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From fruit peel to cancer fighter: The past, present, and promising future of modified citrus pectin

By Isaac Eliaz, M.D., M.S., L.Ac.

"One day, they will find out that there is a cure for cancer in the peel of an orange."

I'll never forget those words. They came from Dr. Ruth Cohen, a neighbor of mine during my childhood in Israel forty years ago now. In a country known for its prized citrus fruits, she and her husband Leo were scientists—each with their specialties in organic chemistry, with a particular focus on the field of citrus pectin.

It was decades later before I would begin to see how true that statement really was—and what once seemed like mere wishful thinking would begin to assume an astonishing reality. In fact, modified citrus pectin (known as MCP for short) might one day be

considered among the greatest medicines of modern times—at once natural, safe, and exceedingly powerful against even the most treatment-resistant cancers.

Perhaps you've battled cancer in the past—and maybe you're fighting it now. Or maybe, it's a dear family member or friend who has begun their battle. Whatever the case, it is my greatest honor as a doctor to be able to share this exciting body of research with you.

The ordinary origins of a natural breakthrough

Though the term itself may not be familiar, you encounter pectin on a daily basis—it's a soluble fiber found in the cell walls of a variety of plants. It's most abundant in the rinds and peels of fruits such as oranges, lemons, grapefruits, and apples, and is perhaps most commonly encountered as a thickening agent for jams, jellies, and other foods. But aside from its usefulness in the kitchen, pectin has a wide array of health benefits, especially for your digestive tract.

As a soluble fiber, pectin is best known for its water-holding abilities—unlike insoluble fiber (which is impervious to digestion and remains intact), pectin binds to water in your intestines and forms a gel. In this way, it helps to prevent constipation and remove toxic waste from your colon. It also plays a key role in balancing the pH of your intestines.

When pectin ferments in your colon, it forms a substance called butyric acid, which in turn binds to mutagens and flushes them out of your system. This is one proposed method by which pectin can significantly reduce cancerous risks to your colon, and there are over a dozen published studies that demonstrate this strong inverse relationship between colon cancer and dietary fiber intake.

Unfortunately, however, the health benefits of pectin—whether derived from apple or citrus—are largely limited to your gut. And while it does play a vital role in the prevention of colon cancer as I explained, the size of pectin molecules are simply too large to be absorbed into your bloodstream in any significant quantities. Because of this, the vast array of disease-fighting properties in pectin remained untapped—until the discovery of MCP, that is.

With a single change in pectin's molecular structure, a flood of previously unexplored applications has poured forth, heralding a new chapter in the field of integrative cancer research. But before I move on to the details of these groundbreaking studies, let me take some time to explain what modified citrus pectin is—and exactly how it's changing the face of cancer treatment.

Disarming sticky proteins that speed up and spread your cancer

Chemically, pectin is what's known as a long-chain polysaccharide, a string of molecules comprised primarily of sugar (about two-thirds of its molecular structure closely resembles the sugar galactose). Given its constitution, pectin is particularly attractive to molecules that bind with galactose—and among these molecules is a class of carbohydrate-binding proteins called galectins.

Like galactose, galectins lie on the surface of your cells. By attaching to this sugar, galectins facilitate cellular communication, allowing your cells to relay messages to one another, and enabling them to stick together. This process is perfectly healthy in normal cells, where the number of surface galectins is relatively few.

Cancer cells, on the other hand, carry a disproportionate number of these galectins—specifically galectin-3—and this defining characteristic prove especially sinister. Hundreds of studies have pointed to the role of galectins in cancer development over the years—the most recent have exposed galectin-3 as a key player in the growth and spread of cancer within the body.

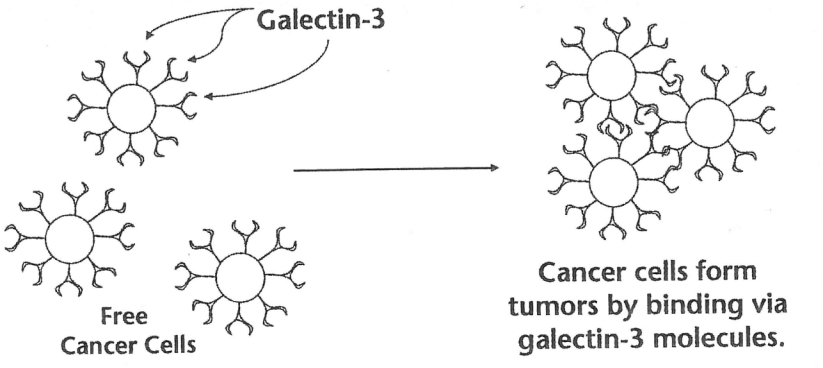
In order to understand this role, you must first understand how cancerous cell behavior differs from normal, healthy cell behavior. So let me take a moment to explain some of the biological misfires involved in cancer's formation.

Healthy cells die and regenerate as part of an orderly process—as one becomes sick, another is produced to replace it. When this cell formation accelerates, however, it causes cells to "pile up" and form a tumor. But as long as these cells appear normal and static, the tumor is considered harmless, or "benign."

Unlike benign tumors, cancerous tumors are malignant. They're marked by uncontrolled growth and the ability to spread aggressively—a process known as metastasis. If given the opportunity, they will spread through your entire body, invading healthy tissues and causing new tumors. And this dangerous ability hinges on the presence of galectin-3.

Galectin-3 promotes cancer progression in three interconnected ways:

- It allows cancer cells to attach to one another, forming groups that can survive in your bloodstream and migrate to other parts of your body.
- Once cancer cells have formed a main tumor, galectins allow the cells to attach themselves to new sites as well, forming secondary tumors.
- Lastly, galectin-3 nourishes malignant tumors by stimulating new blood vessel growth (even where there was no blood supply before) to feed the tumor. This process is called angiogenesis.



It's no surprise, then, that these deadly galectins have become a primary target in modern cancer prevention. If you disarm a cancer cell's ability to communicate, you essentially pull the plug on its power supply—it cannot spread or nourish itself, and ultimately, it will die.

Pectin's molecular structure makes it a vital weapon in this inhibitory process—by tying up galectins on cancer cells' surface, it can disable their ability to communicate with cells around them. But it's not able to perform this crucial function without a few modifications first.

As I explained earlier, unmodified citrus pectin has larger molecules that can't be easily absorbed into your bloodstream—as such, its effects are largely limited to the intestinal tract and the colon. That's why it's been the foremost goal of my research to find a way to break down pectin's long chain of sugar molecules into a smaller, more bioavailable structure. I knew that discovering just the right preparation of pectin could revolutionize complementary cancer medicine—and MCP is the realization of this goal.

Smaller sugar chains pack a more powerful punch

The molecular composition of MCP can be a confusing topic if you're not a doctor or a scientist. But it's also the most crucial aspect of its cancer-fighting abilities, so I'll try to outline the differences between ordinary and modified citrus pectin as simply as I can.

The size of ordinary pectin molecules ultimately determines where they can go and what they can do, and you'll find this value expressed in terms of molecular weight, which is measured in *Daltons*. Unmodified citrus pectins are between 50,000 and 150,000 Daltons—once again, far too large to permeate the intestines and enter into your bloodstream in sufficient quantities.

Research has revealed a couple of ways to lower this molecular weight—but unfortunately, not all of them are equally effective. One way is to modify the pH, using sodium hydroxide (or lye) along with an acid to break pectin molecules down into smaller, non-uniform pieces. This method is relatively inexpensive, but only yields molecules of about 30,000 Daltons or larger.

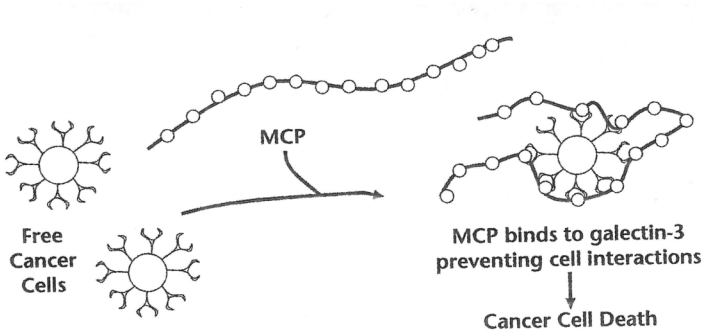
Employing an enzymatic process to produce smaller, uniform fragments of pectin is the more expensive (but also more effective) method of producing MCP. This latter process yields pieces between 10,000 and 20,000 Daltons—a much more desirable size, and one that allows more of these powerful pectin molecules to reach target areas via your bloodstream.

Another key factor to consider in this modification process is the pectin's *degree of esterification*—this measurement dictates its ability to bind effectively to galectins. Esterification is when a galacturonic acid group along the pectin chain has an attached bulky methyl group. Simply put, the degree of esterification is the ratio of Galacturonic acid residues that are esterified, meaning having a methyl group attached to them compared to the ones that are free. For example, 10 percent esterification means that one out of every 10 galactose molecules is bound and therefore not available for galectins to be able to bind to it. It also means that it can't bind to toxins or heavy metals that are positively charged.

galacturonic acid

Thus, the more bulky molecules a MCP preparation contains, the less effective it is in disarming galectins—and the less effective it is in combating the growth and spread of cancer.

Ordinary pectin has a degree of esterification of about 70 percent—but even some modified forms have as much as 50 percent of these larger galactose molecules, rendering it largely ineffective against cancer-spreading galectins. The most powerful preparations of MCP, on the other hand, with have a degree of esterification of 10 percent, or less.



It took years of research to find a preparation that meets all of these standards. But through the combined efforts of me and a handful of other integrative oncologists and scientists, the last decade ushered in a breakthrough for MCP—most notably in the treatment of advanced prostate cancer.

Doubles your doubling-time and cuts cancer cells at their root

In 1995, Dr. Kenneth J. Pienta and his research team carried out the very first evaluation of oral MCP treatment in animals. Modified citrus pectin was introduced into the drinking water of rats implanted with prostate cancer cells. At the conclusion of the study, only half of the rats given MCP developed lung metastases, compared to 93.75 percent of the control group—a profoundly significant difference.

This study paved the way for future research, and the first human trial—a small pilot study conducted by myself along with Dr. Stephen Strum in 1995 and 1996—was finally presented at the International Conference on Diet and Prevention of Cancer in Finland. Seven prostate cancer patients were administered 15 grams of MCP per day for 12 full months. During the duration of the study, PSA doubling time—a measurement that reflects the speed at which the cancer is growing—was evaluated at 3, 6, and 12 month intervals.

The results were extremely promising: Four out of the seven patients responded with a lengthened PSA doubling time of more than 30 percent. Additional in-vitro analysis using human prostate cancer cells revealed that MCP does indeed interfere with cancer cell adhesion—resulting in cytotoxicity between 76.9 and 80.7 percent, compared with only 3.8 percent in the control.

This meant that not only was MCP preventing the spread of the cancer—it was also killing a significant number of the cancer cells already present. Both results warranted a longer, more controlled phase-II study—one which was finally completed in December 2003.

This time, the team evaluated men for whom standard treatment (radical prostatectomy, radiation, or cryosurgery) was initially successful (meaning PSA=0) but whose PSA scores subsequently began to rise. This type of cancer recurrence typically represents a more aggressive form of the cancer—which is one factor that made our study results so remarkable.

Ten patients experiencing cancer recurrence were given 15 grams of modified citrus pectin each day for one year. A total of eight of the patients responded to MCP treatment, with seventy percent of them experiencing a significant slowing in the rise of their PSA—representing a slowing of disease progression. In fact, six out of ten patients more than *doubled* their PSA doubling time—ultimately leading to a significant reduction in the chance of premature cancer death.

Even with these astounding results, MCP alone still isn't a cure for prostate cancer. But it *is* an important adjunct to standard treatment and an extremely valuable nutrient for any man in "watchful waiting"—not least of all because of the many outstanding benefits that continue to emerge with MCP use. While it's true that the promise of MCP has perhaps been the most profound in cases of treatment-resistant prostate cancer, several in-vitro and animal studies have revealed its advantage against other cancers, as well.

Animal studies promise benefits against breast and skin cancer, too

In a 2002 study published in the *Journal of the National Cancer Institute*, mice were injected with breast cancer cells and subsequently treated with varying doses of MCP. Results showed that MCP treatment inhibited tumor growth in the mice in a dose-dependent manner—meaning that larger doses yielded stronger results. In-vitro analysis supported these results, revealing the same reduced angiogenesis and cancer cell adhesion, also in a dose-dependent manner.

Though more research is necessary, these results suggest that MCP might be equally effective in preventing the growth and metastasis of breast cancer in women. But the applications don't end there—animal studies suggest that modified citrus pectin could play a crucial role in the prevention of skin cancer too.

One study (also published in the prestigious *Journal of the National Cancer Institute* years earlier) showed that, while ordinary citrus pectin demonstrated no effect on deadly melanoma cells, administration of MCP reduced tumor metastasis by a remarkable 90 percent. These incredible results were supported two years later, in a follow-up study that demonstrated a similar decrease in melanoma cell adhesion—a phenomenon that the study authors attributed to MCP's superior galectin-3 binding capabilities.

One of MCP's most promising new applications, however, is not against cancer, but against the very condition that *causes* many cancers: heavy metal toxicity. In fact, some

recent clinical studies have demonstrated just how effective MCP can be against this silent—but very dangerous—modern threat.

Unload toxic metals—and boost your defense against disease

Of all the toxins that surround us on a daily basis, heavy metals are among the most difficult to avoid. There's mercury in your dental fillings, fish and seafood, aluminum in antiperspirants and foil wraps, and lead in old paint and water pipes. Even with your best efforts, it's nearly impossible to eliminate all of the varied sources of heavy metals in your environment.

Unfortunately, the consequences of this immersion can be seen in everything from chronic pain and high blood pressure to a variety of neurodegenerative conditions—and most notably, cancer. Even if your exposure is limited to miniscule amounts at a time, these metals can build up gradually in bone and soft tissue, manifesting as any number of very serious conditions down the road.

Removing toxic heavy metals is paramount to any type of disease prevention—which is why the discovery of MCP's chelating powers presented such an exciting shift in the focus of my ongoing research. And once again, it is the unique molecular structure of modified citrus pectin that can be attributed with this credit.

MCP belongs to a specific class of polysaccharides know as polyuronides—in solution, its long negatively-charged fiber chains stack together to create pockets, forming what we call an "egg box." Metal cations have a strong opposite positive charge, and are attracted to these chains, causing them to dislodge from your soft tissues where they're embedded.

Once they reach the "egg box," they become trapped and bound in the pockets, allowing them to be safely excreted from your body. And when paired with another class of polyuronides called alginates, this excretion is even more effective, as the two work synergistically to prevent the reabsorption of heavy metals in your digestive tract (a common shortcoming of other conventional methods of chelation).

While chelation wasn't the primary focus of my early interest in MCP, it is nevertheless a natural corollary. Reports of its strong effectiveness in this field first surfaced in the late 1980s, in the fevered effort to minimize the devastating physical consequences of the Chernobyl disaster on exposed Russians. In a multitude of cases, pectin prevailed as a powerful antidote to this toxic radiation.

Even so, research on this crucial application of MCP remains limited. To fill this gap, I headed a pilot study in collaboration with USDA scientist which was funded by a NIH grant which showed MCP's ability to bind to toxic heavy metals and excrete them while not disturbing the essential minerals or causing any adverse side effects. This research

was published in the peer reviewed journal, Phytotherapy Research in October 2006. Recently published was a case study report involving five patients from my own clinic, Amitabha Medical Clinic and Healing Center, the results of which appeared in an international peer-reviewed journal in December 2007. This was the first study of its kind to examine the relationship between heavy metal loads and a wide range of clinical symptoms using a treatment of MCP and/or a MCP/alginate complex.

The treatments yielded an impressive 74 percent average decrease in heavy metal levels among all five patients—and this reduction coincided with dramatic improvements in the participants' symptoms, ranging from raised PSA levels and asthma to IBS, adrenal fatigue, and depression. No adverse effects were reported—but subsequent increases in heavy metal load in one patient who stopped treatment suggesting continued exposure and ongoing treatment may be necessary to achieve permanent improvements.

This groundbreaking clinical evidence confirms what I've preached in my practice for years—namely, that heavy metals are very prominent and deadly factors in a wide range of livelihood-robbing diseases. Furthermore, it might reveal one clue as to why citrus pectin and its derivatives are so universally beneficial to your health.

Potential applications from atherosclerosis to Alzheimer's

The pool of potential uses for MCP is enormous—some that we've known about for a while, and others that are just emerging. For example, it's fairly common knowledge that pectin and other forms of soluble fiber are valuable tools in the prevention of heart disease, specifically due to their ability to bind to cholesterol in your gut and lower your total cholesterol levels.

One double-blind, placebo-controlled study (published in the journal *Clinical Cardiology* in 1988) showed that patients supplementing with pectin for only four months were able to reduce total cholesterol by 7.6 percent (while lowering LDL—or "bad cholesterol"—by over 10 percent) without making any other changes to their daily routine. These results leave no doubt that pectin is a crucial natural cholesterol-lowering agent—and similar animal studies suggest that it might also help to reduce arterial plaque buildup in cases of atherosclerosis.

Unfortunately, there aren't yet any studies examining the influence of pectin's modified form on heart disease and its related conditions. But because MCP's binding powers reach beyond the intestines and into the bloodstream, it would be fair to assume that its effects might be similar—if not far more pronounced. There are studies showing pectin to be the superior fiber in thinning the media layer of the blood vessel wall, a crucial importance in addressing arteriosclerosis.

A similar promise holds true for another target of future investigation, one that could ultimately prove even more groundbreaking: namely, Alzheimer's disease. A 2003 article published in *The Lancet* proposed that the unique markers of AD (like amyloid plaque deposits) could be traced back to angiogenesis (or new blood vessel growth) triggered by inflammatory states in the brain.

Should this theory have legs, the implications will be revolutionary. Halting the progression of AD could rest on our ability to stop the process of angiogenesis—and, as I discussed earlier in this report, MCP could be a key player in this prevention. It's a distant possibility, to be sure—but follow-ups to these preliminary studies are already in the works and further research will present itself in time.

In the meantime, there's been at least one tangible breakthrough in MCP research—one that's surfaced only in the past months—and it represents some of the most pivotal progress we've made in integrative cancer therapy to date.

New preparation offers new hope to treatment-resistant cancer patients

This research has just been published—and I can't begin to explain how important it is. The German study tracked a group of 49 patients with multiple types of cancer: colon cancer, breast cancer, lung cancer, pancreatic cancer, ovarian cancer, throat cancer, and others. And these were not early-stage diagnoses—we're talking about a group of patients with advanced cancers (almost 90 percent of which had metastasized) who had already gone through surgery, radiation therapy, and chemotherapy.

And yet, 15 grams of MCP per day improved the quality of life and reduced pain in *the majority* of these patients—all of whom were considered to be on the last legs of their life In fact, one patient with advanced prostate cancer had a *50 percent* decrease in his PSA over the period of 16 weeks, with a significant decrease in his clinical symptoms and his pains. This is incredibly exciting news.

And what makes it even more exciting is that the study used a brand-new form of MCP—a refined version of the pectin that I've been working on for quite a few years. So what was different in the MCP used in this study compared to the one used in our other cancer related studies?

Previously, the optimal MCP available for clinical trials and for commercial use had an average molecular weight of about 12,000 Daltons. I always strived to get this molecular weight a little lower, aiming for a preparation between 7,000 and 10,000 Daltons—ideally with different chains in a range of molecular weight between 5,000 Daltons and 13,000 Daltons.

The problem arose when we modified the pectin using an enzymatic process and achieved a molecular weight below 12,000 Daltons. At this size, the MCP started to disintegrate and there was an increase in the percentage of monogalacturonic acid (that is, of the free sugars). This increase meant that the preparation no longer had anti-cancer effects, and no longer had the cellular protection effects.

In this new specific MCP, however, we were able to modify the enzymatic process to achieve the optimal molecular weight of 5,000 to 13,000 Daltons (with an average of 7,000 to 8,000 Daltons, and only 5 percent of monogalacturonic acid). That's only 5 percent of single sugars compared to the 18 to 20 percent in the previously available MCP.

But that's not the only significant change—we also improved our drying process- which provides a finer powder. The optimal molecular weight and the optimal size, in combination with this new drying, is ensuring a higher percentage of material that has all of the cellular benefits, along with a higher percentage of absorption into the blood stream.

The results of this study implementing the new MCP are equivalent to (if not *better* than) the results achieved in the same group of patients with chemotherapy—but without the side effects, and without the toxicity. Once again, it's not that MCP replaces conventional therapies. But it will be an integral part of a whole program for patients with cancer—and quite possibly a new lease on life for anyone with advanced, treatment-resistant tumors.

As for the future of MCP, the possibilities are seemingly limitless. But one thing is certain: My ongoing research—and that of dozens of other dedicated integrative oncologists—will ensure that the many branches of this revolutionary supplement continue to bear fruit for the years and decades to come. In the meantime, I urge you to share the extensive research in this report with your doctor, as it is truly my greatest hope that integrating MCP into your treatment will help to light your way to a longer, healthier, and more vibrant life.

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Dr. Isaac Eliaz, a pioneer in the field of integrative medicine since the early 1980's, is a respected author, lecturer, researcher, product formulator and clinical practitioner.

Dr. Eliaz is a frequent guest lecturer on integrative medical approaches to health, immune enhancement, and cancer prevention and treatment. He has also taught several courses on Traditional Chinese Medicine for medical doctors and licensed acupuncturists. As an innovative formulator of dietary supplements, Dr. Eliaz developed and currently holds the patents for several of his unique herbal formulations. Many of these products are available through EcoNugenics, Inc. as well as from leading integrative medical professionals.

In order to substantiate nutritional approaches to health, Dr. Eliaz regularly participates in clinical studies and has been published in well-recognized, peer-reviewed journals. In addition, many of Dr. Eliaz' formulations have been submitted for validation in independent human clinical studies whose results have been published in peer-reviewed journals.

Dr. Eliaz continually studies, integrates and applies the best of health practices of both western medicine and complementary and alternative approaches. A native of Israel, Dr.

Eliaz lived in the Far East and in Latin America before returning to study medicine at Tel Aviv University. While studying for his degree, Dr. Eliaz' interest turned towards the role of alternative therapies in daily health. This led to his eventual research and personal experience with yoga, shiatsu, and acupuncture as therapeutic modalities.

After graduating medical school in 1986, Dr. Eliaz established a highly successful clinical practice in Tel Aviv, utilizing his training in both western and eastern medicine. While maintaining a clinical practice, Dr. Eliaz pursued graduate studies in clinical herbology at Hebrew University of Jerusalem and classical Chinese medicine with teachers in Israel and Europe.

In 1989 Dr. Eliaz moved to the San Francisco Bay area in order to continue his studies at the American College of Traditional Chinese Medicine, earning a Master of Science degree in 1991. During this time he also energetically sought-out leading practitioners of alternative medicine to broaden his knowledge and experience. Since 1991 Dr. Eliaz has maintained a busy private practice in northern California that focuses primarily on integrative, holistic protocols for cancer patients.

The guiding mission of Dr. Eliaz' professional life is achieving the integration and synergy of multiple healing modalities from both ancient and modern paradigms into a holistic practice of medicine. It is the heart of his clinical practice, of his research, and a mission that he communicates with great passion and clarity.