushes to craft fine lines. Some lost their jawbones as a result.

That such technological and chemical breakthroughs might harm health was barely imagined by most. Thomas Edison was an exception. After his chief assistant died from radiation, Edison refused to have another X-ray (Montgomery, 1997).

The Curies also died from their own research with radiation. Marie and her husband, Pierre, detailed the phenomenon of radioactivity in pitchblende, the ore that yielded uranium. Years of contact with radioactive material proved harmful. Cataracts fogged their eyes, and constant ringing dulled their ears. In 1906, Pierre was struck by a carriage he could neither see nor hear. Marie died of leukaemia.

The Early 20th Century

In the early 20th century, pioneer American medical researcher, Alice Hamilton, undertook postgraduate studies in Germany, the then acknowledged centre of scientific research. She had direct contact with the manufacturing revolution under way for coal and petroleum-based chemicals including benzene and toluene. Hamilton provided the first comprehensive account of the health effects of benzene, building on European and US case reports of benzene poisoning.

In 1926, the American National Safety Council issued a final report on the hazards of benzol, noting the doses at which it induced narcosis and severe weight loss in animals. It included 125 different references (National Safety Council, 1926). In 1936, Brussels hosted the Second International Congress and Social Campaign against Cancer; recognised carcinogens included hormones, arsenic, sunlight, radiation, benzene and other chlorinated hydrocarbons. By then, tools with which to draw causal inferences regarding cancer included experimental studies of cells and whole animals, and statistical observations of human disease patterns.

The Unusual Candour of the American Petroleum Institute, 1948

In 1948, the American Standards Association, a group of industry experts, maintained that a person could safely be subjected to 100 parts per million of benzene over 8 hours. It is unclear where they got this notion, which made no sense. The American Petroleum Institute (API) offered a contrasting statement: 'Inasmuch as the body develops no tolerance to benzene, and as there is a wide variation in individual susceptibility, it is generally considered that the only absolutely safe concentration for benzene is zero' (Drinker, 1948). The candour in this statement is startling and rare in an industry trade association publication. Today, the API takes a far less precautionary position – actively funding research to try to overturn national benzene standards in many countries.

William Hueper and the National Cancer Institute

In 1949, a report in *Scientific American* (Castleman, 2005, p. 62) expanded on the seminal work of Wilhelm Hueper, who would become the first chief of environmental carcinogenesis at the National Cancer Institute (NCI). Some of its ideas are remarkably contemporary (summarised in Box 6.1).

Box 6.1 Rising rates of cancer cannot be fully explained by ageing and diagnosis (1949 statement)

Scientific and technological progress have exposed humans to new physical and chemical agents. Some are believed associated with the rise of cancer as a cause of death. Customary reasons for increased cancer rates – improved diagnosis and population ageing – fail to explain why approximately 7 per cent of known cancer deaths in 1944 occurred in young people.

An explanation of this increase is thus sought in our environment, so much more complex than in 1900. The cancer increase may be caused by environmental agents hitherto considered comparatively harmless.

Many occupational cancers are unidentified. Physicians are poorly informed of basic symptomatic and sociological factors involved in occupational carcinogenesis and need better education. Occupational histories should reach back as far as 25 years. It is urgent to check medical suspicions of industrial cancer by epidemiological studies of plant workers and paramount to impress plant management with the problem's seriousness.

Control of occupational and environmental carcinogenesis is a public health problem of considerable magnitude. Carcinogens should be:

- eliminated from industrial military and civilian use as far as possible and practical;
- enclosed if used in manufacturing processes;
- separated from communities by reduced discharge in solid waste, effluent and air emissions.

Factories using carcinogens should be licensed and inspected, and their workers provided with protective clothing, equipment and medical supervision, including frequent physical examinations.

Causal Awareness of Cancer Obscured after World War II

In 1936, top scientists understood that much cancer emanated from workplace, hormones, radiation and other external sources, and by 1949 the NCI had begun to train doctors to watch for signs of these health risks and to promote their reduction. What happened to derail programmes to reduce the burden of cancer?

The time of the Belgian cancer congress was an era of mounting hostilities and militarisation. In 1935, the physiologist, Walter Cannon, linked growing nationalism with the lapse of long-term interest in humanitarian science, including the ability of chemicals and radiation to damage human life:

'The worldwide economic depression has greatly reduced the material support for scholarly efforts. What is the social value of the physiologist or biochemist?' (Cannon, 1994).

Cannon coined the term 'fight or flight' to describe the physical response of living beings to life-threatening terrors. Nations may be similar. The prospect of unrestrained global conflict might have changed public priorities, altering the way science was supported and used by its underwriters.

The old knowledge of cancer hazards fell victim to enthusiasm for modern industrial advances and its supporting social and economic forces. Optimism about industrialisation, *bona fide* advances in basic disease biology and darker forces generated a milieu in which the dice were weighted towards industry. The burden of proof for workers, physicians and the community shifted to one that was impossibly heavy. The search for more scientific information morphed into reasons to reject what once was known. The rise of chemotherapy also assisted. If cancer could be cured, then fundamental changes in the nature of modern life could be avoided.

But new chapters have opened due to growing numbers of cancers in young adults, some following therapies allowing them to survive childhood cancer. Other evidence is accruing of the combined effects of low levels of exposures to pesticides, other environmental toxins and persistent materials such as flame retardants and printer inks that put wildlife and humans at risk of cancer and other chronic ailments (Colburn et al., 1996).

Saran Wrap and Stunted Fingers

In 1933, a glass cleaner at Dow Chemical could not get one vial to come clean. It was covered with a tough, transparent film that would become the basis for Saran wrap, formed by linking many molecules of the plastic vinyl chloride. Saran wrap became a common household item.

Vinyl chloride, invented in Germany in the 19th century, was essential to the burgeoning chemical industry. As a slightly sweet-smelling gas under pressure in metal cans, it was once used to propel liquids including whipped cream, vaginal deodorants and hairsprays. More than half of this gas is chlorine, which was used to poison troops in the Great War. But it was presumed, incorrectly, that it lacked the poisonous properties of chlorine. It just turned out to be slower acting.

Commercial production of its solid form – polyvinylchloride (PVC) – skyrocketed. Workers in plastics factories started to notice a strange effect. Stunted fingers had been reported very occasionally in Europe in the 1940s, but not linked to vinyl chloride. Before 1965, only 72 cases of dissolved bone had been recorded globally, mostly in genetically linked families. However, in the 1960s, this rare bone defect was reported in groups of vinyl chloride workers (Lamy and Maroteaux, 1961; Ross, 1970).

A 1964 letter that was sent to a physician at a plant where several cases were found is instructive (see abridged version, Box 6.2) (Trade Secrets, 2014).

Box 6.2 Curious cases of hand disabilities among workers

'We have recently observed several cases of hand disabilities, the causes of which are unknown. We would like to determine as quietly as possible whether similar disabilities might exist in your plant. The disability we have seen is characterized by soreness of finger tips and resorption in the distal phalangeal joints. Several cases exhibit fibrous dermatological changes of the hands.

Please carefully observe the hands of employees if you see them for any reason. If you observe any similarity to this condition, note the individual's job assignment as well as his work history with the company. As yet, we have no firm opinion that these disabilities are occupational in origin.

I appreciate your rapid attention, incidental to other examinations. We do not wish to have this discussed at all, and I request that you maintain this information in confidence.'

In 1967, a report appeared of a man whose fingers had become stunted while working with polyvinyl chloride (Harris and Adams, 1967). His employers considered he must have a genetic defect or a rare disease. But similar reports appeared. In one case, a man's jaw dissolved. The notion that these oddities had common cause became hard to reject.

The vinyl chloride story is a dark moment in occupational medicine. As it looked problematic to humans, companies decided it was logical to see the response in animals. In 1971, Viola reported cancers of the skin, lungs and bones in rats exposed to high levels of vinyl chloride (Viola et al., 1971). Aware of this work and fearful of its implications, a group of companies including Montedison, a major Italian vinyl chloride manufacturer, commissioned a Bologna toxicologist named Maltoni to study it. Maltoni's work proved groundbreaking. For two years, 500 rats were subjected to various levels of the gas. The highest dose group

were given 10,000 parts per million (ppm) – a level that nearly anaesthetised them. The lowest dose group were given 250 ppm – an amount that consumers could easily encounter when using aerosolised PVC in hairspray or that workers might inhale in the factory. A third group was unexposed.

One ppm is equivalent to a single minute over two years. Two years, or one million minutes, is the usual time to expose rodents to test compounds. Maltoni's innovation was to allow the rats to live their natural lifetimes, another year that allowed tumours to appear in the last third of life – corresponding to the retirement that human workers look forward to after their factory lives. After the exposures ended and all of the rats – exposed or not – lived out their natural lifetimes, their organs were examined.

The results horrified him. About one in ten of the exposed groups had liver angiosarcoma, an exceptionally rare, untreatable tumour. Not a single unexposed animal did. Maltoni showed a dose–response curve, but some developed this malignancy even at the lowest dose.

By 1972, Maltoni knew vinyl chloride was a serious problem. At first, he honoured his contract and kept quiet. Montedison assured him it would release his findings. Maltoni first expected this would be when the manufacturers met with government officials. But such meetings occurred and his work was not mentioned.

Disgusted, Maltoni violated his agreement in 1974, publishing the results. In Kentucky, a physician noticed that the fingers of a man who worked in B. F. Goodrich's vinyl chloride plant were shortened and stubbed. Within a few weeks, he saw three more in the same plant. His report (Centers for Disease Control and Prevention, 1997; Creech) made Maltoni's work with animals indisputably relevant.

Millions of dollars were at stake. To manufacturers, it made sense to fight any effort to restrain production. From the first reports of harm, the vinyl chloride industry had a simple response: call for more research but release enough information to reassure most people that the problem was trivial. It is cheaper to set up laboratories to evaluate chemicals. It takes time to get things right. Nobody can be opposed to serious scientific investigations. It is also heady for scientists to be told that their work is so important that more is needed. Funding for research on vinyl chloride expanded, as a delaying and distracting tactic.

As with tobacco, asbestos and climate change, attempts to expose the vinyl chloride hazards were met by concerted efforts of obstruction and intimidation. It was argued that case reports were not sufficiently rigorous to justify major

changes in vital national production systems on which rested military and industrial foundations. Then, when rodent experiments revealed serious health problems, their relevance to humans was challenged.

Finally, enough time passed for public health studies on large numbers of people with well-documented exposures. But these had to overcome numerous statistical and procedural objections, including court challenges on the grounds that studies of large groups of people were 'mere statistics'. In the meantime, thousands, and sometimes millions, of people continued to be exposed to conditions that had been known decades earlier to be dangerous.

Deceit and Denial

Eventually, the control of vinyl chloride became a regulatory victory. In 1975, the Occupational Safety and Health Administration (OSHA) mandated limit for polyvinyl chloride dropped from 500 ppm to only 1 ppm. Emissions previously released into the community were captured. Contrary to dire warnings that this would mean the end of the plastics industry, business boomed (Ashford, 1984). But deceptions continued.

More than 20 years later, the historians, Markowitz and Rosner, published *Deceit and Denial*, a detailed account of the sordid history of vinyl chloride (Markowitz and Rosner, 2002). This drew the wrath of 20 of the biggest chemical companies in the world, including Dow, Monsanto, B.F. Goodrich and Union Carbide. The chapter that especially rattled these companies was called 'Evidence of an Illegal Conspiracy by Industry'. The title was from a memo by the Manufacturing Chemists Association's lawyers. It warned that concealing evidence of the connection between vinyl chloride and cancer 'could be construed as evidence of an illegal conspiracy by industry if the information were not made public' (Wiener, 2005). The book detailed the machinations of the companies involved in suppressing public awareness of rare and deadly incidents affecting their employees (Markowitz and Rosner, 2002). The authors drew from hundreds of thousands of pages of internal corporate documents.

As a reward, they found themselves at the centre of a major lawsuit. Trying to quash the book's public discussion, chemical firms filed a 'slap suit', a strategic lawsuit against public participation (SLAPP), a widely used tactic to intimidate opponents (Beder, 1998) This charged that they had damaged the reputation of honourable companies, even though they used the industry's own documents to reveal a three-decades-long struggle to keep the public unaware of, or confused about, the dangers of vinyl chloride. Industry subpoenas demanded the records used in writing this book – many from the plaintiffs' own files – and those of the publisher, the book's academic reviewers and the non-profit research

organisations that had supported them (Guterman, 2004). To their credit, the authors prevailed and the suit was eventually dropped. The history of vinyl chloride is as sordid as the authors indicated.

Sir Richard Doll

Recognising its danger, the chemical industry employed the best counsel they could afford – Sir Richard Doll, then considered a top epidemiologist. Doll published his own analysis, agreeing that angiosarcoma was associated with vinyl chloride but disputing its links with more common cancers (Doll, 1988). Although he found more cases of brain cancer than expected, he argued this was statistically insignificant (Doll, 1988). However, Doll failed to declare his highly paid consultancy (Doll, 2000) for the Chemical Manufacturer's Association (Sass et al., 2005).

As a result, workers who developed more common tumours after exposures to vinyl chloride were unable to gain compensation. Not until 2000 did it become known that Doll's efforts on vinyl chloride had not been the independent musings of a disinterested expert. A letter found after his death in 2005 indicated that Doll had served as a consultant to Monsanto since at least 1979, at a fee of US$1,500 a day (Roush, 1986).

The Environmental Mutagen Society

Some researchers who received industry funds eventually grew disenchanted. Marvin Legator was one such researcher. He began working in industry in the 1950s, then with the Food and Drug Administration. He was full of ideas but short of funds. In 1969, with three colleagues, he co-founded the Environmental Mutagen Society (EMS). This society sought to investigate environmental factors causing genetic damage. Legator describes being impressed by the Dow Medical Director, who talked of the need to monitor workers continually. He thought, 'we can really find out whether benzene is getting to the bones of these guys!'. But co-EMS founder, Sam Epstein (author of *The Politics of Cancer*, 1978), was unimpressed.

In 1970, Bernard Goldstein was asked by the API to review the benzene literature. He concluded that benzene caused leukaemia. After that, the API withdrew funding. Despite hearing such stories, Legator was unmoved. He did not share Epstein's attitude and believed that solid experimental work would generate reform. He thought Dow Chemical was genuinely interested in basic occupational

research. For a while, his was well-funded to perform chromosomal studies in exposed workers. They designed basic methods for detecting structural damage of DNA. Legator remembers this period fondly, until one critical point.

In life, sisters borrow things from one another. But when this happens within chromosomes, it can lead to trouble. 'Sister chromatid exchange' happens when related segments of a chromosome cross over and duplicate unwanted material. Legator's group showed that benzene could induce such genetic damage. The Dow study had collected blood from men when they first began working. Six years later, researchers took additional blood to check on the accrued chromosomal damage. But the results showed that chromosomes had been harmed. Dow pulled the plug on funding.

'Epstein had been perfectly right all along. I was the naïve one.' Legator laughed as he told me (DD) this story. By then, he was riddled with cancer. The disease was no surprise. 'I spent my youth awash in chemicals that can slice right through you. I know what they mean.'

The Weakening of OSHA

There is a widespread belief that OSHA regulates chemical exposures in the workplace – and there was a time, in the late 1970s, when it actively tried to do so. You still hear people complain that OSHA is overzealous. The truth is that it has been a paper tiger for decades.

Nowhere is OSHA's failure clearer than with benzene and vinyl chloride, where even now well-heeled efforts are under way to roll back existing standards. In 1979, OSHA took the radical step of setting a benzene standard of 1 ppm – a level then believed to be as low as feasible. But in 1980, the Supreme Court ruled against the standard, arguing that the agency had failed to prove that this low level would provide measurable health benefits in workers. The court demanded evidence that only time, money and epidemiologists could produce.

Today, OSHA is a shell. For a while, OSHA set standards for an average of one carcinogen a year, but most standards were developed decades ago.

Cancer in China

Since the 1980s, colleagues at the Chinese Academy of Preventive Medicine have been conducting a large epidemiologic study of workers exposed to benzene in Chinese cities. In 1989, they found a statistically significant excess of leukaemia and lung cancer, along with possible increases of liver and stomach cancer, and lymphoma. The NCI is now co-sponsoring further research in China.

Such studies, involving thousands of workers in more than 700 Chinese factories, have finally provided what the Supreme Court asked for two decades ago. Bone marrow disorders, including cancer, are clearly worsened by greater benzene exposures. Recently, these researchers have found that even at exposures of 1 ppm, Chinese shoemakers with certain common genetic traits suffer reduced bone marrow function.

However, these studies could also end up being ignored, because of a brazen act of manufacturing uncertainty that could well lift exposure standards. Unhappy with the efforts under way by the NCI and others in China, five major oil companies have bet millions of dollars that they will be able to 'contradict earlier claims that link low- and mid-levels of benzene to cancers and other diseases from exposure to benzene' (Capiello, 2005).

Personal Notes

The first time one of the authors (Davis) met Tony McMichael was at Cold Spring Harbor,[3] New York, USA in 1980. She explains:

> The first time I met Tony was at Cold Spring Harbor in 1980. I was quite young and naive about the ways that science worked. I had begun working with Marvin Schneiderman of the NCI evaluating the impact of workplace carcinogens and was about to start working on a post-doc with Abe Lilienfeld. We had determined that there appeared to be an increase in cancer not tied with smoking or ageing and had published some of these findings. Tony took the time to look at what we had calculated and admitted that he shared our concerns. Tony and I were among the only people there who raised questions directly to Sir Richard Doll about his proclamation that the only important cause of cancer was tobacco. We were all shocked to learn that at the time that Doll was vociferously arguing against environmental carcinogens being of any major consequence, he had served secretly as a consultant to the chemical

3 www.cshl.edu/About-Us/History.html, accessed 10 April 2015.

> industry, as we describe above. Others pointed out that major funding to Oxford's Green College which Doll led also came from the chemical industry (www.preventcancer.com/losing/other/doll.htm).
>
> When I organized a major international conference on avoidable causes of cancer for the Collegium Ramazzini, Tony was again one of the strong voices urging attention be paid to workplace cancer causes and more general environmental carcinogens. In his refusal to compromise his views and his commitment to impeccable scholarship and integrity, Tony remains a model to us all.

The first time the second author (Butler) met Tony was at Sydney University in 1993, just prior to the 13th International Epidemiology Association conference. His interest in the causes and politics of cancer was piqued by several experiences as a junior family doctor. He recalls that the first patient he ever diagnosed with cancer, in Devonport, Tasmania, in 1989, had asked whether his own exposure to agricultural sprays could have been a factor. His concerns about faint-hearted government enquiries into cancer date to that period, and are described on his blog.[4]

He also recalls reading, later that year, John Goldsmith's keynote talk from the first International Society for Environmental Epidemiology (ISEE) meeting (Goldsmith, 1988). In it, Goldsmith had written:

> We, the environmental epidemiologists of the world, are the canaries, capable of giving warning of impending environmental disaster in time for remedial steps to be taken. Fortunately, our fate is not to have to die as the unfortunate canaries of the coal miners did, but to sing, to call out in clear tones the nature and type of impending health danger that threatens. It is the methods and criteria of scientific detection, analysis, and interpretation that give us our lifesaving potential. (Goldsmith, 1988)

Conclusion

The best wars, to take a line from President McKinley's Secretary of State, are short, splendid little affairs, all pageantry and little fighting. The protracted war on cancer (generally viewed as beginning when US President Richard Nixon signed the National Cancer Act in 1971) has been none of the above. How did we get to this point?

4 globalchangemusings.blogspot.com.au/2013/04/canaries-struggling-to-improve.html, accessed 10 April 2015.

The war on cancer has long been obstructed by vested interests. The ISEE, of which Tony McMichael later became president, has, since its formation, endeavoured to identify and to ameliorate environmental cancer, including among workers. Its ethics committee, in particular, is keenly aware of issues of bias, suppression and repression. Yet, on the whole, proof that the world in which we live and work contributes to cancer has often been systematically overlooked and suppressed.

Prevention has been considerably diluted and diverted to attempts to find, treat and cure the disease. We spend more money than ever to detect and treat cancer (Hanahan, 2014). Today, one subsidiary of Industrial Chemicals Inc. makes cancer-causing pesticides, like atrazine – a compound banned in much of the industrial world –, while another division produces tamoxifen, a widely prescribed anti-cancer drug. Could this paradox be related to the fact that the incidence of cancer not tied to smoking and its treatment options keep increasing, while efforts to restrain environmental causes of the disease limp far behind?

Of course not. Remember that we live in a highly technological, interconnected world. It is safer, and better for your reputation in polite society, to keep reminding yourself that the disease is just so damned complex.

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