

## Muscles: More Than Just Movement

**T**raditionally, the function of muscle has been relegated to promoting movement of or within the body. Muscles allow us to walk, run, and jump, they help us move our eyes, breathe, chew and swallow food, circulate our blood, empty our bowels and



*Dr. David Williams*

bladder, lift and push objects, and they keep us upright. This is what we've all been taught since our first elementary science or health class. And it's

still the story in elementary classes just as it is in medical school.

You may not be aware, though, that muscle has several functions separate from body movement. In fact, the amount of muscle tissue

you have can actually help determine your ability to prevent disease, recover from illness, and live the longest life possible.

Over the next decade, I believe we're going to see a monumental shift in the way the scientific and health communities view muscle tissue. I would venture to say that we'll start to hear that muscle loss is not only a primary cause of disease and frailty, but also one of the biggest killers of our time.

### Pharmaceuticals to the Rescue?

A while back I discussed sarcopenia (the medical term for muscle loss), and I explained how it will become one of the most common health problems facing our elderly. Those in the pharmaceutical industry have now recognized this and have plans to "save the day" by creating an entirely new market and category of drugs to add to their financial bottom line (uh...I mean "treat" the problem). As one research consultant to the pharmaceutical industry stated, "There's a lot of interest in trying to come up with something for sarcopenia because at the moment, there's no treatment."

That's the typical pharmaceutical mindset. If there's no drug on the

market, then there's obviously no form of treatment available. Wrong.

There *is* a way to naturally preserve and promote muscle growth: Weight-bearing or resistance exercise. Every single person should incorporate this type of exercise into his or her daily activities. The goal is not to get "cut" or have the proverbial six-pack abs; it's to prevent disease and live longer.

### Muscle Regulates Blood Sugar, Boosts Immunity

Muscle tissue is a huge metabolic organ. Because it is almost always in a state of tension, it requires energy in the form of glucose (blood sugar). Through its constant consumption of glucose, muscle can be a major regulator of blood sugar. (*Appl Phys Nutr Metab* 14;39(9):987-97) (*J Nutr* 11 Apr 1;141(4):568-73)

Having adequate muscle tissue can act as a buffering mechanism to help your body cope with the surge in glucose that occurs after meals. Additionally, increasing your muscle mass as you age is one way to prevent type 2 diabetes. It's no coincidence that the rate of diabetes begins to rise around the

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*You will observe with concern how long a useful truth may be known, and exist, before it is generally received and practiced on.*

— BENJAMIN FRANKLIN

same time that muscle mass starts to decline.

Muscle tissue is also the only place where your body can store amino acids. While we typically credit amino acids as the building blocks of protein, they have a crucial role in proper immune system function.

Amino acids such as glutamine, arginine, and cysteine play a part in how effectively the immune system produces antibodies and responds to pathogens and toxic compounds. When you lose muscle mass, your body loses its amino acid storage facility. The unavailability or deficiency of amino acids weakens your immune system, makes you more susceptible to opportunistic infections, and impairs your body's ability to fight off these attacks. We see this repeatedly in the elderly and hospitalized patients, both of whom have a much greater risk of contracting and dying from almost every communicable disease. This is also one of the primary reasons mortality rates are so much higher in the elderly and frail during various epidemics. (*Crit Care Med* 90 Feb;18(2 Suppl):S86-93) (*Br J Nutr* 07 Aug;98(2):237-52)

As you recall, the largest immune organ in the human body is comprised of the lymphatic tissue that lines the intestinal tract and colon. Amino acids are not only necessary for the growth and integrity of the

gastrointestinal lining, they provide the energy for immune cells such as lymphocytes, neutrophils, and macrophages. (*Am J Physiol* 95 Feb;268(2 Pt 2):R334-42)

Maintaining adequate muscle tissue helps give your immune system the necessary compounds it needs to save your life. Unfortunately, you likely won't see anyone suggesting that you consume more amino acids, or stressing the importance of maintaining muscle mass even as we're facing another flu epidemic in this country.

Although recommending that the public take a couple of scoops of amino acid-rich whey protein each morning would probably be one of the best things they could do to get through the flu season unscathed, the powers that be continue to push the latest flu vaccine. Yet decades of research confirms that flu vaccines have few, if any, benefits. Even under the best-case scenario, when the vaccine is perfectly matched for that year's flu strain, the prevention rate appears to be about one in every 100 people who get the shot. At that low rate, it is difficult to give any credit to the flu vaccine. There's probably more damage caused by the shots than benefits. Of course, the side effects are getting harder to monitor now that the government has effectively exempted

pharmaceutical companies from legal action when it comes to vaccines.

And this year, the vaccine is really a joke. The dominant strain of flu is related to the H3N2 virus, and health experts from the Centers for Disease Control and Prevention (CDC) say that the current vaccine wasn't made for this mutated virus and probably won't offer any protection. Even so, they still have the audacity to say getting the vaccine is better than nothing. Absurd.

The key to preventing flu and other illnesses is to keep your immune system running at peak efficiency—and to do that, you need to maintain muscle mass and amino acid reserves.

## Less Muscle Equals More Falls

In addition to affecting immunity, lack of muscle leads to a greater risk of falls. Since I've covered this so many times in the past, I'll only briefly mention this connection. Falls are the leading cause of death due to injury among the elderly, and 87 percent of all fractures in the elderly are caused by falls. In older people who fall, 40 percent never return to independent living and 25 percent die within a year.

This particular subject hit home this last year when my mother fell. She's in her late 80s and tripped

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Dr. Williams works with Healthy Directions, LLC to develop his unique formulations that supply many of the hard-to-find nutrients he recommends. Dr. Williams is compensated on the sales of these nutritional supplements and health products, which allows him to continue devoting his life to worldwide research and the development of innovative, effective health solutions.

while taking out the garbage. She broke her hip but is recovering extraordinarily well since a great deal of her rehab program focuses on increasing muscle strength. I can't help but think she might not have experienced this fall if she had prioritized the building of muscle mass in the past. (By the way, she reads this newsletter, so there's no way I'm going to say, "I told you so." That would come back to haunt me. And in all fairness to my mom, I'm sure I could have avoided *a lot* of issues in my life had I listened more carefully and followed her advice.)

It's human nature for us to believe we're different from the rest of the crowd and somehow the statistics don't apply to us. The reality for most people doesn't become apparent until something actually happens to them. As I've said before, people get religion by either "seeing the light" or "feeling the heat," and unfortunately, for most of us, it happens to be the latter.

## Lower Risk of Death

Although at this point the research on muscle mass and its effects on health has focused mainly on falls, immunity, and a few other areas, it obviously influences our health in ways we have yet to discover.

In one of the most interesting studies I've seen in a long time, researchers found that muscle strength alone (determined by handgrip and knee extension tests) in those under 55 years of age was associated with a 20–30 percent lower risk of all causes of death (except cancer), independent of

body mass index or blood pressure. (*BMJ* 12 Nov 20;345:e7279)

Older people with the weakest grip strength are more likely to die in the following few years, compared to individuals in similar health. (*J Epidemiol Community Health* 14;68(7):663–8) (*BMJ* 10 Sep 9;341:c4467) (*J Nutr Health Aging* 12;16(9):769–74)

You don't need to become a professional bodybuilder or weightlifter, but it does take more than a television remote to build your grip strength.

If you don't have access or the knowledge to use traditional weights, there are lots of other inexpensive ways to begin adding strength and muscle mass. Elastic bands and/or cords are probably the most affordable, easiest to use, and most readily available tools that can be used by anyone of any age. They provide resistance and simulate the effects of weights. You can find them online and at stores such as Walgreens or Wal-Mart. For example, for \$13, Walgreens sells the GaiaM Adjustable Pilates Band with handles and a complete illustration guide.

It's important to take simple steps to maintain your muscle mass regardless of whether you're a 50-year-old sedentary office worker or a retired grandmother. One thing is certain: If you're not actively exercising to preserve or boost your muscle mass, it's being lost. And as you gradually but surely lose muscle, you are compromising your immune system, raising your risk of developing diabetes and cardiovascular disease, jeopardizing your future ability to live

independently, and increasing your risk of dying prematurely.

## Don't Fall for the Scary Sales Pitch

If I were trying to sell you something, this would probably be the perfect, scary sales pitch. That's exactly what the pharmaceutical companies are counting on.

Over the next decade, I suspect you'll start to see a huge advertising blitz highlighting the need to treat and manage sarcopenia. There will be a token amount of effort given to weight-bearing exercise, but they know the public is lazy. They'll claim, "When exercise doesn't work, there's always the magic pill."

Here's a short preview of what the sales pitch will focus on and, more importantly, the part of the story you won't hear.

There will be a lot of discussion about mitochondria—the little organelles or "energy generators" that reside in each cell. Mitochondria combine oxygen and nutrients to create fuel for cells.

Mitochondria sort of operate on their own, independently from the rest of the cell. They have their own DNA and repair systems and multiply on their own. Over time, their genetic material mutates and the number of mutations overwhelms their ability to make necessary repairs. As a result, mitochondria start to malfunction and die. In the process, muscle cells shrink and die. Many in the scientific community think this is the underlying cause of aging.

The pharmaceutical industry is working on drugs that counteract the damage from mutations and help preserve mitochondrial



function. We've seen similar situations time and time again with drugs to reduce cholesterol, increase bone density, and so on. In every case, the results are underwhelming and the side effects very often outweigh the benefits. Changing and artificially manipulating body chemistry can have miraculous effects in the short term. And it can definitely be a godsend in emergency situations. But long-term manipulation, or what the pharmaceutical industry now calls "managing a disease," isn't always so advantageous (at least to the patient anyway).

You probably won't be told just how effective exercise can be at counteracting mitochondrial aging.

Canadian researchers recently studied the effects of exercise on specially bred mice that lacked the ability to repair their mitochondria. By the time they were three months old (the human equivalent of age 20), their mitochondria were already malfunctioning. At eight months (age 60 for humans), they were very frail and decrepit. Their muscles were thin and flaccid, their hearts were enlarged, their hair gray, thin, and balding, and their brains and sex organs shrunk and shriveled. None of the mice reached one year of age.

A corresponding group of these same mice, however, were allowed to run on an exercise wheel 45 minutes a day, three times a week starting at three months old. Each session was roughly equivalent to a person running six miles in just under an hour. These mice exercised for five months.

At eight months old, the difference between the two groups was astounding. The exercising mice

were youthful. Their pelts were dark, without any gray. They had maintained all their muscle mass and brain volume. Their hearts and sex organs were totally normal, and their ability to balance and exercise was retained. In fact, none of the mice had died of natural causes.

When they were examined, they had more mitochondria overall,

and the mitochondria had far fewer mutations than those in the sedentary group—despite the fact that genetically, the exercising mice still lacked the capability of mitochondrial repair. (*Proc Natl Acad Sci U S A* 11 Mar 8;108(10):4135–40)

Dr. Mark Tarnopolsky, one of the lead researchers who has performed several similar studies,

## Exercise Improves Skin, Too!

When Canadian researchers saw the dramatic changes exercise had on the color and quality of mice pelts, they wondered if exercise would also reverse skin aging in humans. They reported their findings last year at the 23rd annual meeting of the American Medical Society for Sports Medicine in New Orleans.

To rule out the effects of frequent sun exposure, they evaluated skin samples from the buttocks of 29 volunteers between the ages of 29 and 84.

They divided the volunteers into two groups. One group exercised vigorously at least three hours per week, and the other group worked out maybe an hour each week.

By the end of the study, the skin samples of the two groups were remarkably different. Among the more active exercisers (male and female) over the age of 40, the visible layer of skin (stratum corneum) was healthier and thinner while the underlying dermis layer was thicker, compared to the more sedentary group.

In a follow-up three-month study, volunteers over age 65 with like skin were divided into two groups. The first did not exercise and the other exercised twice weekly by either jogging or cycling at a relatively non-strenuous pace (65 percent of aerobic capacity) for 30 minutes.

At the end of that study, the skin of the sedentary group looked the same. A close-up examination of the skin samples biopsied from the exercising group, however, resembled that of 20- to 40-year-olds.

During the skin evaluations, researchers discovered that those who exercised had higher levels of proteins called myokines, which are secreted by muscle cells. (*J Appl Physiol* 07 Sep;103(3):1093–8) (*J Exp Biol* 11 Jan 15;214(Pt 2):337–46)

Myokines are the active class of compounds responsible for many of the positive changes that take place in the body as a result of exercise. These compounds have been linked to improved immune function, stabilized glucose levels, enhanced skin repair and tissue regeneration, improved memory, optimized fat and carbohydrate metabolism, better circulation, and reduced inflammation.

Myokines are only released during muscle contraction. So if you want to tap into their amazing power, all you have to do is exercise. It's by far the best anti-aging program out there.

commented that, although the exercise was pretty strenuous, this high level of exertion isn't necessary to achieve benefits.

If you haven't exercised at all, Dr. Tarnopolsky recommends that you start by walking five minutes a day, and gradually increase your activity level as you become more fit. To maximize benefits, it's best to combine endurance training with resistance exercise.

Resistance/strength training, in particular, appears to trigger muscle stem cells called satellite cells, which seem to rejuvenate mitochondria. Researchers refer to the phenomenon as "gene shifting," which is thought to be responsible for turning back the biochemical, physiological, and genetic signature of older muscle by 15 or 20 years after regular strength

training or weightlifting. (*Hum Mol Genet* 99 Jun;8(6):1047-52)

The actual exercise threshold necessary to obtain anti-aging benefits hasn't been established, but we know other studies have confirmed that both moderate endurance exercise, as well as weightlifting, can provide these same effects.

Obviously the sooner you start, the better. Studies show that lifelong exercisers have the mitochondrial function of individuals half their age. Athletic 80-year-old men have the aerobic and mitochondrial function comparable to that of non-endurance trained men 40 years younger. (*J Appl Physiol* 13 Jan 1;114(1):3-10)

Tissues such as bone and muscle grow in response to mechanical stress placed on the body. It's all part of a complex adaptation process where the body responds to a change in its physical environment.

Trying to artificially trigger those changes with drugs, especially on a continual basis, will be a disaster in the making.

Why take the risk when we know the right types of exercise combined with the consumption of quality protein and amino acids are all that you need?

The drug companies will undoubtedly market these new sarcopenia drugs as miraculous breakthroughs that are essential if you have any desire to slow the aging process. They won't tell you that impairments in skeletal muscle and mitochondrial function are directly caused by inactivity and not the aging process, per se. (*J Gerontol A Biol Sci Med Sci* 09 Sep;64(9):927-39)

One thing is for certain: Muscle aging is not caused by a drug deficiency. ■



## Alternatives MAILBOX

### How to Burn Visceral Fat

**Question:** You've talked about the dangers of visceral fat, which you say is common in people who have type 2 diabetes. Can you tell me the best type of exercise to get rid of visceral fat?  
—Steven A., Waco, TX

**Answer:** The two primary types of fat are subcutaneous and visceral.

Subcutaneous fat, which lies beneath the outermost layer of skin, often gets the most attention and can

be measured by body fat calipers to provide a rough estimate of total body fat.

Visceral fat, sometimes called "organ fat," is located deeper inside the body between the organs. Research has definitively linked high visceral fat levels to insulin resistance, glucose intolerance, high blood pressure, and cardiovascular disease. This is why I've talked extensively about it in past articles. Fortunately, there are ways to help target its removal.

I'm sure you know my thoughts on refined carbohydrates and sugar. They are killers. One of the worst culprits is high-fructose corn syrup (HFCS). Studies have shown that HFCS increases fat accumulation, particularly visceral. Avoid it as much as possible.

Also, I continually talk about the bacterial flora in the colon and the importance of fiber. Research shows that higher consumption of soluble fiber (the kind that dissolves in water) reduces visceral fat. It slows digestion, which improves absorption

and reduces spikes in blood sugar that result in the release of insulin. It is also fermented and used as an energy source for beneficial bowel bacteria. Soluble fiber is abundant in many vegetables and fruits, but I particularly like flax, chia, and hemp seeds as sources. I include one or more of these in my morning protein shake.

### Anaerobic Exercise

As for exercise, if you specifically want to get rid of visceral fat, anaerobic (sometimes called glycolic or glycogen-depleting) exercise is the way to go. Anaerobic is different than aerobic, which includes cardio machines, running, swimming, dancing, cross-country skiing, spinning, kickboxing, etc.

In a strict sense, the terms aerobic and anaerobic actually refer to either the presence or absence of oxygen, respectively. Most of our cells prefer to produce energy in the presence of oxygen (aerobically).

During periods of minimal activity, your body gets almost all of its energy from aerobic metabolism. If you gradually increase your exercise intensity along with your breathing and oxygen intake, you can pretty much stay in an aerobic state. With proper training, you can stay in an aerobic state for long periods of time. However, when you reach a point where your need for energy exceeds what can be met by aerobic activity, your body begins to count on anaerobic metabolism.

When exercise intensity increases, muscles begin to produce energy through anaerobic metabolism. Sugar, stored as glycogen in muscles, is burned as energy. Anaerobic exercise also triggers the release of growth hormone and produces waste molecules and lactic acid that progressively impair muscle contraction and reduce blood pH, resulting in fatigue. Although training can improve your body's ability to deal with higher levels of lactic acid, anaerobic exercise can only be performed for short periods of time, compared to aerobic exercise.

Probably one of the best examples of this would be long-distance running. These people can run for miles as long as they stay at an aerobic pace that doesn't exceed their metabolic threshold. They must time their hard sprint at the end of the race properly. If they increase their pace too soon, they fatigue before finishing and are forced to slow

down below that threshold to recover from the lactic acid-induced fatigue.

### Aerobic Has Little Effect on Visceral Fat

While visceral fat burns easily with anaerobic exercise, aerobic exercise doesn't seem to have much effect on it at all. One recent study clearly demonstrated this. (*Diabetologia* 14 Oct;57(10):2081–93)

A group of 30 untreated individuals diagnosed with type 2 diabetes were divided into three groups. The control group didn't perform any targeted exercise. The second group walked at a continuous pace for one hour five times a week, and the final group walked briskly for three minutes then slowly for three minutes, and repeated that process for one hour five times a week. The study lasted four months.

Results revealed that only those individuals performing the interval walking experienced a reduction in the volume of visceral fat. Additionally, they had the greatest decrease in overall body fat.

The researchers expected to find that both exercising groups would also have an improvement in blood sugar control, but that wasn't the case. The interval walkers had a 20 percent improvement in glycemic control, and their hemoglobin A1C levels dropped as well. The steady-paced walkers saw no improvement at all.

Other research found that, when compared to continuous-pace walkers, interval walkers lose more weight and lower their cholesterol levels. (*Diabetes Care* 13 Feb;36(2):228–36)

Despite these facts, some prediabetics and type 2 diabetics are told to avoid interval or intense exercise because it causes their blood sugar to skyrocket. However, that only occurs during exercise. Muscle tissue is the number-one consumer of blood sugar in the body. Blood sugar levels increase as glycogen is released for energy. The benefits of higher-intensity interval exercise far outweigh any potential drawbacks associated with temporary spikes in blood sugar.

### Sumo Style

As the guru in the crowd, here's a little tidbit of related information that you can share with your family and friends.

Next time you see a Sumo wrestler, remember that they typically have very little visceral fat. Although they carry a lot of fat, almost all of it is subcutaneous.

They also have a lot of underlying muscle mass. They are able to maintain a large total-fat to visceral-fat ratio by 1) intense anaerobic exercise alternated with periods of rest (interval exercise); 2) the consumption of calorie-dense foods, and 3) performing their exercise in a fasted state in the mornings prior to eating a large breakfast.

When you exercise in the morning prior to eating (particularly carbohydrates), your body will quickly deplete any carbohydrate reserves, and then it begins the process of converting glycogen stores, then fatty tissue, into energy.

These training and eating habits allow Sumo wrestlers to consume high amounts of carbohydrates, yet have low levels of visceral fat and no problems with high blood sugar, diabetes, or cardiovascular disease. (*Horm Metab Res* 96 Sep;28(9):440–4)

### Final Thoughts

In summary, if you want to reduce visceral fat, don't exercise at a constant pace. Interval training will benefit you whether you're trying to get fit or

lose weight, and whether you're a weekend warrior or a high-performance professional athlete.

Interval walking is one of the most convenient exercises. It doesn't require any special equipment and can be performed anywhere. Weight training with only short periods of rest between sets (one minute) is one of the best all-around exercises, in my opinion. The anaerobic aspect of weightlifting causes muscles to fatigue rapidly. And don't forget kettlebells, which also cause an anaerobic burn.

Finally, exercising first thing the morning before breakfast can make a tremendous difference. I exercise immediately after my morning protein shake. Exercising before eating anything might be a little better, but the main problem comes from consuming carbohydrates. If you start exercising with a belly full of carbohydrates (or one of the high-carb energy drinks in your hand), your body will use that for fuel and never have to burn any extra body fat or glycogen stores. Protein and fat take longer to digest, and when consumed immediately prior to exercise, they won't get into the system quick enough to be used as the primary source of energy. After 45 minutes to an hour of hard exercise, protein will start to be available for muscle repair and growth.

## Granny Smiths are Good for the Gut

I get tired of hearing clichés, but “an apple a day keeps the doctor away” quickly came to mind when I ran across a small research study from Washington State University. I delve through mountains of this stuff every month and most of the data I read just gets piled up in the back of my brain or in the five-foot stack of research papers behind my desk. But my decades-long interest in the role intestinal bacteria plays in our health made this particular study stand out.

Hundreds of studies have been done on the nutritional content of apples and their health benefits. This study, however, focused on the compounds in apples that the body *does not* digest. These researchers

analyzed the various content of phenolics, proanthocyanidins, and dietary fiber found in some of the most common varieties of apples, including Braeburn, Fuji, Gala, Golden Delicious, Granny Smith, McIntosh, and Red Delicious. Much to my delight, Granny Smith apples had the highest levels of each of these compounds. (Granny Smith happens to be my favorite and the one I eat almost exclusively. I find other varieties far too sweet. Granny Smiths go great with a bowl of popcorn.)

The interesting part of this study came about when Granny Smith apples were put through a simulated digestive process, similar to what occurs in our gastrointestinal tract,

and then used for the fermentation of the feces from diet-induced obese mice. In simple terms, they wanted to see what effects eating Granny Smith apples had on the intestinal bacteria of obese animals.

If you recall from my past articles, research has shown that the numbers and types of intestinal bacteria are remarkably different between normal-weight and obese individuals. In fact, when fecal transplants from normal-weight animals are given to obese ones, the obese animals begin to lose excess fat and weight. This has also occurred in humans on a routine basis. The problem is that over a period of time, the bacteria population in the obese individuals begins



to switch back and the extra pounds return.

Based on the latest research, I'm always trying to address this issue by including the most effective blend of bacterial strains in my probiotic products. It's not always just a matter of including certain bacteria, but also trying to determine which strains are more compatible and conducive to producing the best overall environment.

Research is confirming what nutritional pioneers and proponents of fermented foods discovered decades ago: If you can introduce, or re-introduce, the right bacteria and then properly "feed" these bacteria, you can experience amazing improvements in health. This is why I believe in taking a quality probiotic on a daily basis, and that eating the right foods to feed and encourage the growth of specific bacteria is so essential for your health.

These researchers discovered that Granny Smith apples specifically encourage the growth of specific strains of bacteria that are more predominate in the feces of lean animals. (*Food Chem* 14 Oct 15;161:208-15)

I've talked about how, through the brain via the nervous system, the bacteria in the colon trigger cravings for different foods. By manipulating your cravings, these bacteria get the specific foods they need to thrive and dominate the environment in your colon. If your colon is populated with the strains of bacteria associated with obesity, your cravings will be different from those of a person who has a dominance of bacteria associated with leanness, such as *Bacteroidetes*. Lean individuals

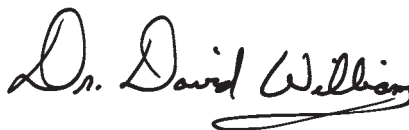
also have a greater variety of bacteria than those who are obese.

When compared to all the other apple varieties, after going through the digestive process, Granny Smith apples delivered more insoluble fiber and polyphenols with fewer carbohydrates to the beneficial bacteria in the colon. The bacteria strains associated with leanness were able to ferment and use these specific compounds for their energy production. This, in turn, resulted in a stabilization of their metabolic processes, a reduction in inflammation, and a feeling of satiety or fullness.

It would be interesting to do a follow-up study to determine if leaner individuals tend to prefer Granny Smith apples, while obese people lean toward the other varieties. This testing could, and hopefully will be, conducted with other food as well. I'd like to see which groups prefer nuts, fruits, vegetables, yogurt, chocolate, candy, or other foods as snacks. If and when this research becomes available, I'll let you know.

For now, the take-home message is this: The food we consume determines the balance of bacteria in our bowel. Continue to take your probiotic every single day and don't forget to nourish these beneficial strains with a variety of fermented foods and a few Granny Smith apples.

Until next month,



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