

## THE BIG IDEAS

### **\$100B + \$100B = 0**

The uncomfortable truth of cancer.

### **One Prime Cause**

Otto Warburg + cancer metabolism.

### **Recon Cells**

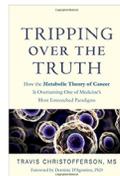
Fascinating experiment.

### **Starve Cancer**

Of its preferred fuel.

### **Cancer Clinics**

A new vision.



# Tripping over the Truth

How the Metabolic Theory of Cancer Is Overturning One of Medicine's Most Entrenched Paradigms

BY TRAVIS CHRISTOFFERSON · CHELSEA GREEN PUBLISHING © 2017 · 288 PAGES

“It was a scientific detective story that had to be told, and it became the focus of my life for the next two years. Soon it was apparent, in interview after interview, that the story went far beyond the cold, empirical data—it tapped into base psychology, human limitations, economic incentives, and the deep-rooted, powerful force of groupthink, forces that carry the inertia of the *Titanic*. Scientific progress doesn't glide from one exalted epiphany—like the story of Isaac Newton getting hit on his head by an apple—to the next. It is a torch carried by human beings. It lurches, stumbles, wanders into dead ends, and then finds its way back out. It doesn't march in a straight line—it trips its way toward the truth. But the beautiful thing about science is that no matter how bumpy the ride, eventually, because of the process itself, the truth is slowly, inevitably mapped out.

This book is a culmination of that scientific pilgrimage. It is both the scientific and the human story of the revival of Warburg's old theory and the profound therapeutic consequences that travel with it. It is a look into the continuing quest to discover the nature of cancer from a different angle, taking all the puzzle pieces and assembling them in a new way.

This book is about the continuing quest to discover the true origin of cancer, reduce the problem to its core elements, define it in its simplest terms, and find the critical molecular events that manifest in uncontrolled cellular proliferation.”

~ Travis Christofferson from *Tripping over the Truth*

*“Cancer, above all other diseases, has countless secondary causes. But, even for cancer, there is only one prime cause. Summarized in a few words, the prime cause of cancer is the replacement of the respiration of oxygen in normal body cells by a fermentation of sugar.”*

~ Otto H. Warburg

This is the second book specifically on cancer I've read after my brother Rick was diagnosed with cancer. (Get a copy [here](#).) The first book I read was *Anticancer* by [David Servan-Schreiber](#). And, we've referenced cancer dozens of times over the last decade in [this collection of Notes](#).

One in two men and one in three women will be diagnosed with cancer in their lifetimes. Those numbers are staggering. It's (obviously) a big deal and (not always as obvious) there's a LOT we can do to prevent and then fight cancer beyond the (current) conventional methods.

Of course, I'm not an oncologist or cancer specialist per se, but as I continue supporting my brother in every way I can, I'll be sharing Notes on other books so we can wrap our brains around how to Optimize our approach to preventing and fighting cancer.

[Travis Christofferson](#) is a science writer. In this great book, he provides a compelling look at the history of scientific research on cancer and the traditional therapeutic models offered—juxtaposing the (traditionally accepted) Somatic Mutation Theory (or SMT) with the (much more compelling) Metabolic Theory of Cancer.

[Dr. Mercola](#) leans heavily on the same research in his book *Fat for Fuel* and says this about the book: “Phenomenal . . . required reading for anyone who has cancer or knows someone who has cancer. . . . I cannot stress its importance enough. Get yourself a copy, and read it.”

As you'd expect, the book is packed with Big Ideas. I'm excited to share a few of my favorites so let's jump straight in!

## THE UNCOMFORTABLE TRUTH OF CANCER

*"This year, almost six hundred thousand Americans will die from cancer. One in two men and one in three women will be diagnosed in their lifetimes. Despite embellished announcements from government actuaries, the real death rates from cancer are the same today as they were in the 1950s."*

~ Travis Christofferson

"The uncomfortable truth of cancer threatens our exalted march toward immortality. Cancer stands alone as our most ardent, confusing, shape-shifting, and devastating enemy. The numbers don't lie. One in two men and one in three women will be diagnosed in their lifetimes. Despite embellished announcements from the government actuaries, the real death rates from cancer are the same as they were in the 1950s. We can't seem to penetrate its elusive armor, and it's not for lack of trying. Cancer receives more funding from the National Institutes of Health (NIH) than any other disease. Not to mention that it is under investigation at every major pharmaceutical company around the world."

Two days before Christmas in 1971, Richard Nixon declared a "War on Cancer."

This was two years after we landed a man on the moon so everyone was pretty bullish about the prospects of knocking the disease out.

How's that War on Cancer going?

Well, Travis tells us that we've spent \$100 billion (!) in research over the last four decades. And, we currently spend \$100 billion (!) every year on cancer medications. (!!!)

And...

*"Despite embellished announcements from the government actuaries, the real death rates from cancer are the same as they were in the 1950s."*

Again: After all that research by all those brilliant scientists, the current death rate from cancer is still the same as it was in 1950.

That kinda makes you scratch your head and wonder how that's possible, eh?

Well, Travis tells us that the primary reason we have pretty much utterly failed in our War on Cancer is that we've been working with the wrong paradigm regarding the *cause* of cancer.

As Travis says: *"To utter it is heretical, to say it out loud invites scoffs, dismissal, even outright anger, but here it is: Maybe we've mischaracterized the origin of cancer. Maybe cancer is not a genetic disease after all. Maybe we are losing the war against cancer because scientists are chasing a flawed scientific paradigm, and cancer is not a disease of damaged DNA but rather one of defective metabolism."*

That, my friends, is the thesis of the book.

\$100 billion dollars has been spent focused on the idea that cancer is, primarily, a "disease of damaged DNA." ← That's known as the "somatic mutation theory" or SMT.

But, alas, Travis shares research that paints a very different picture.

Although cancer certainly involves damaged DNA, the metabolic theory of cancer says that the CAUSE of cancer is not the faulty genetic mutations.

Rather—and this is a VERY important distinction—the genetic mutations are the *effect* of (or by-product/epiphenomenon of) the *true* root cause of cancer: damaged mitochondria.

Helping us wrap our brains around that distinction is what the book is about.

Which leads us to Otto Warburg and our next Idea.

*"It takes eighteen times more glucose to extract the same amount of energy from fermentation than from aerobic respiration. If the two pathways, aerobic and anaerobic, were represented by cars—the only difference being the motor—the aerobic model would get 38 miles per gallon, and the anaerobic model would get 2 miles per gallon."*

~ Travis Christofferson

*"This led to Warburg's famous distinction: Unlike normal cells, cancer cells ferment glucose in the presence of oxygen, a characteristic now known simply as 'the Warburg Effect.'"*

~ Travis Christofferson

## CANCER: ONE PRIME CAUSE

"[Otto] Warburg's observation was this: Cancer cells have a perverted method of generating energy. They truncate the conversion of glucose (sugar) into energy. They depend much less on the efficient process of aerobic respiration, using oxygen to produce energy—instead relying much more on the ancient and highly inefficient pathway known as fermentation. Later in his career, Warburg contended that this was the true origin of cancer. The cell's ability to generate energy through the oxidative pathway is damaged, and the cell reverts to fermentation. He said, 'Cancer, above all other diseases, has countless secondary causes. But, even for cancer, there is only one prime cause. Summarized in a few words, the prime cause of cancer is the replacement of the respiration of oxygen in normal body cells by a fermentation of sugar.'"

Otto Warburg was one of the greatest scientists of the 20th century.

He won the Nobel Prize for Physiology and Medicine in 1931 "for his discovery of the nature and mode of action of the respiratory enzyme." (And, apparently he was nominated two additional times for separate work.)

In 1924, Warburg made the claim that cancer was caused by a dysfunctional method of generating energy. As he put it: "Summarized in a few words, the prime cause of cancer is the replacement of the respiration of oxygen in normal body cells by a fermentation of sugar."

Enter: The Warburg Effect.

As per Wikipedia: "Most cancer cells predominantly produce their energy through a high rate of glycolysis followed by lactic acid fermentation even in the presence of abundant oxygen. This is called aerobic glycolysis, also termed the Warburg effect."

The Warburg Effect is the germinal idea for the metabolic theory of cancer. Unfortunately, for reasons Travis outlines in the book, Warburg's ideas never gained traction as we pursued the idea that cancer was caused by genetic mutations.

We'll talk more details in a moment. For now, I want to reflect on a couple of points here. First, we have the "one prime cause" of cancer vs. the "countless secondary causes." Then we have the prime cause itself. [Gary Taubes'](#) brilliant point in [The Case Against Sugar](#) hits both points.

He says: "When Isaac Newton paraphrased the concept of Occam's Razor, he did so by saying, 'We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances.' This was rule number one of Newton's 'rules of reasoning in natural philosophy' in his Principia. So is it necessary to posit multiple aspects of diet and lifestyle—multiple causes—to explain the presence of these chronic diseases that associate with Western and urban lives, or will one suffice? Sugar, for example."

One of the challenging things about cancer is that it's an incredibly complex disease. ESPECIALLY if you orient from the idea that the causal factor for its initiation is genetic.

However, you know what happens when you step back and look at it from a metabolic perspective? You see that the primary thing all cancers have in common is damaged mitochondria that leads to a weird metabolism and uncontrolled growth in cancer.

The (very) good news? The way cancer creates its energy is its Achilles' heel. More on that in a moment. First, a fascinating study that points to the power of the metabolic theory.

## RECON CELLS

"According to Seyfried, the mutations at the heart of the SMT of cancer were downstream to the true cause: damaged mitochondria. They are a side effect, an epiphenomenon. The upshot is that mutations to DNA 'arise as effects rather than as causes of tumorigenesis,' Seyfried said.

*"It was clear that the intertumoral heterogeneity, or the variability in mutations from sample to sample, was the most poignant feature of the disease. Each person's tumor was almost as unique as a fingerprint, as a snowflake."*

~ Travis Christofferson

*"If Warburg was right and cancer originates from injured respiration, therapeutic strategy and drug design have to be completely reconfigured. Rather than attacking a hazy, moving target that by its nature cannot be directly hit, researchers will be presented with a single target that permeates the spectrum of disease. This scenario implies that cancer cells are not mutated versions of cells with superpowers programmed by an omniscient supervillain. They are damaged cells trying to survive in their own misguided way. They can be corralled, guided, manipulated and killed."*

~ Travis Christofferson

Mutations seen in the DNA of cancer cells are 'red herrings' that sent researchers on a futile hunt.

The most striking evidence that Seyfried dug up was from the late 1980s: a series of uncomplicated experiments that drew remarkable conclusions. Not all experiments are created equal; some are better than others. Experiments that are technically simple in design yet offer results that answer big questions tend to leave a lasting mark in their fields.

Two groups working independently, one in Vermont and the other in Texas, performed a meticulous series of nuclear transfer experiments, both with shocking results. The experiments consisted of a simple transfer. Warren Schaeffer's group at the University of Vermont wondered how much control the cytoplasm (where all the mitochondria reside) had over the process of tumorigenesis. To find out they conceived of a beautiful experiment. Simply put, they took the nucleus of a cancer cell and transferred it into a healthy cell with its nucleus removed. The reconstituted cell (or *recon*) now contained the DNA of the cancer cell, with all its supposed driver mutations, but retained the cytoplasm and mitochondria of a noncancerous cell.

The recon now had tremendous power. It alone could answer the question of who was right: Warburg or Varmus and Bishop. If mutations to DNA cause and drove cancer, the recons should be cancerous, regardless of their mitochondria. But, if, as Warburg, Pederson, and Seyfried contended, the mitochondria are responsible for starting and driving cancer and mutations were largely irrelevant, the recons should be normal, healthy cells."

How's that for a fascinating experiment?

Imagine a cancerous cell with a cancerous nucleus and a cancerous cytoplasm (where the mitochondria hang out). Now, imagine being able to take the cancerous nucleus out of the cancerous cell and drop it into a healthy cytoplasm—replacing the healthy nucleus with the cancerous one in the "recon" cell.

What do you think science says should happen?

Well, the answer depends on your paradigm. If you ascribe to the somatic mutation theory of cancer, you'd expect the cancerous nucleus to make the cell cancerous. If you're a metabolic theory of cancer guy or gal, you wouldn't expect it to make a difference.

As it turns out, when the recon cells were dropped into 68 mice, only one of them grew a tumor. (Which makes no sense if the CAUSE of cancer is damaged DNA.)

But get this.

If you reverse the experiment and take cancerous CYTOPLASM (/mitochondria) and drop that into a recon cell with a healthy nucleus guess what happens?

*"When they transplanted the recons containing malignant cytoplasm into newborn mice, 97 percent of the mice developed tumors."*

Again: Less than 2% of the rats got cancer when the nucleus of the recon cell was cancerous. 97% (!!!) got cancer when the nucleus was fine but the cytoplasm of the recon cell was cancerous.

That's crazy. Guess what happened when the researchers shared their results? Crickets.

*"Astonishingly, rather than shaking the very foundation of cancer biology, the claim was ignored—even worse than being argued against."*

*"Seyfried reflected on the lost importance of the experiments, saying, 'In summary, the origin of carcinogenesis resides with the mitochondria in the cytoplasm, not with the genome in the nucleus.'"*

Over the last several years, even the iconic discoverer of the double helix himself, James Watson, is moving away from the purely genetic theory into an epigenetic approach.

*"It seemed that in every scenario, entering ketosis enhanced other therapies while keeping toxic shrapnel from damaging healthy tissues. The diet appeared to slow cancer growth, but that alone did not appear to be R-KD's strong suit. The way it prepares the therapeutic landscape make it unique. It was like primer to a painter or fertilizer to a gardener. It conditions the environment in which the cancer exists, enhancing other therapies while attenuating side effects."*

~ Travis Christofferson

*"PET scanning revolutionized cancer diagnostics. To this day, no imaging technology is able to differentiate living, actively metabolizing cancer with the accuracy of a PET scan. CT scans can image a spot, but they can't tell you if the cancer is alive or dead. PET scans are the only way to detect actively metabolizing tumors," Pederson said."*

~ Travis Christofferson

I'm going to skip a detailed accounting of epigenetics (which literally means "above the genes" and represents the environmental and lifestyle factors that influence gene expression) but know this: "Seyfried illuminated basic research showing the important epigenetic signaling that travels from the damaged mitochondria to the nucleus, the missing link to a complete metabolic theory of cancer."

## STARVE CANCER OF ITS PREFERRED FUEL

"Starting with the premises that cancer needs glucose and that cancer cells have drastically reduced numbers of mitochondria, damaged mitochondria, or both, Seyfried modified the ketogenic diet to put as much metabolic stress on the cancer cell as possible. He restricted the overall calories in order to drive blood glucose down as far as possible, depriving cancer cells of their preferred fuel. He knew that healthy cells would transition to burning ketone bodies in their intact mitochondria, something that cancer cells are unable to do. Seyfried found that this restricted version of the ketogenic diet dramatically slowed the growth of tumors in mice."

Recall from prior Notes that cancer loves sugar. "Sugar," as cancer survivor (and thriver!) [Tom Rath](#) says in *Eat Move Sleep*, "is candy for cancer." Now we know why.

It's the disrupted metabolism of cancer cells that allows them to break some rules and create energy that fuels their uncontrolled growth via the fermentation of sugar.

(In fact, the PET scan that my brother will be getting soon is basically a tool to track the glucose metabolism hot spots in one's body. The areas that light up? That's where cancer tumors are feasting on the fermentation of sugar.)

There's good news here. THIS, again, is cancer's Achilles heel. Cancer NEEDS the sugar to produce energy. Cut off that supply line (and Optimize the terrain in all the ways we discuss in *Anticancer* and *Conquering Cancery* 101) and we have a shot at forcing cancer's retreat.

As Dr. Mercola says in *Fat for Fuel*: "What all this means is that when you remove processed foods, sugar, grains, and high-net-carb fuels from your diet, you essentially stress cancer cells by depriving them of their preferred metabolic food."

This book is more of an intellectual analysis of the conflicting theories of cancer and the history of cancer research and treatment methods. We'll be discussing super-practical tips in our next Note on *The Metabolic Approach to Cancer*.

For now, if you and/or someone in your family is battling cancer and you'd like to understand what's been going on in our scientific approach over the last 100 years, I think you'll love the book as much as I did.

The main thing I hope to have impressed upon you with this Note is that a bunch of evidence seems to point to the fact that our brilliant scientists have been looking in the wrong direction (and continue to do so!) in their hunt for solutions to cancer.

When we've spent \$100 billion on research and spend another \$100 billion EVERY YEAR on cancer medications yet see essentially ZERO (!!!) results, something's clearly not working.

P.S. Signs your oncologist falls too squarely into the traditional approach: They tell you not to worry about changing your diet and have a bowl of candy in the reception area of their offices. (Both of which occurred with my brother—along with the post-surgical drip that was basically pure glucose. Might as well have a celebratory party for cancer as you try to get rid of it.)

## CANCER CLINICS: A NEW VISION

"R-KD was essentially free, although a cancer center would have to retrain staff nutritionists, and HBOT [hyperbaric oxygen therapy] was comparatively cheap. In Seyfried and D'Agostino's

*"Can you imagine coming out of chemotherapy healthier than you came in? That's the way it should be! The process should be restoration!" Seyfried said.*

~ Travis Christofferson

vision, a cancer center would be a clinic where patients went to restore or 'enhance' their damaged mitochondria and, in a nontoxic and orderly manner, kill off the diseased cells. There would be no buckets to throw up in and no bald patients with lifeless expressions, shells of their former selves. There would be no medical bankruptcies or families scrambling to pay for drugs that cost more than \$100,000 for a single treatment course that was of almost no benefit. There would be no radiation burns or subversion of healthy cells to cancerous ones cast forth by the treatment itself, no massive increase in acquiring cancer later in life from dripping war gas into people's veins.

When cancer is framed as a metabolic disease, the entire paradigm of treatment is turned inside out. Doctors are treating a single disease, and they are treating 'sick' cells, not the immortal, super cells that the genetic theory paints them as. Is this vision realistic? The treatments are in their infancy—this is the first act in treating cancer as a metabolic disease. Only time will tell."

How's that for a vision of a future cancer clinic?

A place where you go to "gently rehabilitate" your mitochondria rather than a place where you get, in the terms used in current cancer clinics: "slashed" (surgery), "burned," (radiation) and "poisoned" (chemotherapy)?

Only time will tell.

And time will only tell that potential outcome if we, as individuals within a remarkably (!) broken system, have the courage to stand up and fight for the truth and for a truly integrated, optimal response to the challenge that is cancer.

Sending love to you and your family.

B

**Brian Johnson,**  
*Chief Philosopher*

If you liked this Note, you'll probably like...

[Fat for Fuel](#)

[Anticancer](#)

[The Case Against Sugar](#)

[Head Strong](#)

[The Telomere Effect](#)

[The Keto Reset Diet](#)

[The Bulletproof Diet](#)

[Fat Chance](#)

[Eat Fat, Get Thin](#)

## About the Author of "Tripping over the Truth"

TRAVIS CHRISTOFFERSON



Travis Christofferson, M.S. received his undergraduate degree in molecular biology from the Montana State University Honors Program and a master's degree in Material Engineering and Science from the South Dakota School of Mines and Technology. Today, he is a full-time science writer and founder of a cancer charity. He lives in South Dakota.

## About the Author of This Note

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Brian Johnson loves helping people optimize their lives so they can actualize their potential as he studies, embodies and teaches the fundamentals of optimal living—integrating ancient wisdom + modern science + practical tools. Learn more and optimize your life at [optimize.me](https://optimize.me).