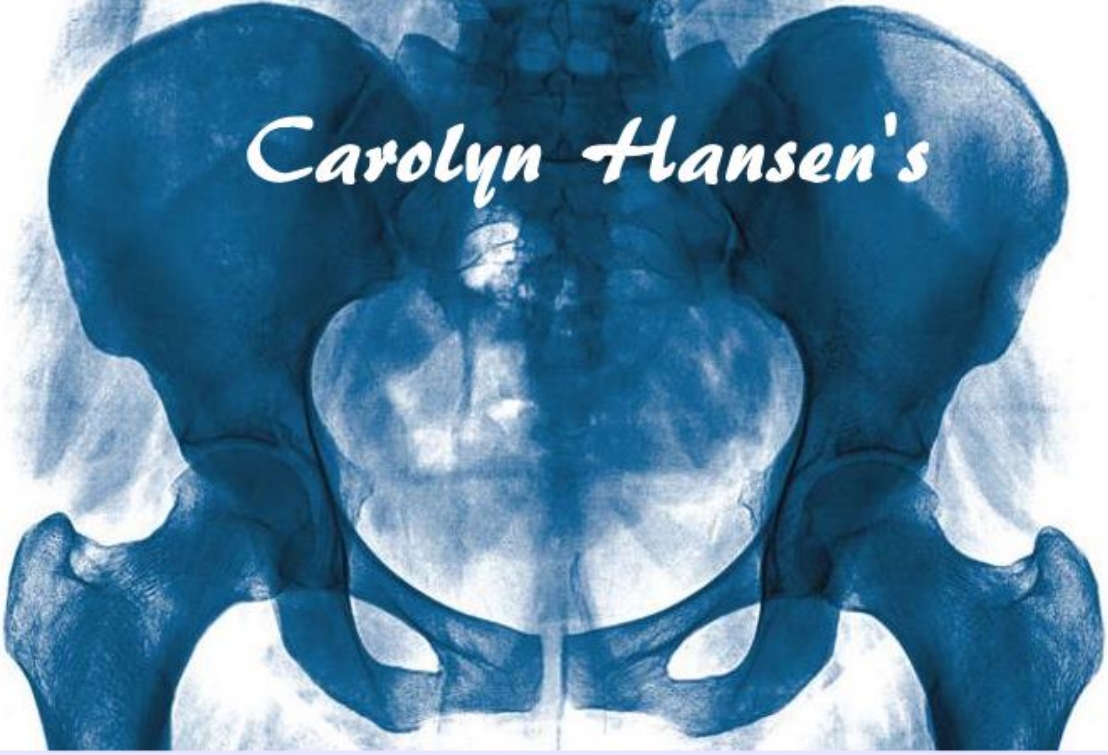

Carolyn Hansen's

WEAK BONES, WEAK MIND: Age-Related Cognitive Decline & The Menopause Penalty

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Menopause: Surprise, It's Actually Worse Than You Thought

Hey, this is Carolyn Hansen, and if you are a woman, and especially if you are a woman who finds herself muddling through the confusions of menopause and wondering what lies ahead, do I have some interesting news to share with you!

But before we get into this, before I tell you about the association between bone health and the health of your brain (which unless you happen to be versed in arcane biological knowledge should strike you as a most unlikely connection), let me first make an important distinction between cognitive decline that takes place because of disease and cognitive decline that sets in even if you are otherwise perfectly healthy.

Because the latter process, age-related cognitive decline, affects everyone to some degree. Regardless of whether dementia ever touches you, regardless of whether or not menopause might be turning your life into a living hell right now, age-related changes to your cognitive abilities are as inevitable as graying hair, wrinkles, and excessive weariness.

And the role of menopause in all of this?

I'll be spending the rest of this guide showing you how its effect on bone loss ties directly into your brain's ability to sustain itself in the long run.

Let me linger for a moment on this distinction between "normal and expected" mental deterioration, and the disease-fueled kind. Because I want to assure you that if you are confused about the difference between the two, and their underlying causes, you are far from alone in this.

Besides the millions of women who experience unsettling mental changes around the time of "The Change" and wonder if something more serious than hormonal imbalance might be afoot, until recently even the neuroscience experts were not exactly sure where to draw the dividing line between changes in the brain that lead to disease and those that just diminish one's quality of life (sometimes significantly so).

You are going to learn that changes to your body (not just changes to your brain) can occur that hasten, for example, age-related memory loss. But also that these gradual age-dependent transformations may play little role in whether or not you go on to develop Alzheimer's disease.

Or they may, depending on the severity of their influence on the brain, act as fuel to a more serious neurodegenerative condition (e.g. dementia).

These age-related changes in the brain can affect both women and men, but in practice, and most disproportionately, they affect us ladies.

In fact when you hear about the brain health penalties you will incur because you happen to carry an extra X chromosome you may find yourself railing at the injustice of it all.

But that will not relieve you of any of the cognitive problems that might lie ahead for you.

Don't worry though, by the end of our exploration into the strange connection between bone and brain I will have some suggestions for you!

Now, if you do happen to be a woman in her forties you may already be going through perimenopause. This is the symptomatic period preceding menopause which can last for up to a decade.

Hot flashes, mood swings, trouble sleeping, night sweats... For some women the physical discomforts are extreme.

Christiane Northrup in her book "The Wisdom of Menopause" [Ref. Northrup] devotes a full chapter to the mental distress experienced by the less fortunate among us. She titled that section of her book, which seems to me to nicely characterize the predicament of the more symptomatic woman: *The Brain Catches Fire At Menopause*

If your age puts you squarely into this perimenopausal group you may be experiencing some of these issues. Or, if you are lucky, you are barely noticing them at all. You might also be on the other side of menopause entirely, in your fifties or older, and thankful you have put the experience behind you.

Regardless of where you happen to be on the menopause "spectrum" what you are going to learn in the following pages will be eye-opening, relevant to your current situation, and hopefully it will also be a stimulus to you taking action to ensure the long-lasting health of your brain.

Because regardless of how you "feel" your brain is doing right now I can guarantee the current state of your gray matter is likely a lot worse than you imagine it to be.

When it comes to the issue of cognitive decline, time is not on the side of the woman who has reached the mid point of her life.

More Than Just Hormonal Imbalance

Let me ask you a question. What pops into your mind when you hear the word *menopause* arise in conversation?

Ignore for the moment that your initial reaction might be to want to change the conversation. If the symptoms of menopause ARE beginning to disrupt your life, then you may be wondering about those memory loss episodes, the bouts of confused thinking, the wild mood swings...

Are they just a passing phase? Or do they represent a more worrying

fundamental change in your cognitive profile?

Surely, God forbid, the changes in the way you feel could not possibly outlast the menopause experience and dog you for the rest of your days!

Doubtless, you reassure yourself, these "brain catching fire" sensations are just a matter of *hormonal imbalance*.

One that will eventually settle into a new equilibrium, and to which you will soon adjust...

Hormones are often the first thing your physician will address when you show up in his office complaining that your chest is erupting in volcanic episodes of heat. And that you are getting no sympathy from your husband when you bolt upright in bed in the middle of the night and yell for ice cubes.

Yes, those changing hormones can make some woman feel as though they are "losing it" during the perimenopause phase.

Much of it can be traced to falling progestrogen levels which can cause a cascade of hormonal disruption.

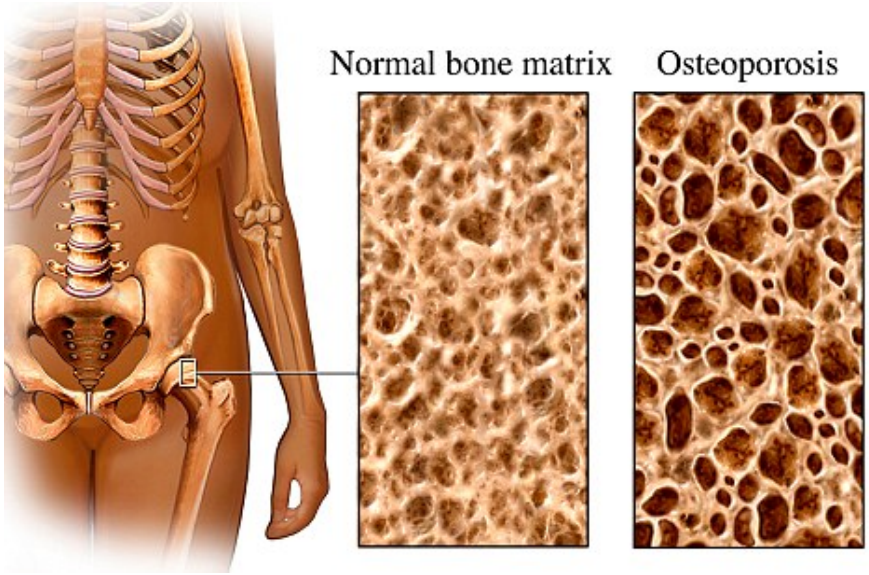
According to Northrup, and contrary to popular belief, estrogen levels in a woman's body usually remain relatively stable until shortly before her periods cease altogether. At that point estrogen levels may even swing wildly before plummeting and putting a woman into what for her is a completely uncharted hormonal profile.

So yes, hormones play a huge part in the way we FEEL about the changes going on inside us at this time.

But there are other changes going on in our bodies which we cannot sense during this period. These are changes with the potential to have a

profound effect on our health in the years ahead.

The whole-body change I am going to concentrate on here, a well-known consequence of the eventual loss of estrogen from a woman's body in the postmenopausal phase, is bone loss.



Bone loss is one of those easy-to-ignore issues when you are sat across from your physician and begging for something to help put the night sweats and the insomnia behind you.

The state of your bones a decade or two from now? The threat of a busted hip joint or a collapsed disc in your spine? That's an issue for another day, doc.

Except I am about to show you why the topic of bone loss is NOT something you can put off until the x-rays reveal you are losing bone mineral density at an alarming rate.

I am also going to show you how this bone thinning process may negatively impact not only your ability to protect yourself from nasty (and

sometimes fatal) bone fractures, but also your ability to remain sound of mind.

You are going to see how allowing your bones to grow weaker is tantamount to declaring that memory loss, lack of motivation, fuzzy thinking, depression, and all the other cognitive deficits that we attribute to "normal" age-related cognitive decline are penalties you are not only *willing* to accept going into the second half of your life, but which you are *actively encouraging*.

However, I am betting the only reason you are willing to concede robust brain health is you have not been fully informed about what the state of your bones has to do with the state of your mind.

I think when you understand how age-related memory loss (and related cognitive symptoms) can be due solely to chemical changes going on not in your brain but ELSEWHERE in your body, in your bones, you will have a much greater appreciation for why it is you should be taking actions right now to stem bone loss and even to begin rebuilding bone (which is not hard to do).

Bone Loss Loves The Ladies

Sometimes being a member of an exclusive club can be fun.

For example, a baby-shower with it's girls-only policy can leave you feeling for a short time both liberated and special in a way that you may not experience elsewhere in your life.

"Sorry, honey. But you're going to have to leave your gift at the door and wait for me in the car. Love ya!"

Having said that, I feel confident in declaring that you are VERY unlikely to take any satisfaction whatsoever from being a part of the following girls club.

The Bone Loss Club.

To be fair, it's not entirely exclusive of men. The National Osteoporosis Foundation tells us that of every 5 people who go on to develop osteoporosis (advanced bone loss) 4 of them will be women [Ref. NOF]

If you are more than 50 years of age then there is a greater chance than not (55 percent likelihood) that you either have osteoporosis or you are in the beginning stages of it (osteopenia) [Ref. Northrup].

Of the women in this "latter half of life" club half will suffer an osteoporosis fracture before they die.

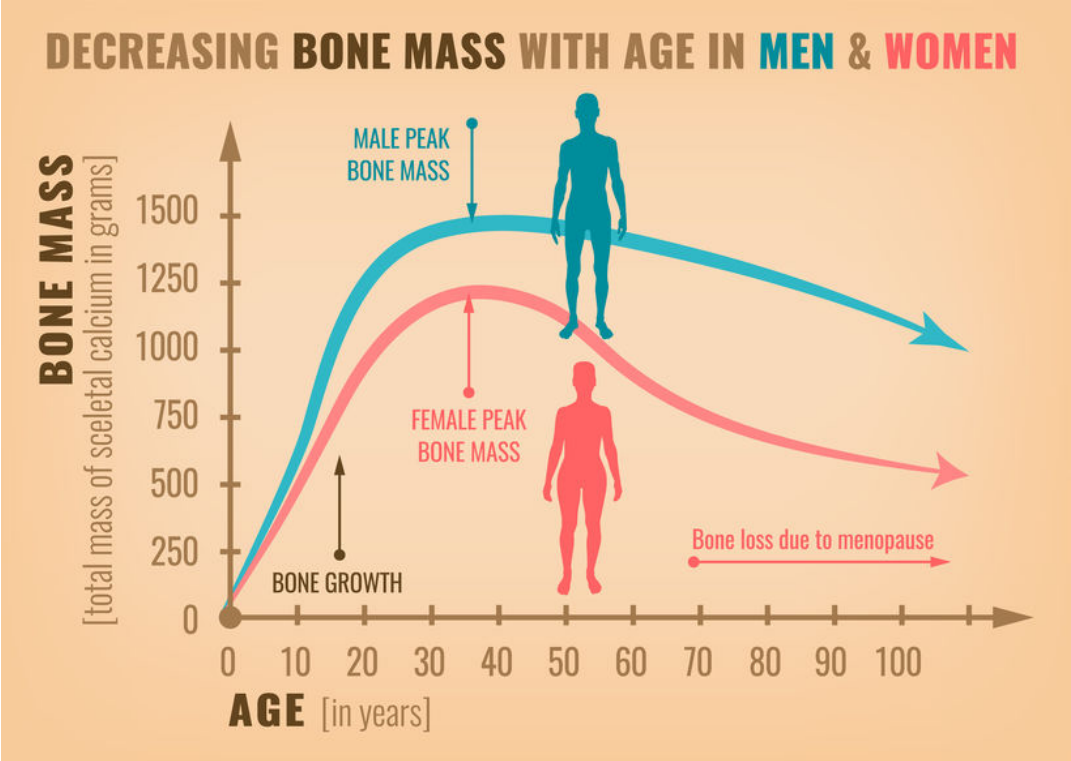
If it happens to be a hip fracture, one in four women will not see out the remaining year. They will leave behind family members who will wonder if anything could have been done to avert the fall that took the life of their loved one.

And of course there is.

There is plenty that can be done.

The trouble is that bone loss gets started quietly in your body. You will not know it is happening.

It also gets started a lot sooner than you are likely to realize, beginning around the age of 30 years. So that by the time you reach menopause the whittling away of your skeletal structure has already been happening for two decades.



Over the course of your lifetime you may lose as much as 38 percent of your bone mass to this withering process. This accumulated bone loss is a staggering 65 percent greater than the corresponding number for men.

Are you beginning to feel gender-cursed?

Consider this, as a women between the ages of 55 and 64 years (the "postmenopausal" years) you are 19 times less likely than a man to experience no bone loss during the following decade.

Northrup points out that the average woman (and especially those with fair skin) will lose 2-4 percent of her bone mass every year for the 5 year period immediately following menopause.

In part this is a consequence of a woman's loss of estrogen, the primary

sex-hormone that up until that point in her life has been responsible for maintaining all the feminine aspects of her biology.

That's because one of the functions of estrogen is to slow the rate of bone "resorption" which is the process of breaking bone down so that mineral stores (calcium in particular) can be released to the body. So when estrogen vanishes the brakes come off and bone thinning kicks into high gear...

We could spend 50 pages discussing the ins and outs of this terrible affliction that can cause bones to grow so feeble they are able to spontaneously collapse and throw a woman to the ground.

You read that correctly.

Some bone fractures are NOT the result of a fall or other impact-type injury. They are simply the end result of wear and tear. Like the bridge that collapses without notice and upends the lives of the people who have been depending on it.

When your bones grow so porous they can barely support your body weight just the act of picking up a heavy object invites potential disaster.

Northrup does an excellent job of detailing the issues of bone loss during the menopause years and her book is well worth a look. But here we are going to talk about an issue she was entirely unaware of when she wrote her book - because its discovery did not come for another dozen years or so.

I am talking about the ability of bone to influence the survival, growth, and rewiring of brain cells.

Why are these three processes so important?

Because:

• *Brain cells are continually lost as the result of cumulative damage caused by energy metabolism and faltering cellular repair mechanisms. Enhanced brain cell survival makes your brain less vulnerable to neurodegenerative diseases, like Alzheimer's disease.*

• *Growth of existing brain cells strengthens the already-forged neural connections (memories and automatic behaviors), while the growth of new brain cells combats the deficit due to those lost to regular wear and tear, and to looming disease.*

• *Rewiring of existing brain cells allows you to maximize your ability to store new memories, make more efficient use of what you have already learned, and build redundancy into your neural circuitry so as to better withstand damage elsewhere in the local environment.*

In other words, it is going to turn out that good bone health is essential to the maintenance of a sharp, fully-engaged, and vibrant mind.

My personal interest in this topic stems from an awful period in my life when I was forced to watch helplessly as my mother's life was suddenly hobbled by amnesiac dementia and then slowly and continually degraded until she passed away a little more than six year later.

In response this, years after her passing, I created the Ageless Brain protocol based on my realization that, while it may be near impossible to get people to drop all the bad habits that progressively damage the fine structure of their brain over time, it usually is possible to get them switch to a vastly more "brain friendly" way of going about their lives.

One of bad habits addressed in that program is failing to take the actions needed to address the slow deterioration of your bones. I will have more to say on what you can do about that by the time we get to the end of

this guide.

Before we reach that point I am going to lay out the case for why you should want to take the actions I am going to suggest.

It is a story with a few twists and some surprising findings. But at the end of it I think you'll find it offers compelling reasons for doing everything you can to rebuild your bones, and as a consequence of that rebuild your brain so that it can serve you well for the remainder of your days.

Weak Bones, Weak Mind

As I mentioned at the beginning of this guide I am going to make a distinction between age-related cognitive decline and dementia.

The latter is a disease state. It is one characterized in general by irreversible damage caused to the fine-structure of the brain. Particularly at the level of individual neurons.

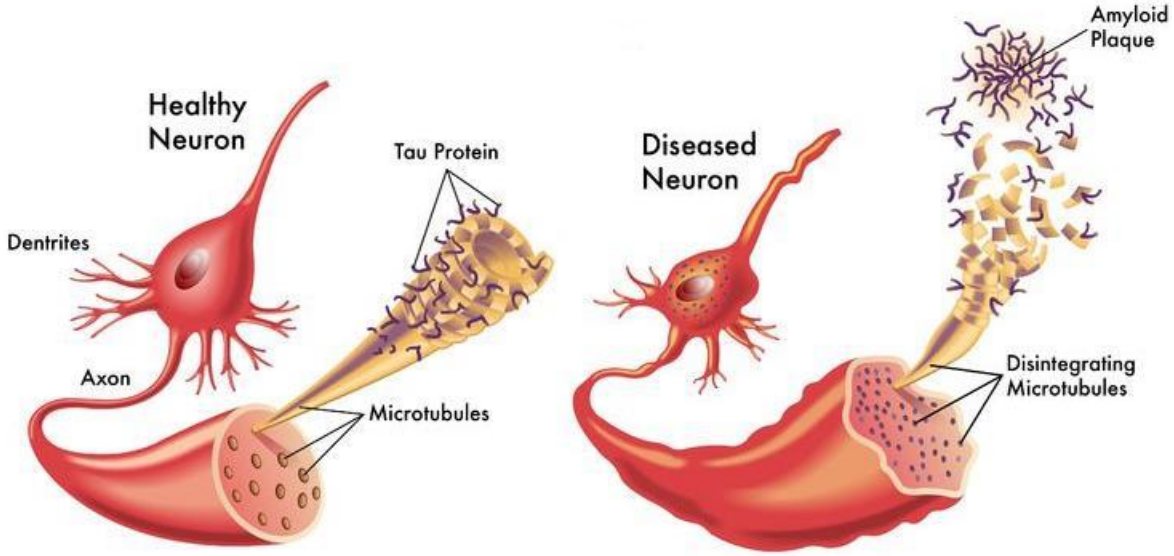
About 70 percent of dementia diagnoses are the result of Alzheimer's disease. Alzheimer's, its cause and its evolution in the human brain, is therefore extremely consequential when it comes to discussions about best practices to take to avoid losing your mind in your later years.

But trying to figure out how to shield yourself from the threat of Alzheimer's requires a lot more discussion than we have room for here.

Still, I'll make two brief points that I think are worth noting about this insidious disease and its (possible) connection with bone loss.

The first is that Alzheimer's disease provides for a very complex topic. You may be familiar with the idea that the Alzheimer's brain is riddled

with neurons that show two distinctive features: plaques of amyloid-beta protein which clog the synapses between brain cells, and tangles of tau protein inside the neuron.



Both of these abnormalities interrupt brain cell signaling but brain researchers are still divided about what causes it.

I go into this topic in some depth in *Ageless Brain*, including a discussion of those practices which offer the best chance of reducing your risk of ever having to face down this horrible disease the way my mother had to do.

My second observation about Alzheimer's as it may potentially relate to bone loss is that the disease behaves very much as though it is irreversible.

Once the damage is done - brain cells rendered inactive or eliminated entirely, brain synapses and the dendrites that support them damaged and inoperable, fine blood vessels blocked or otherwise subverted from their primary functions - the job of repairing these abnormalities becomes formidably difficult or even impossible to pull off.

Your brain has passed the point of being able to repair itself.

So even if you could change the health of your bones you could not repair the damage done to your brain. As we will see, the situation with age-related cognitive decline and bone health is different. Reversing cognitive impairment, not just averting it, may indeed be possible.

This is not to say there is no evidence linking bone loss to Alzheimer's disease and for that reason practice that lead to thinning bones should be avoided. There is such evidence [Ref. Bednarski].

But there is also evidence for a slew of other causes for Alzheimer's disease and the only logical cause of action to take if you are worried about contracting the disease is to tackle each of these causes one by one.

For that I would refer you to my *Ageless Brain* program.

On the other hand, when it comes to the question of the influence of bone health on less dramatic cognitive impairment, the age-related cognitive decline you can expect to be dealing with at some point even if you are otherwise perfectly healthy, there is a lot more which can be said about how to efficiently tackle the issue and even erase some of the symptoms (including memory loss, anxiety, depression, and learning impairment).

The evidence for the connection between bone and brain in this case is also well established in the human female population [Ref. Brownbill]. The lives of postmenopausal women do seem to be "inconvenienced" not only by the commonly-accepted risks of bone loss (fractures) but also enhanced cognitive impairment.

Unlike the case for Alzheimer's disease, there is lot more we can say about the cause of age-related cognitive decline.

Better yet, the evidence suggests (as mentioned already) that the type of influence bone loss has on age-related cognitive decline is, in principle, completely reversible.

That is because, as you are about to learn, it boils down to a (correctable) hormonal imbalance.

If this idea strikes you as new and somewhat startling, that's because it really is!

Until recently the hormones in your body were believed to be entirely under the control of the traditional endocrine system, made up of a set of glands distributed throughout your body.

According to the Mayo Clinic the endocrine system is made up of: the pancreas, the thyroid, parathyroid, pineal, hypothalamus, adrenal and pituitary glands, and the ovaries (women) and testes (men).

Completely missing from that itinerary of hormone producers: bone.

So what you are about to learn your doctor would likely tell you is simply not true.

That is how new this information is.

It has yet to percolate into the medical text books. If you bring up what I am about to teach you in normally polite company then be prepared to get some odd looks directed your way.

Even your doctor may think you are bonkers if you repeat what I am about to say (in which case you can direct him to the references at the end of this guide).

The Bone Hormone That Keeps You From Losing Your Mind

The story of the bone hormone that is believed to protect your brain from age-related memory loss, anxiety, depression, and learning impairment begins in the laboratory of a French geneticist named Gerard Karsenty.

Today Karsenty is the chair of the Department of Genetics and Development at Columbia University Medical Center. But back in the nineties Karsenty had yet to make his name.

As he cast about for a worthy research topic he found himself curious about the specific role of a mysterious protein found in bone that seemed to play a role in laying down the mineral layers that contribute to the strength of our skeleton.

The name of the protein was *osteocalcin*.

Osteocalcin was known to be produced by osteoblasts. These are cells which travel across the surface of bone in the wake of another cell type

known as an osteoclast.

If you are familiar with the video arcade game Pac-Man you have a good idea of how to picture an osteoclast as it goes about its munching locomotion over the surface of bone. It is the job of osteoclasts to break down existing bone and release calcium and other minerals into the bloodstream for use by the rest of the body.

Bone is our storage reservoir for minerals.

Osteoblasts follow osteoclasts and repair the damage they do, rebuilding the missing bone.

When you are young osteoblasts are more active than osteoclasts and the "bone remodeling" process results in bone growth. When you are much older the balance goes in favor of osteoclasts and your bones slowly lose mass. As mentioned before, this process goes into overdrive when your ovaries stop pumping estrogen into your bloodstream.

While looking for answers about the biological function of osteocalcin Karsenty performed an obvious experiment. He bred a group of mice which lacked the gene for osteocalcin production.

Mice and humans share 98 percent of their genetic code, and at the level of proteins their biology is very similar. So Karsenty was confident he could learn a lot about the role of osteocalcin in human bone production by studying his "osteocalcin knockout" mice (those in which the gene had been knocked out of their DNA). Perhaps osteocalcin would ultimately prove to be the basis for a new treatment of osteoporosis in women.

Karsenty confidently predicted that the bones of his knockout mice would be damaged in some way by the time they reached adulthood. More frail than the bones in regular wild type mice.

But he was wrong.

To his surprise the knockout mice showed no signs of any kind of bone impairment at all. If anything their bones were even stronger than the wild type mice.

The experiment proved to be a complete dead end that flat-lined the scientist's enthusiasm for his osteocalcin research.

On the other hand, Karsenty did notice something about odd his osteocalcin-deficient mice...

On the whole they seemed anxious, depressed, and fatter than normal. They barely moved about in their cages (which at least partially explained their weight gain) and when picked up they never tried to bite their handlers or escape from them.

"Stupid" is how Karsenty characterized them.

It was as if deleting osteocalcin from the bodies of these mice somehow affected their brains.

That was strange, thought Karsenty, given that osteocalcin is only generated in bone...

The more he pondered this the more it seemed the only explanation was that osteocalcin must somehow travel in the bodies of normal mice from their bones to their brain where it... does what?

Karsenty had no idea.

But if he was correct then osteocalcin would be behaving as though it was a hormone - a chemical messenger able to regulate distant bodily functions in response to locally changing conditions in the body.

But what changing conditions? Again, Karsenty had no idea.

So he disappeared back into his laboratory to find some answers. We'll return shortly to see what he uncovered.

Miracle Gro For The Brain

At about the same time Karsenty was wrestling with his discovery that osteocalcin might behave like a kind of brain-influencing hormone, other researchers had isolated a completely different protein which appeared to be the master switch for the brain.

They called it BDNF, which is short for brain-derived neurotrophic factor.

Unlike osteocalcin, BDNF is produced in the brain where it is responsible for several processes critical to the long term health of your brain. Without them your mental state would devolve rapidly until you became an incoherent addled-brained simpleton, not entirely unlike what happens when dementia truly takes hold. And this may not be a coincidence.

BDNF has been described as Miracle-Gro for the brain.

When sprinkled on brain cells in a petri dish the cells are stimulated to grow. They sprout new branches, the dendrites that connect one brain cell to thousands of others, a process critical to learning and new memory formation.

BDNF strengthens the connection between synapses when they fire in response to communication between brain cells.

That means the more you repeat a learned skill or retrieve a stored

memory the more that learned skill or memory resists being downgraded and eventually discarded.

BDNF also stimulates the production of new brain cells to replace those lost to the damaging influences of energy metabolism in the brain.

Your brain accounts for about 2 percent of your body weight but uses around 20 percent of your daily energy reserves.

All that furious fuel-burning creates toxic by-products, not all of which can be cleared away in time to avoid damaging or even destroying neurons.

When this happens in the hippocampus, the area of your brain critical to memory and learning, your powers of cognition will eventually take a hit

The brain-cell repopulating efforts of BDNF help to offset this process.

No wonder then that the nickname "Miracle-Gro for the brain" stuck once it was introduced. Or that BDNF has been described as the master switch for the brain.

Of course that begs the obvious question.

If BDNF acts like a switch, how do you turn it on?

Is there a way to increase its activity so that, while at the microscopic level it is repairing damaged neural pathways, sprouting new pathways, and stimulating the growth of new brain cells... in the higher realms it is boosting intelligence, lightening mood, increasing productivity and strengthening memory?

To the surprise of many the "on" switch for BDNF turned out to be physical activity.

Exercise!

When researchers put volunteers through an experimental protocol involving strenuous activity they were able to detect large surges in the amount of BDNF flowing in the brain.

But the effect also exists outside the laboratory.

In his book "Spark" John Ratey, an associate clinical professor of psychiatry at Harvard Medical School, details a high school program in Naperville, Illinois which capitalizes on the effect.

Students of the Zero Hour PE program perform intense exercise. This gets their heart rate up to about 80 percent of maximum before they head off to their first class. The boost in circulating BDNF has been documented to improve their memory and learning capacity as evidenced on national test scores.

The explanation for this is that exercise is especially good at raising BDNF levels in the hippocampus, the area of the brain involved in memory and learning.

Study after study has proved this association between BDNF and exercise.

But initially no one had any idea how the two were connected. You cannot physically exercise your brain. It is walled off from the rest of your body by a blood-brain-barrier which is extremely selective in what it lets through from the bloodstream.

So the question was: How was the body able to message the brain remotely?

Wait a minute, you may be thinking to yourself, doesn't osteocalcin travel

to the brain from the bones? Could there be a possible connection there?

Actually yes, although at the time no one was able to connect the two ideas...

A Tale Of Two Moms

Before I tell you how BDNF and osteocalcin are connected through exercise I want to remind you about the connection between bone loss and exercise.

It is well established that regular physical exertion, and especially weight training, is great at stimulating bone growth. One of the best things a woman can do before her bones begin to thin rapidly is take up strength training.

To show you the world of difference I believe it can make to one's life I want to recount Christiane Northrup's story of her mother's attitude to physical fitness and contrast it with that of my own mother.

The senior Northrup made a decision to commit herself to trekking the Appalachian Trail in her late sixties.

Then in her seventies she graduated to climbing the one hundred highest peaks in New England.

Needless to say, this is hard work and Northrup tells us the result of it was her mother's frame grew stronger as she gained more bone mass. In fact, her bones were so hardy that she was able to take a significant fall later in life without suffering any fractures.

In comparison my mother spent her postmenopausal years pottering around in her garden. She abhorred the idea of physical exercise and chided me whenever she saw me doing it.

When she fell at the age of 71 and broke her wrist (a common point of fracture in women with weakened bones) she also suffered a complete mental detachment from the world she had known until that point. If her bones had become porous, her brain had followed suit.

I tell the heart-breaking story of my mother's tale of dementia in Ageless Brain.

I point out the contrasting later-stage lives of these two women because I believe one of the greatest gifts you can give yourself is to acknowledge that your body and your mind are not physically separated entities that evolve independently of each other over the course of a lifetime.

When one is healthy, so too is the other - and vice versa.

Now I am going to tell you about a physical mechanism that explains at least a part of this connectedness between the brain the rest of the body, in particular in relation to our bones and how they play a big part in

influencing age-related cognitive decline (or the lack of it, which is really what we are interested in).

For that I am going to take us back to Gerard Karsenty's laboratory and his studies on the bone hormone osteocalcin.

How Our Bones Influence Our Minds

Karsenty ended up spending almost 20 years looking into the biology of the osteocalcin protein before publishing his conclusions about its ability to control processes going on deep inside the brain.

At about the same time he released his findings [Ref. Oury] other researchers were making some surprising discoveries about the age-rejuvenating abilities of "young blood". A team at the University of California San Francisco found that by passing the blood plasma of young mice into the bodies of old mice they could reverse the effects of age-related cognitive decline [Ref. Villeda].

The aged mice performed much better on memory tests. They showed less anxiety and were no longer afraid to explore their environment. They were also much better at figuring out how to manoeuvre their way out of taxing or dangerous situations (better spatial learning). In short, the brains of those old mice functioned as if they were the brains of young mice.

Something in the blood plasma of the young mice was acting like an age-reverser. But the researchers had no idea what it might be.

Meanwhile Karsenty had been able to figure out that osteocalcin was being produced in the bones of *active* mice [Ref. Mera]. Not the sedentary ones that sat around doing nothing, like his osteocalcin

knockout mice or old mice. Osteocalcin was tied to physical exertion.

In both young mice and young humans Karsenty has been able to detect a large increase (more than a doubling) in the level of circulating osteocalcin after a bout of intense exercise.

Stress placed on our bones by physical activity stimulates osteocalcin production. The hormone then travels through the bloodstream to the brain and crosses the blood-brain barrier. Karsenty and his colleagues were able to show that once inside the brain osteocalcin attaches to a set of unique receptors found in the brainstem, the midbrain, and the hippocampus (memory and learning center) [Ref. Khrimian]. The receptor is known as Gpr158.

It is this unique signaling mechanism that stimulates BDNF to perform its duties.

Among them:

• *Preventing hippocampal neurons from self-destructing at the first signs of dysfunction (this is especially important if you have separate neurodegenerative processes going on like Alzheimer's disease)*

• *Promoting the production in the midbrain and brainstem of three neurotransmitters critical to good mood: dopamine, serotonin and norepinephrine, while at the same time lowering levels of the neurotransmitter GABA. The combined effect is to reduce feelings of anxiety.*

• *Improving memory formation and spatial learning abilities by strengthening existing neural pathways, growing new ones, and promoting the growth of altogether new brain cells.*

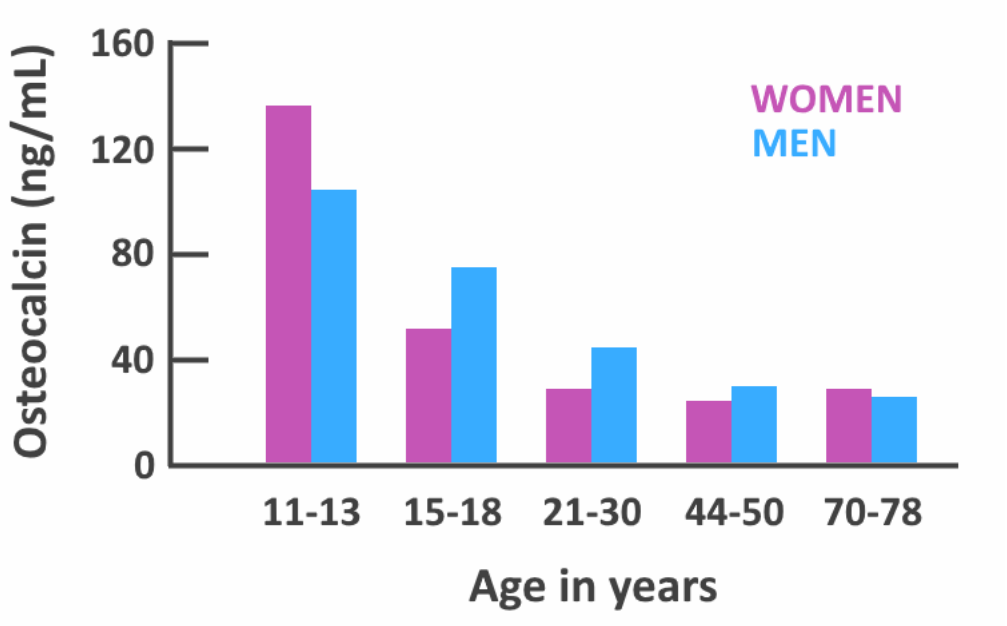
And it's all possible because bone pumps out osteocalcin in response to

physical exertion. At least during the period that bone is abundant in the body and functioning as does during youth. Because as with most hormones in the body osteocalcin drops off with age.

In women in particular it drops precipitously once they reach puberty.

As shown in the earlier graphic of bone loss as a function of age, bone growth for women slows and bone mass peaks around the age of 30-35 years.

But this is about a full decade beyond the point when the amount of circulating osteocalcin has sunk to a low point, which is then more or less maintained for the rest of a woman's life. Assuming of course that she takes no action to shore up bone mass through various approaches such as a vigorous physical exercise regimen.



Men do much better here. Their osteocalcin reaches its minimum level around the age of 45 years and bone thinning does not really begin to kick in until men are in their mid sixties.

Karsenty was able to point to osteocalcin as the mysterious substance causing the "fountain of youth" effect at the University of California San Francisco, which was exhibited in the brains of old mice which received the blood plasma of young mice.

Osteocalcin really did act like an age reverser, restoring memory formation and learning abilities to levels equivalent to those seen in the younger mice.

Karsenty could inject osteocalcin either into the bodies of old mice that produced almost none of the hormone, or into the bodies of his osteocalcin knockout mice engineered to express no osteocalcin, and both groups would undergo marked improvement in memory and learning capability [Refs. Obri, Oury].

The mice also became less anxious.

Not only that, but the osteocalcin-juiced old mice even developed the physical stamina of young mice. They were able to run for much longer distances when placed on a running wheel.

That's because osteocalcin turned out to be more than just a bone hormone that activates neurons in the brain.

It has been found to regulate insulin production in the pancreas and the rate at which glucose and fatty acids are metabolized in muscle cells.

It also increases insulin sensitivity of fat (adipose) cells and raises the amount of the fat-burning hormone adiponectin so that it becomes harder to store fat in the body.

This explains why Karsenty's osteocalcin-deficient "knockout" mice, and older mice in general, are apt to gaining weight. In this sense osteocalcin acts indirectly a weight loss hormone.

Taken by itself this observation provides yet another reason include exercise as part of your overall weight loss strategy.

But it turns out there's an even stronger reason to focus on developing your bone strength if body weight has become an issue. And that has to do with the discovery of a *second* bone-derived hormone that has a *direct* influence on your ability to lose weight.

The Bone Hormone That Suppresses Appetite

A few years after Karsenty's group at Columbia University Medical Center (CUMC) published its findings about osteocalcin's influence on the brains of mice a second group at the same institution announced their own exciting finding.

In 2017 researchers at CUMC were able to show that lipocalin 2, another bone hormone produced by osteoblasts, acts as an appetite suppressant in mice [Ref. Mosialou].

When the researchers "knocked out" the gene for lipocalin 2 production in osteoblasts the amount the hormone circulating in the blood dropped by two thirds (it is also produced in white fat cells). The result was the mice ate more, increasing the amount of fat in their bodies and their overall body weight.

When they looked at patients with Type 2 diabetes the group found the same hormonal pathway also appears to be present in humans. The less lipocalin 2 produced by your bones, the heavier you tend to be.

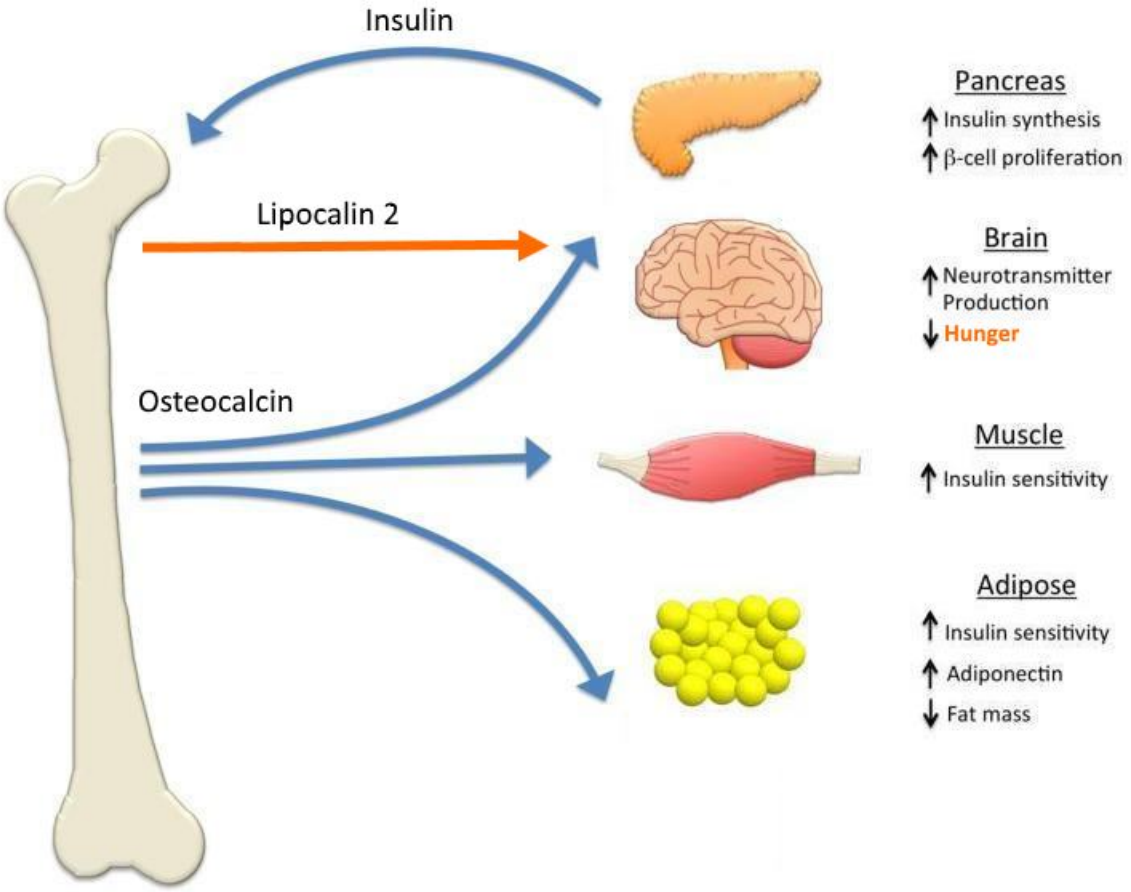
If you are thinking this sounds like yet another reason to be concerned

about menopause-induced bone thinning, I suspect you're right!

Like osteocalcin, lipocalin 2 travels through the bloodstream to the brain where it crosses the blood-brain barrier. It then attaches to a specific receptor in the hypothalamus, the area of the brain long-known to control body weight by modulating sensations of hunger in response to hormonal input.

Two of the better known of these "weight loss" hormones are leptin (hunger suppressant) and ghrelin (hunger stimulant).

What all this means is that this second "bone hormone", lipocalin 2, joins the family of weight-loss hormones.



So you don't just get smarter and acquire better memory when you exercise with intensity to build bone.

Your physical stamina and muscle strength also increase as a direct result of osteocalcin production AND you maintain a much healthier weight profile because of the increased production of hunger-suppressing lipocalin 2.

At the very least we know these finding are true of mice.

But (as indicated above) both initial and retrospective studies carried out in human populations suggest that what is true for mice is likely true for us as well.

Of course, to be absolutely sure about all this larger, more well-defined human studies need to be designed and carried out.

In the meantime you can use the preliminary findings to get a head start on:

[1] Reducing the amount of age-related cognitive decline believed to be the result of osteocalcin loss in your body as a result of both aging and excess menopause-induced bone loss.

[2] Getting rid of unwanted excess body weight caused by lipocalin 2 depletion which is a secondary result of menopause-induced bone loss.

So - let's wrap this up by summarizing what we have learned and then I'll provide you with an action plan to put the brakes on menopause-enhanced cognitive decline, including memory loss, feelings of anxiety, and impaired learning potential.

How To Remain Mentally Sharp Your Entire Life

Thanks for making the effort to read this far!

That you did suggests to me you have a serious interest in making sure your mental faculties remain fully intact as you journey through the second half of your life.

This is a goal I share with you.

In truth, it's not an easy one.

To have the best possible chance of avoiding the fate which catches up with so many women as they advance into their 60s, 70s, and beyond you will need to implement a long program of consistently brain-friendly actions.

In my opinion any willingness to simply kick back, roll the dice, and deal with the consequences if there happens to be any is just reckless.

Even if you do not buy into the idea (despite all the evidence I have provided) that thinning bones predispose you to increased incidence of memory loss, anxiety, and diminished intellectual capacity there is still the ever present threat of life-threatening bone fractures.

According to the National Osteoporosis Foundation a woman's risk of breaking a hip is about equal to her combined risk of breast, uterine and ovarian cancer.

But it is the risk to your mental well-being, your sanity even, that I really want to impress on you here.

I am thinking about dementia in particular because it took my mother's life. But age-related cognitive decline can also pose serious challenges to your quality of life once you get a few years behind you.

I mean, it's not as if there won't be other non-brain-related health issues to deal with along the way, right? And you are going to need even ounce of mental fortitude you can muster to deal with them as they arise.

It is because of these challenges that I believe the only sensible approach to lasting brain health is to go at it with a "whole body" mentality. To treat the brain as just one element of the larger whole and plan accordingly.

This, in essence, was the motivation behind my *Ageless Brain protocol*, which is a unique science-based approach to immunizing one's brain against the ravages of time.

It came out of taking the result of a year of researching the science of brain health and combining it with the hard lessons I learned while

watching my mother go through her brain health struggles.

Ageless Brain focuses on how to take a preventative approach to Alzheimer's disease, less devastating dementias, small vessel disease of the brain, and related neurodegenerative conditions.

But it turns out the *remedies* for treating disease and non-disease initiating cognitive impairments, like the more easily correctable osteocalcin deficiency discussed in this guide, have a great deal in common.

That means what works to help prevent one condition also works to help prevent the others.

In the case of osteocalcin deficiency, which ALL women experience to some degree, I would suggest taking up weight training.

That is, assuming your body is not already so frail you cannot risk loading it with weight-bearing stress. But if you are physically capable, I would recommend the dead lift (pictured above) as the ideal movement.

This involves pulling a weighted bar from the floor up to the mid thigh area while keeping you back straight, then lowering the bar back to the floor.

I could not guess how many thousand dead lifts I have performed over the years. It has been quite a few!

Of course, the question of how best to strengthen your bones in a safe and effective way is deserving of a much larger discussion than I can attempt here.

But I will take a moment to remind you of the key points you've learned today relating to the influence of bone on the health of your brain.

In particular, I want to remind you about it's influence on age-related cognitive decline which, from what we have seen, would appear to be quite reversible.

Here's what we have learned:

• *Your skeleton does more than keep your body from collapsing against the force of gravity. It sends messages to your brain and other parts of your body by pumping out hormones.*

• *One of these "bone hormones" is osteocalcin, which is produced in abundance in response to physical activity.*

• *Osteocalcin travels in the bloodstream to your brain where it stimulates your brain master switch, a growth factor called BDNF (brain-derived neurotrophic factor).*

• BDNF allows brain cells to live longer, to strengthen in response to repeated stimuli (learning), and to grow replacements.

• This "brain rewiring and replenishment" buttresses your brain against the threat of neurodegenerative conditions like Alzheimer's disease.

• It also reduces the effect of age-related cognitive decline, including memory loss, increased bouts of anxiety, and impaired learning ability.

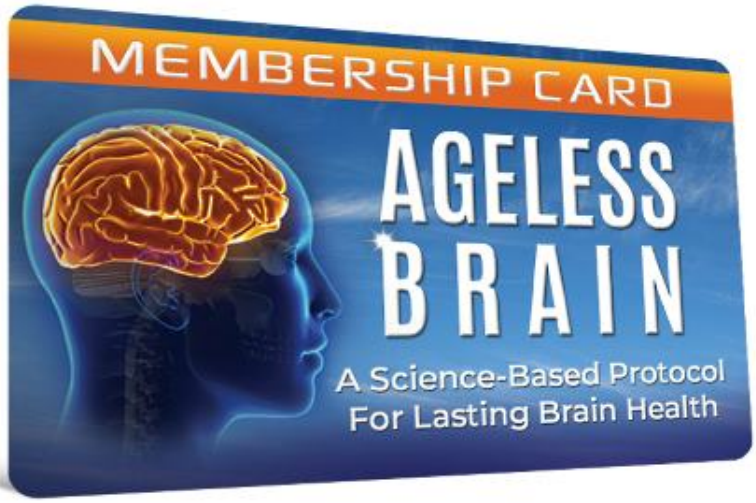
• Women lose osteocalcin early in life (by the age of 30 years), making them more susceptible to this "hormone induced" cognitive decline.

• Menopause can up the ante by accelerating bone loss, which further impairs osteocalcin production and puts even greater stress on their brains...

• Luckily it isn't all that hard to add bone mass to your body to counter the effects of low osteocalcin.

• One of the best ways to thicken those bones is exercise!

Next Steps: Other Things You Can Do To Protect Your Brain



I have mentioned that I recently created a program to help women like you make the adjustments to their lives needed to significantly lower their risk of cognitive decline as they head into the second half of their lives.

I hope you will consider joining me in this goal and taking advantage of everything I have learned on this hugely important subject.

Members of my **Ageless Brain** program enjoy a cutting edge brain improvement protocol that spans a period of 24 weeks (six full months). This allows for ample opportunity to put into effect techniques designed to provide a lifetime of protective benefits for your brain.

The *Ageless Brain* emphasis is on getting you into the habit of performing actions which have a proven scientific basis for reducing your risk profile for brain disease, especially dementia and the increasingly common

affliction which we all dread, Alzheimer's disease.

So, if you would like to become proactive on matters relating to the health of your brain...

If you share my goal of maintaining sharpness of thinking, superior recall, and the degree of motor skill sufficiency that allows you to remain physically independent of others for the remainder of your days, click on the following link to learn more about how you might get started with the *Ageless Brain* protocol:

Discover The Ageless Brain Protocol

To the lasting health of your brain,

Carolyn Hansen

https://theagelessbrain.com

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