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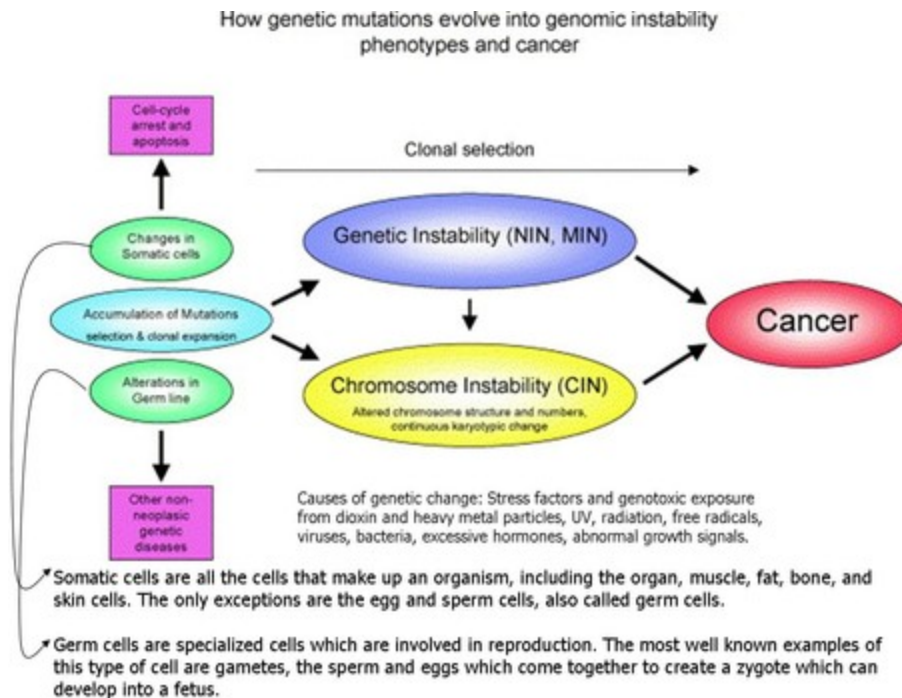
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# How Agent Orange and Depleted Uranium Affect the Body

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Since the use of **AGENT Orange** in both Vietnam and to some extent in Korea, all will acknowledge that dioxin (2,3,7,8-tetrachlorodibenzodioxin-TCDD) has become one of the most controversial issues our military has ever faced. **IARC**, the International Agency for Research on **Cancer**, which is part of the World Health Organization, classified dioxin as a known human carcinogen in 1997. The September 2000 draft of the U.S. EPA's Health Assessment document on dioxin also classifies dioxin as a known human carcinogen. In January 2001, the Department of Health and Human Services' National Toxicology Program came around and finally classified dioxin as a known human carcinogen. I find it remarkable that with all the evidence dating back to the 1940's, that the US bureaucracy didn't come to the conclusion that dioxin was a carcinogen until the early 2000's.

Effects on the **immune system** appear to be among the most sensitive endpoints studied. Animal studies show that dioxin *decreased immune response* and increased susceptibility to infectious disease. In human studies, dioxin was associated with immune system depression and alterations in immune status leading to increased infections. Dioxin can also disrupt the normal function of hormones—chemical messengers that the body uses for growth and regulation.

Certain human cells, such as liver cells, contain a large molecule called an **aryl hydrocarbon receptor (AhR)**, which can be thought of as shaped like a pocket. Compounds like dioxin that are foreign to the body, fit snugly into this pocket. Once in the pocket, dioxin activates the AhR and the whole unit can travel to the cell nucleus which contains our genes. Once in the nucleus, the unit may either activate or suppress specific genes that control the normal cell cycle. For example, certain cells

may begin to grow preferentially, or other cells may not die appropriately, as normal cells do. It is important to note that gene suppression or activation is not the same as DNA damage.

Dioxin is an endocrine disruptor chemical-EDC (EDCs are substances that alter functions of the endocrine or hormonal-system) that may interfere with the body's endocrine system and produce adverse developmental, reproductive, neurological, and immune effects in humans. Dioxin is commonly used to refer to a family of toxic chemicals that all share a similar chemical structure and a common mechanism of toxic action that can disturb the homeostatic mechanisms of the body or initiate processes at abnormal times in the life cycle. The chemicals can exert their effects through a number of **different mechanisms**:

- Dioxin may mimic the biological activity of a hormone by binding to a cellular receptor, leading to an unwarranted response by initiating the cell's normal response to a naturally occurring hormone at the wrong time or to an excessive extent (**agonistic effect**).
- It may bind to the receptor but not activate it. Instead the presence of the chemical on the receptor will prevent binding of the natural hormone (**antagonistic effect**)
- It may **bind to transport proteins** in the blood, thus altering the amounts of natural hormones that are present in the circulation.
- It may **interfere with the metabolic processes** in the body, affecting the synthesis or breakdown rates of the natural hormones.

The endocrine system is distributed throughout the body and includes: glands, hormones synthesized and secreted by the glands into the bloodstream, and receptors in the various target organs and tissues which recognize and respond to the hormones. The systems regulates a range of biological processes, including control of blood sugar, growth and function of reproductive systems, regulation of metabolism, brain and nervous system development, and development of an organism from conception through adulthood and old age. Disruptions in hormonal balance at critical life stages may have long-lasting effects. This has been seen with Agent Orange exposure and now with exposure to the cook-off of **depleted uranium** in what is widely termed Gulf War Symptom.

**Depleted uranium** is a heavy metal that is also slightly radioactive and can become a health hazard from the "cook off" from exploded weapons. Heavy metals (uranium, lead, tungsten, etc.) have chemical toxicity properties that, in high doses, can cause adverse health effects. Taken into the body via metal fragments or dust-like particles, depleted uranium may pose a long-term health hazard to personnel if the amount is large. However, the amount which remains in the body depends on a number of factors, including the amount inhaled or ingested, the particle size and the ability of the particles to dissolve in body fluids.

From a report by Dr. Rosalie Bertell, Ph.D., G.N.S.H. which was prepared for Hague Peace Conference, May 1999, we have the following facts relating to the use of and health concerns for using depleted uranium munitions:

*"There is no dispute of the fact that at least 320 tons of depleted uranium (DU) was "lost" in the Gulf war, and that much of that was converted at high temperature into an aerosol, that is, minute insoluble particles of uranium oxide, UO<sub>2</sub> or UO<sub>3</sub>, in a mist or fog. It would have been impossible for ground troops to identify this exposure if or when it occurred in war, as this would require specialized detection equipment. However, veterans can identify situations in which they were likely to have been exposed to DU. Civilians working at military bases where live ammunition exercises are conducted may also have been exposed.*

*Uranium oxide and its aerosol form are insoluble in water. The aerosol resists gravity, and is able to travel tens of kilometres in air. Once on the ground, it can be resuspended when the sand is disturbed by motion or wind. Once breathed in, the very small particles of uranium oxide could reside in the lungs for years, slowly passing through the lung tissue into the blood. Uranium oxide dust has a biological half life in the lungs of about a year. According to British NRPB [ National Radiation Protection Board ] experiments with rats, the ceramic or aerosol form of uranium oxide takes “twice as long” or about a two year biological half life in the lungs, before passing into the blood stream. [Stradling et al 1988]....*

*Uranium is both a chemical toxic and radioactive hazard: Soluble uranium is regulated because of its chemical toxicity, measured by damage to the kidney and tubules. Uranium is a heavy metal, known to cause uranium nephritis. Insoluble uranium, such as was released in the Gulf War, is regulated by its radiological properties, and not its chemical properties. Because of its slow absorption through the lungs and long retention in body tissues, its primary damage will be due to its radiological damage to internal organs rather than chemical damage to the renal system. Obviously, both types of damage occur simultaneously, therefore it is a matter of judgment which severe damage, radiological or chemical, occurs at the lowest dose level. However, with the lengthening of the time during which the contaminant resides in the body and the low overall dose, the risk of cancer death becomes greater than the risk of significant damage to the renal system.”*

**Studies confirm** that heavy metals, like dioxin, can directly influence behavior by impairing mental and neurological function, influencing neurotransmitter production and utilization, and altering numerous metabolic body processes. Systems in which toxic elements can induce impairment and dysfunction include the blood and cardiovascular, detoxification pathways (colon, liver, kidneys, skin), endocrine (hormonal), energy production pathways, enzymatic, gastrointestinal, nervous (central and peripheral), reproductive, and urinary. But most important could well be the immune system, which if not hindered or altered might well severely limit the body's protection from genotoxins.

As to toxicity from depleted uranium cook-off particles, it is obvious that the US had some expectation of the health effects related to using such ordnance in the Gulf War. This is evident based on military research and manuals. The Department of Defense had access to information on chemical and biological agents which could protect against some of the harmful side effects of depleted uranium toxicity. These agents would include radio-protective agents such as thiols, also called mercaptans, which are organosulfur compounds that are derivatives of hydrogen sulfide, and nitroxides (used as a food aerosol and an anesthetic).

The body's own biological defense system of cytokines (non-antibody proteins released by T-lymphocytes, generating an immune response) and eicosanoids, which are signaling molecules made by oxidation of twenty-carbon fatty acids would naturally come into play when an immune response was activated creating a cascade affect of immune molecules but are totally inadequate to the effects of most genotoxins. Eicosanoids exert complex control over many bodily systems, mainly in inflammation or immunity, and act as messengers in the central nervous system. The networks of controls that depend upon eicosanoids are among the most complex in the human body. If affected by genotoxins there can become a complete breakdown of the immune system.

With the evidence overwhelming it is obvious the government didn't do its due diligence before exposing our military to the consequences of using Agent Orange and depleted uranium weaponry. As a veteran I understand the need to go “all out” when it comes to fighting a war (something we haven't really done since World War II). Since the Korean War, the military has allowed subsequent conflicts to fall prey to international politics and political correctness with wars lasting decades.

The effort to give our troops an edge on the battlefield has lead to state-of-art weaponry but by the same token has lead to the use of tactics (Agent Orange defoliants) and weapons that while devastating to the enemy have become a liability to ourselves (depleted uranium). Both have lead to a trail of human suffering on civilian populations and our own military personnel.

To coin an old phrase, "The cat is out of the hat", and to those subject to the aftermath of our military's decisions, getting back to a normal life for many will mean a healthcare nightmare. In my final segment next week, I'm going to address how biological response modifiers (BRM's), some of which are products of cutting edge medical research and some which are modifications of what Mother Nature has given us, looks to be the salvation to many who are afflicted with exposure to Agent Orange and [Gulf War Syndrome](#).