A System Compromised

Cancer, from the word *Karkinos* meaning crab, is an illness from within. The disease overthrows our homeostatic system and harnesses our cells’ ability to propagate and heal. No other illness is so cunning, so omnipresent. Cancer is usually nonpathogenic and occurs in both the somatic and germ-line cells. This is because every diploid cell possesses forty-six chromosomes, twenty-three from the mother and twenty-three from the father. In those chromosomes, there are genes, specifically oncogenes and tumor repressor genes, that when both unregulated have the ability to create a malignant neoplasm or tumor. The cells relentlessly proliferate with the constant activation of the growth pathway. In fact, cancer utilizes the same genes that allowed a single cell to become a new organism. In response, neighboring cells release highly specific signals to the growing mass in a process known as contact inhibition. When the cell finally loses the ability to respond to these signals, it soon becomes malignant. As Siddhartha Mukherjee stated in *The Emperor of All Maladies* (Scribner 2010), cancer is an illness with many modern metaphors. I like to describe it as a modern day opportunist, an individualist in the most extreme sense. The illness will compromise the entire system to accomplish its personal goals. In the harmonious body system, cells like this simply cannot exist.

The year was 1986 and my grandmother, a university professor, was abroad in a small Ukrainian village. After attaining her visa, she delved into the regional historical records to gather data for her research paper. In an “Act of God” or fate, my grandmother was in the blast radius. The Chernobyl nuclear meltdown, a severe Fukushima, catapulted colossal clouds of debris into the atmosphere and disseminated its radioactive isotopes across continental Europe.
Mommy, as I called my grandmother, was within 25 miles, safe at least from the debris. In the subsequent days, she recalled a peculiar rain and the setting of a red sun.

Ten year later, after enough mutations had accumulated in her cells, Mommy began experiencing a slight cough. She did not smoke (one of the most definitive carcinogens), was highly active, and lived in an almost pollutant-free suburb of Northern California. She visited her physician the following day for an x-ray. The doctor noted a small dark lump in her lungs, but this was eventually dismissed as some interference in the scan. Unfortunately, this was not the case. In fact, as stated in my biology textbook, Alberts’ *Cell Biology* (Garland Science 2002), a tumor identified by an x-ray is at least one hundred million cells. This was no trifling mass, but my grandmother disregarded this and committed herself to her research. In the following summer, she studied abroad in Pakistan, and during her stay, she developed a low-grade fever. Mommy assured herself that it was a small viral infection or perhaps food poisoning. After returning from Pakistan, she discovered an enlarged nodule in her neck–tumors at this palpable stage, Alberts states, are at least one billion cells. She underwent a biopsy, and they confirmed the tissue to be malignant. The cancer had infected her lymph nodes, lungs, liver and kidney.

Malignancy is mobility. The genetically “fit” cells of a tumor are able to relocate to a distal tissue by using either the blood stream or the lymphatic vessels. The immortal clump of cells seeks a new tissue, perhaps in the membranous endothelial lining. The cell mass, enveloped in the tissue and its nurturing folds, establishes a new domain. The insatiable growth allows the cancer to endure and adapt. Halting this growth, as many pharmaceuticals are struggling to achieve, leads to the demise of some tumors, but other times causes the undesirable evolution of the tumor by Darwinian selection. The malignant cancer cells are the conquistadors that truly
discovered the fountain of youth. They epitomize our deepest desire to live forever at the cost of our mortality.

Surgery would not be an option. There was no way to effectively remove a delocalized tumor. The physician reported a discouraging verdict of a maximum of four months of life. Mommy looked to academia for solace and a solution. She enrolled herself in the cancer research clinic at Stanford University. There she underwent a most rigorous combination of chemotherapy and radiation (ironically the cause of the cancer). Her chemotherapy was taken both orally and intravenously for greater potency, but it also meant a more taxing treatment. My grandmother told the doctors to give her the strongest dosage to completely eradicate her body from cancer’s crustacean grip.

Chemotherapy is a treatment, but so is amputation. It almost always kills the healthy cells, along with the cancerous tissue. As Mukherjee recounts, it was selective poison that was developed from the vast arsenal of chemicals created by Germany during the Industrial Revolution. The inspiration for using these chemical agents came from mustard gas used in World War I. If a compound was able to hollow out the somatic cells, why not use the same principle to selectively target cancerous tissue.

My grandmother took her oral poison regularly and became frail, but far from weak in spirit. To the doctors’ and everyone’s disbelief the cancer went into remission. Usually people expect this to be six months, maybe a year, but my grandmother was an experimental outlier. Four years of remission was unprecedented for this stage of cancer.

The unfortunate part of chemotherapy is that it kills a mass of rapidly dividing cells while wreaking havoc to other tissues. The body is evolutionarily designed to respond to the fluctuating environment. Chemotherapy is a poison, and the body’s defense to this drug leads to
its eventually downfall. As Mukherjee states with regards to leukemia, as the drug decimates the cancer, the cerebrospinal fluid serves as a safe haven and harbors the healthy somatic cells and stowaway malignant cells. The fluid isolates and protects these cells from the chemotherapeutic toxins.

The cancer survives.

My grandmother’s cancer came back with a vengeance. It debilitated her to the point of bed rest. Multiple rounds of chemotherapy and radiation therapy were experimented with no success. The cancer, once vulnerable, was now overpowering. On one of the final days of her illness, I entered into my grandmother’s room, as she rested with IV tubes and intravenous chemotherapy. As I walked in, she opened her anesthetized pupils and smiled reassuringly. A day later, she passed away.

Cancer arises from a single cell. One individual cell with an accumulation of mutations compromises the entire system. It is this cell’s quest for immortality that destroys the very being that gave it life.
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