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Review

IT IS NEVER TOO LATE TO REGENERATE YOUR BRAIN

A review of *Brain Longevity*, by Dharma Singh Khalsa, M.D., with Cameron Stauth.

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It can be terrifying. It seems like only yesterday you could remember even the trivia you'd rather forget, and now, though you are hardly over 50, you seem to forget all sorts of important details. Phrases such as "what's-his-name" become a part of your daily vocabulary. Could it be—so early in life—the beginning of Alzheimer's disease?

Not likely, Dr. Khalsa reassures his readers. It's probably the burnout caused by long exposure to excess cortisol, our main "stress hormone." Probably the main contribution of this excellent and multi-faceted book is the presentation of Khalsa's central thesis: the mental decline that seems to set in during our 50's and 60's is not an inevitable part of aging, but is very largely due to chronic cortisol overload. Lower your stress, lower your cortisol levels and it is likely that your brain can regenerate its powers to learn and remember.

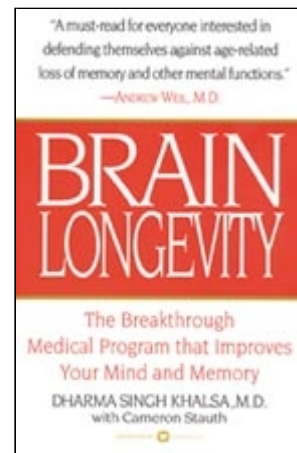
The deadly downward spiral

It took Khalsa many years to discover the "cortisol connection." He was puzzled by the strong relationship between stress (such as chronic pain) and cognitive dysfunction that he observed in his patients. "Very intelligent people would become markedly less cogent as their stress mounted," he notes (p. 34). He also points out that the modern world creates unprecedented levels of neurological stress. We are constantly battered by noise of all sorts—not only the noises of modern urban living, but also information overload. Add to this the relentless "struggle to survive and succeed" (p. 84). We are simply trying to do too many things, sometimes all at the same time (proudly calling it "multi-tasking" rather than brain-destroying stress). It is no wonder that working mothers, for instance, have been found to have chronically elevated cortisol.

Eventually Dr. Khalsa discovered that the studies of Robert Sapolsky of Stanford, Herbert Benson of Harvard and several others have indeed revealed a strong correlation between high levels of cortisol (or high levels of stress) and symptoms such as memory loss. Chronic stress did indeed turn out to be a very important cause of mental decline. Conversely, keeping cortisol levels low apparently preserves brain health and cognitive skills. A recent Canadian study of elderly patients over a four-year period showed that patients with low cortisol levels performed as well as young people on various cognitive tests. On the other hand, patients whose cortisol levels increased during the study showed a decline in memory and overall cognitive function.

This is easy to grasp when we take a look at the neurotoxic effects of high cortisol. First, it inhibits the uptake of glucose by the hippocampus, our main memory center. When the hippocampal neurons don't have enough energy to function, memories cannot even form. Second, too much cortisol inhibits the action of various neurotransmitters. If neurotransmitters are not working, then nerve cells can't communicate with one another. That's why people under heavy stress find it hard to concentrate and think clearly. Finally, excess cortisol actually kills neurons. It causes too much calcium influx into the cells (autopsies of the brains of Alzheimer's disease patients typically show a buildup of calcium). Over the years, cortisol can kill billions of neurons.

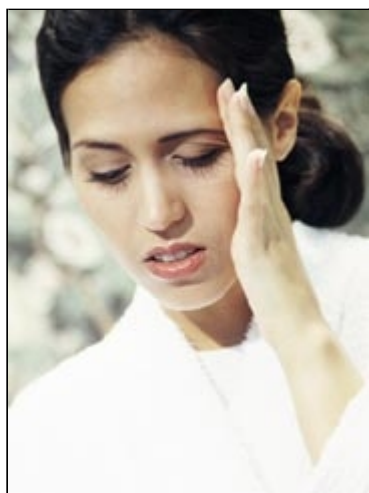
Khalsa speaks of the "deadly downward spiral" involved in the neurotoxicity of stress. The hippocampus normally helps inhibit the release of stress hormones. The more damaged the hippocampus becomes by the stress hormones, the poorer the inhibition of stress-hormone production and the greater the damage to the brain, resulting in more memory loss. As Khalsa puts it, "the more damage to the brain a person has suffered, the harder it is for him or her to 'turn off' stress. When this happens, the person reacts even more strongly to stress—and therefore suffers even more damage to the shut-off mechanism" (p. 52). In fact, according to Robert Sapolsky, it is the total lifetime exposure to stress hormones (glucocorticoids) that best predicts the rate of neuronal death in the hippocampus and the degree of cognitive impairment. The degree of cognitive impairment is in turn a reliable predictor of mortality.



Brain Longevity
1997

by Dharma Singh
Khalsa, M.D., with
Cameron Stauth
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Soft cover, 454 pages

Many of us can identify with Dr. Khalsa's summary of this disastrous situation: "For many years you may have been pushing yourself through one stressful day after another, and this has probably physically damaged both your memory and your "fluid intelligence." When you endure stress on a regular basis, you chronically oversecrete brain-destroying cortisol. When this happens, brain function deteriorates. Unfortunately, when cognitive function declines, people tend to push themselves even harder, to compensate for the decline. Thus a degenerative cycle is created" (p. 91). No wonder midlife professionals so often suffer from burnout. It is a classic case of "brains fried in cortisol."



If severe stress continues, the result is chronic high levels of cortisol, with devastating consequences for the brain, including memory loss and overall cognitive decline.

in spite of the obsolete beliefs to the contrary, we can rejuvenate the brain. And it all starts with lowering cortisol—primarily through stress reduction and, secondarily, by taking cortisol-lowering hormones and supplements.

"To most modern people, having a relaxed state of mind feels extraordinary," Khalsa states (p. 271). In Dr. Herbert Benson's phrase, the fully relaxed mind is the "magical mind." Khalsa is adamant about the importance of achieving this kind of relaxation. "Make no mistake: optimal cognitive function requires a relaxed mental state" (p. 272). Greater relaxation also leads to enhanced perception; when we are relaxed, we are able to "take in" more of the world. Blake's famous saying about "cleansing the doors of perception" can actually be translated into biochemical terms: cleanse the brain of stress chemicals and you will enjoy "expanded consciousness."

A very mild degree of stress, however, is beneficial for the brain, Khalsa points out. It causes the release of the excitatory neurotransmitter norepinephrine, which creates a positive mood—and also moves short-term memory to long-term storage. Thus, responding to challenges that feel within our ability to cope is definitely good for us. This mild, non-overwhelming level of stress also helps the brain grow new dendrites and create new synaptic pathways.

Interestingly, moderate degrees of stress also make us feel good. They create the addictive "adrenaline high." Thus, it could be said that many people are addicted to stress: that's when they feel "fully alive." Another term for it is "the adrenaline rush." That's one reason why so many prefer the office to the home: the office is where the excitement is, together with just enough sense of being in control. However, the danger here is that if prolonged, even moderate stress will cause a long-lasting rise in cortisol, with all its deleterious consequences, such as chronically elevated blood pressure and an undesirable predominance of the fast, "uptight" beta brain waves. Those addicted to the adrenaline rush, or "life in the fast lane," should understand that they are being ultimately self-destructive. Taking frequent breaks for "de-exciting" is an effective remedy.

Obviously, fun challenges like working on a crossword puzzle, or even a demanding but enjoyable job, is not what we commonly mean by stress. The destructive kind of stress involves a feeling of being overwhelmed and unable to cope. The resulting irritability, depression, inability to concentrate and think clearly and feelings of inadequacy and helplessness lead to even more stress. If such severe stress continues, the result is chronic high levels of cortisol, with devastating consequences for the brain, including memory loss and overall cognitive decline.

Thus, lowering stress to relatively mild levels is the primary foundation of any effective brain longevity program (and of course brain longevity translates into longevity, period—an extra decade of life in a nursing home in a state of deepening dementia is not the goal of life extension). Besides the three primary coping skills that one can use to lower stress—taking control of the stressor, reaching for social support and learning to release stress through physical activity and/or verbal venting—Khalsa teaches Benson's remarkably effective technique of the "relaxation response."

The part of the brain that appears most vulnerable to cortisol-induced damage is not only the hippocampus, but more broadly the limbic system. The limbic system consists of the hypothalamus, thalamus, hippocampus, amygdala and the pituitary gland; it governs emotion, hunger, thirst, body temperature, sleep, sexuality and memory. The limbic system has been called our "emotional brain." After prolonged exposure to stress, we often feel emotionally numb. Even when the stress is over, we can hardly feel any pleasure. We are "burnt out."

If too much stress profoundly injures the brain, leading to mental decline, could one slow this decline by lowering stress through various techniques? Could one go even further and reverse at least some of the damage? Could one possibly prevent and/or arrest Alzheimer's disease? On the basis of his clinical experience, Khalsa has become convinced that the answer is yes. We do not have to become victims of the aging process, compounded with unprecedented levels of neurological stress (just think of all the noise and incessant information that we are bombarded with). And no, it is not true that if only we live long enough, we are sure to become demented and spend our last years vegetating in a nursing home.

Some apologists for the aging process and the "wisdom of nature" claim that the decline in memory and learning ability is nature's way to keep us from overloading with information. After all, our "hard drive" can only hold so much. This is reminiscent of the old argument about age-related rise in blood pressure: high blood pressure was supposed to be adaptive in view of the decreased kidney function. Fortunately Dr. Khalsa doesn't buy any of this nonsense. He has no doubt that we can be mentally agile and creative at 50, 60, 80 and beyond. What we need to do to ensure this optimal, joyful level of functioning is to take good care of our brain. In fact,

The relaxation response is the very opposite of the stress response. We can learn to achieve it through techniques as simple as a prolonged sigh. Muscle tension and blood pressure decrease; brain waves slow and shift into alpha; cortisol decreases; oxygen consumption declines; blood lactate levels drop; the immune response increases; blood flow to the brain increases by as much as 25%; alertness and memory are potentiated. Meditation is a hypometabolic state that has been shown to slow the aging process.

Meditation, including chanting, is a powerful way of eliciting the relaxation response. But Khalsa points out that even watching TV in a “mindless” way can shift brain waves into alpha and thus serve as a form of meditation. We need to find the type of meditation that we enjoy and start doing it every day—since meditation appears to be a very effective way to lower cortisol and raise DHEA. It is by now documented that regular meditation does have an anti-aging effect.

A mystical set of mind is not required. You can still derive considerable benefits simply by meditating for about 20 minutes a day, with or without the help of a mantra such as “peace” (or simply “one,” or whatever word best calms you down). As Khalsa points out, “you can use the meditative state for nothing more mystical than giving yourself a break from stress, and lowering your cortisol levels” (p. 305).

Expressing love, even if it does not lead to receiving love, has also been found to lower stress. It is not just receiving love that feels good; giving love can be even more satisfying and is just as healing. One outstanding characteristic of Dr. Khalsa’s book is that he doesn’t limit his discussion to drugs and supplements. He is very much interested in the anti-aging power of positive emotions.

Khalsa’s approach fits in with the “glucocorticoid cascade” theory of aging. His special emphasis is preventing brain aging by lowering cortisol. He is perfectly aware, however, that there are broader anti-aging implications of reducing cortisol. It is a truism that cortisol, like insulin, rises with aging. This appears to be one of the major causal factors not only in increasing brain dysfunction, but also in muscle and bone atrophy, abdominal obesity and immune dysfunction (excess cortisol suppresses the immune system).

Depression versus joy: “Attitude and biochemistry create each other”

“Depression is not only emotionally painful in itself, but is also extremely destructive to memory. It is one of the most common causes of memory loss” (p. 55). He also points out the existence of disquieting clichés about aging and depression: “grumpy old men” and “crotchety old women.” One survey indicated that more than half of older Americans consider depression a “natural” part of aging. Yet the root of this depression is basically neurotransmitter shortage (it is a mistake to think that only serotonin is low), prolonged exposure to stress hormones and poor blood flow to the brain; all of these factors are correctable.

Dr. Khalsa has the insight to see the circular nature of biochemistry and emotions. Obviously, whatever happens in the brain is an electro-biochemical event; there is the biochemistry of depression and despair and the biochemistry of joy and hope. But while many clinicians, including some mainstream clinicians, insist that a positive attitude always has to come first, Khalsa acknowledges that sometimes it is the other way round: the right treatment can restore the right biochemistry, and the biochemistry will then restore a positive attitude.

As Khalsa states, “Often a new, improved attitude requires a new, improved biochemistry” (p. 76). Some people are biochemically incapable of feeling excited or motivated. These individuals may first need to take the right drugs and supplements (for example deprenyl, acetyl-L-carnitine and green drinks) for a while before they can regain the ability to experience positive emotions. “You can improve your life by physically improving your brain,” Khalsa asserts (p. 97). There is simply no separation between “body and mind.”

“Dendritic fireworks”: How to start rejuvenating your brain

Not too many people realize that physical exercise helps us preserve cognitive function. The most obvious mechanism of the benefits of exercise for the brain is the improvement in general circulation and blood flow to the brain. “Because about one-fourth of all the blood in the body is used by the brain, almost any exercise that increases blood flow will help the brain” (p. 55). The increased blood flow means a greater influx of oxygen and nutrients, as well as better removal of metabolic wastes; this in turn leads to a surge of energy, including mental energy.

Exercise also has a well-documented anti-depressant effect. It raises the levels of norepinephrine and endorphins. Most of us have heard of the “runner’s high.” It should be pointed out, however, that this improvement in mood is at least partly the result of increased blood flow.



It is by now documented that regular meditation does have an anti-aging effect.

Interestingly, exercise also has a tranquillizing effect; it diminishes the response to stress for up to four hours. Khalsa says that exercise, especially enjoyable, playful exercise, creates “a psychological oasis of relaxation.” It also stabilizes blood sugar and lowers insulin. And as long as it is not too strenuous and prolonged, exercise lowers cortisol secretion. “When you have a low resting heart rate, as a result of exercise, it prevents your adrenal glands from overreacting to stressors and oversecreting cortisol” (p. 333).

There is more. “Exercise is a godsend to the brain and body,” Khalsa asserts. He validates at length his claim that old people need exercise even more than young people do. In fact, he asserts that older people who keep exercising have better cognitive function than sedentary young people. This stems not only from improved cerebral blood flow and better neuronal metabolism, but perhaps even more so from the exercise-induced release of two growth factors: brain-derived growth factor and nerve growth factor. These growth factors can rescue damaged neurons, increase the production of acetylcholine and dopamine, increase the density of dopamine receptors and enhance the activity of free-radical scavengers.

Khalsa notes that most of his patients are older professionals who have put their time and energy into their careers while neglecting physical exercise. Ironically, these people might have been even more successful in their careers had they engaged in regular exercise. They would be less likely to suffer from cognitive impairment in midlife. Even 30 minutes of brisk walking every day might be enough to have benefits for the brain. Study after study has shown that when older people are put on a regular exercise regimen, their memory improves and their scores on various cognitive tests go up.

Mental exercise, however, is at least as important. “Use it or lose it” is particularly applicable to brain function. Quoting Dr. Marian Diamond, an eminent brain researcher, Khalsa puts it more elegantly: “the brain decides its own destiny.” In other words, “the more we choose to use our brains, the better our brains will function throughout our lives”; “the more we think, regardless of age, the bigger our brains become, and the better they function” (p. 347).

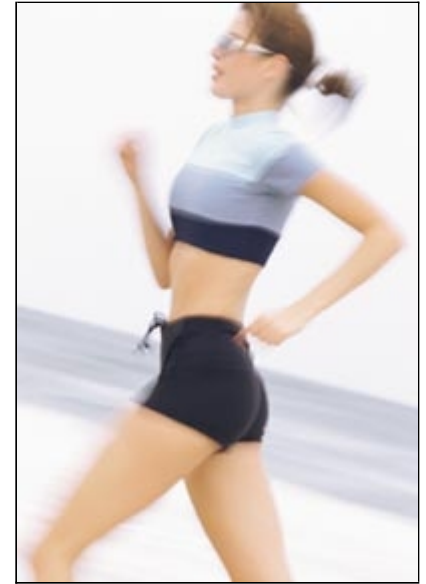
Does it mean that our brains actually grow larger as a result of mental activity? In a way, yes. Citing Dr. Diamond’s research, Khalsa explains that the enlargement is due to an increase in glial cells, the housekeeping cells that support the metabolism of neurons, making it possible for the nervous system to work more efficiently. Einstein’s brain, for instance, showed a significantly greater abundance of glia in an area known to play an important role in abstract imagery and other functions that could be loosely termed “higher intellect.” We also have some exciting animal data, showing that exposure to a challenging, “enriched” environment does increase the number of glia. This happens even in elderly animals.

Remaining mentally active is thus the key to being able to sustain mental activity no matter how old a person becomes. The belief that the older you get, the less you can learn and remember, and that this is “normal,” is itself depressing and pro-aging. Of course we all know people who began to deteriorate mentally in a really noticeable way already in their 50’s or 60’s (in women, lack of hormone replacement after menopause can be a major factor in midlife mental decline). And hopefully we also know some 80-year-olds (or beyond) whose minds have stayed “razor-sharp.” What is the secret of ageless intelligence? “Vigorous mental exercise,” Dr. Khalsa replies, (p. 347). Such exercise (provided by learning new things, for instance) stimulates the release of neurotransmitters, as well as the formation of new neural pathways through the growth of new dendritic branches. (It’s not the size of the brain that determines intelligence, but the number of connections.)

Khalsa quotes Dr. Arnold Scheibel, an eminent neuroanatomist at the UCLA Brain Research Institute, who remarked that mental exercise “sets off dendritic fireworks.” Engaging in novel tasks is especially beneficial for the brain. Trying to practice what he preaches, Dr. Scheibel took up sculpture in his senior years. It turns out that you can teach old neurons new tricks; in fact, you must continually do so in order to preserve optimal brain function.

It is interesting that there is a strong correlation between IQ and life expectancy. Studies of centenarians show that staying mentally active is a mark of the spectacularly healthy centenarians, those who may live to 110 or beyond. It is not unusual for them to continue to work in their professional field, or to take up a new hobby such as painting. They seem to intuitively know that giving up on learning is giving up on life itself.

Finally, we should also nourish our brain with pleasure and positive emotions. One of the most exciting features of this book is Khalsa’s profound understanding of the role of pleasure in brain health and overall longevity. “One of the best things you can do to regenerate your full intellectual power is to learn once again to take as much pleasure as possible from life” (p. 90). Pleasure balances and replenishes our neurochemistry (conversely, depression impairs cognitive function). In addition, “the more pleasure you feel, the less you will physically react to stress. The less you react to stress, the less you will damage your brain with cortisol” (p. 93).



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Another fascinating discovery made by Dr. Marian Diamond concerns the effects of a certain kind of pleasure on the limbic system. Namely, Dr. Diamond lavished “tender loving care” upon one group of animals. Not surprisingly, the animals began to show physical signs of better limbic system function. Khalsa thinks that this is associated with “emotional IQ.” But simply being more resistant to stress and sleeping better could mean an overall improvement in brain function. While performing such experiments with children would run into ethical problems, informal observation confirms that children who receive loving care do better not only in school, but in life in general. It is that “upward spiral” of positive input leading to multiple benefits.

What if you had an unhappy childhood? Does it mean you are doomed to poor limbic function and premature brain aging? Not if you deeply understand that “it is never too late to have a happy childhood.” You simply must become a loving parent to yourself, making yourself and your happiness a priority.

For some older individuals, however, pharmacological agents are a must. Khalsa’s favorite “smart drug” is deprenyl, which inhibits the neurotransmitter-degrading enzymes known as MAO-B. Deprenyl is particularly effective at raising dopamine levels. Both deprenyl and another smart drug, Lucidril (centrophenoxine), have been shown to extend the life span of animals (caution: there is wide disagreement about the optimal dosage range of deprenyl for humans. In addition, the dosage that is optimal for short-range benefits may be excessive for long-term usage). Khalsa also often prescribes hydergine, at the standard European dosage of 9 mg a day. Yet another drug he sometimes prescribes is Piracetam, a compound similar to pyroglutamate, a nutrient which stimulates the production of acetylcholine.

In addition, Khalsa favors hormone replacement as a means of raising neurotransmitter levels. He states, “sex hormones influence how efficiently we think, how well we remember, how well we perform physical tasks and how good we feel emotionally” (p. 117). He acknowledges the benefits of estrogens, which include increased acetylcholine production and increased serotonin, as well as improvement in memory through stimulating the growth of new neural connections in the hippocampus. In addition, estrogens lower the production of cortisol (this has recently been found true also of phytoestrogens).

Khalsa does not seem aware of the findings that men on testosterone replacement enjoy improved mental function, both in terms of memory and mood (in the brain, a percentage of testosterone is converted to estradiol, but it is likely that testosterone itself has a range of effects, such as increased dopamine release). He comments only briefly on the benefits of growth hormone replacement, hypothesizing that growth hormone probably stimulates new dendritic growth. In the main, Khalsa appears to favor mainly DHEA and pregnenolone. He believes that in order to achieve optimal mental function, DHEA should be restored to the high levels typical of our late 20’s.

DHEA is indeed a very important neurohormone. It serves as a precursor to other hormones that are necessary for brain function, including estradiol. Although DHEA is our most abundant steroid, it is especially abundant in the nervous system, being 6.5 times more concentrated in the brain than in the serum. Apparently the brain needs the protection that DHEA offers.

Khalsa points out that DHEA levels in the brain are at their highest between the ages of about 25 and 30—the time when memory is also at its peak. Patients with Alzheimer’s disease, on the other hand, tend to have lower DHEA than healthy people of the same age. But unless DHEA is replaced, even healthy people in their 70’s and 80’s typically have only 10% of the DHEA they had in their 20’s.

DHEA is in a constant tug of war with cortisol. High cortisol levels go hand in hand with low DHEA levels. This situation is typical not only of elderly individuals, but also in those who are only middle-aged, but happen to have suffered severe chronic stress. DHEA could be called “the anti-stress hormone.” It protects against glucocorticoid damage. Thus, a deficiency of DHEA exacerbates the damage caused by cortisol.

Dr. Khalsa typically prescribes 50 mg of DHEA per day. Some patients may need only 25 mg; others respond to higher doses, up to 200 mg. He also recommends pregnenolone, another cortisol-lowering and memory-improving hormone, and melatonin, a



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powerful protector against free radicals. If a patient is hypothyroid, then a thyroid supplement is indicated; low levels of thyroid hormones result in poor mental function and depression.

Because of the time when the book was written, Khalsa does not discuss the effectiveness of SAME in raising neurotransmitter levels. SAME's greatest impact appears to be on the levels of acetylcholine, crucial for memory and learning. Acetylcholine also governs the function of the calming cholinergic pathways that predominate in the parasympathetic system.

DMAE also helps synthesize acetylcholine, but according to Khalsa it should be taken only in the morning, due to its stimulant properties. The point is to keep acetylcholine high all day long. This improves not only cognitive performance during the day, but also helps produce sound sleep at night, since acetylcholine helps screen out stimuli such as random noises that might wake us up.

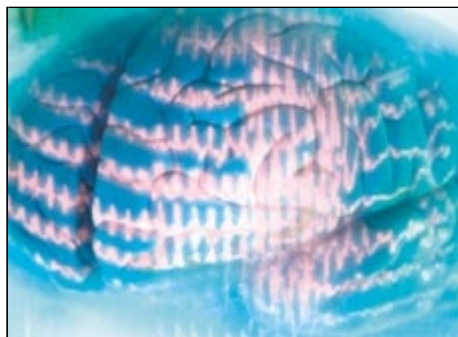
Vinpocetine enhances cerebral blood flow and increases the production of ATP in the nerve cells, thus "energizing" them. With more energy available, the cells can produce the needed neurotransmitters, defend themselves against free radicals and perform other functions more efficiently. An even more potent neural energizer is acetyl-L-carnitine, which also helps raise the levels of dopamine and acetylcholine, besides acting as an important antioxidant. Acetyl-L-carnitine also improves cell membrane fluidity. In both human and animal studies, acetyl-L-carnitine has been shown to improve memory and learning. However, it is extremely important to remember that acetyl-L-carnitine should be taken together with lipoic acid and other powerful antioxidants such as vitamin E and green tea polyphenols, since increased metabolism also means higher production of free radicals, especially in older individuals.

What about diet and brain rejuvenation? Here we part ways with Dr. Khalsa, since we do not favor a vegetarian diet, particularly one that is heavy on grains. We favor a diet abundant in seafood and vegetables, with grains kept to a minimum, but do agree on the importance of calorie restriction in slowing brain aging. Khalsa suggests that being 20% under the average weight for your height should provide those benefits.

Khalsa is also rather negative about the use of alcohol. He does admit, however, that studies have shown that moderate drinking does appear to preserve cognitive function and lower the risk of Alzheimer's disease. This may be due to the cardiovascular and stress-lowering benefits of light-to-moderate drinking. But because even a low amount of alcohol is neurotoxic to some degree, Khalsa does have a point: we can obtain the benefits of wine in other ways.

Optimal brain function

First, Dr. Khalsa makes the case for the various B vitamins. For instance, did you know that vitamin B1 (thiamine) was a powerful antioxidant that increases the ability of vitamin E and B6 to protect nerve cells against free radicals? Or that niacin and niacinamide have a calming effect, since they potentiate the action of the inhibitory neurotransmitter GABA? B12, B6 and folic acid are indispensable methylating agents, while pantothenic acid (B5) is necessary for the production of acetylcholine.



Besides being an excellent methyl donor, choline is of particular importance for the health of the nervous system, Khalsa points out. Choline is a precursor of the key neurotransmitter acetylcholine, which is crucial for memory and sleep maintenance.

As previously mentioned, this book was published before the benefits of SAME became better known. Those who find SAME too expensive can turn to the common and very affordable methylating agents such as B12, B6, folic acid, trimethylglycine (TMG) and choline. We are only now discovering the anti-aging importance of maintaining youthful methylation, one of which is the lowering of homocysteine levels. Basically, Alzheimer's disease and atherosclerosis are closely related; Alzheimer's patients have elevated homocysteine levels. Likewise, older people with high homocysteine tend to perform poorly on some cognitive tests. And yet a few inexpensive vitamins can be very effective in lowering the levels of this harmful substance.

Besides being an excellent methyl donor, choline is of particular importance for the health of the nervous system, Khalsa points out. Choline is a precursor of the key neurotransmitter acetylcholine, which is crucial for memory and sleep maintenance. Choline also maintains "brain plasticity," meaning the ability to form new neural pathways if the old ones are destroyed. It helps protect and restore communication between nerve cells by protecting dendrites, the tiny branch-like parts of neurons that reach out to other neurons. Patients with memory loss may experience a significant improvement simply by supplementing with choline.

Vitamins A, C and E are indispensable allies in the struggle against brain aging. Selenium and zinc also function as antioxidants; in addition, zinc plays a role in maintaining healthy cell membranes and helps detoxify the brain of lead.

Though Dr. Khalsa does mention the amino acid taurine as an effective antioxidant, we think its neuroprotective function should be given more emphasis. Like GABA, taurine appears to have a calming, inhibitory effect. Taurine may be of great value in preventing

excitotoxic damage, as well as epileptic seizures. In addition, the cardiovascular benefits of taurine (it lowers blood pressure, for instance, and decreases insulin resistance by acting as an insulin mimetic) also imply benefits for the brain. As Khalsa points out, "what is good for the heart is good for the brain." Altogether, when one also considers taurine's role in helping prevent macular degeneration, this is a neglected nutrient that needs to be widely publicized. It's interesting that taurine is a unique amino acid in that it is not used for building proteins; the body uses it for many other purposes, such as neurotransmission.

Among other amino acids, Khalsa stresses the benefits of glutamine, methionine and arginine. Glutamine supplementation has been shown to raise the levels of two important neurotransmitters, the excitatory glutamate and the calming GABA; the brain decides which neurotransmitter is needed more at any given time. Methionine, a sulfur-containing amino acid, is not only a precursor of SAMe, but also an antioxidant. It can also chelate heavy metals such as mercury or cadmium (caution: unless you are a strict vegetarian, you are probably getting plenty of methionine from the diet; excess methionine can be harmful). Arginine has many functions, one of which is to serve as a building block for a polyamine called spermine, important in memory formation.

Since the balance of neurotransmitters is essential, it would be unwise to try to raise only dopamine, or only acetylcholine. Serotonin also decreases with age. Hormone replacement is one important way to sustain more youthful serotonin levels and serotonin receptors. In addition, the amino acid tryptophan acts as a precursor for serotonin production. It is best to obtain it from the diet.

Magnesium likewise has a calming effect. People with type-A personality are likely to show more magnesium excretion, and thus become deficient in magnesium. In addition, magnesium increases cell membrane fluidity, thus enhancing the neurons' ability to receive nutrients. Magnesium is very important for the brain also because it is a natural calcium antagonist, and thus helps protect against the damaging (often deadly) buildup of calcium ions (excitotoxicity). It has been found that the brains of Alzheimer's patients show a deficiency of magnesium and toxic levels of calcium.

Siberian ginseng is Khalsa's favorite tonic. Ginseng has an interesting property of lowering the release of cortisol by stimulating the production of adrenaline (epinephrine). When the supply of adrenaline is plentiful, less cortisol is released in response to stress. Adrenaline is the preferred stress chemical because it is quickly cleared out of the body, and its effects are less harmful. It also boosts reaction time and cognitive function. By increasing adrenaline at the expense of cortisol, ginseng has been found to help protect against stress-related diseases.

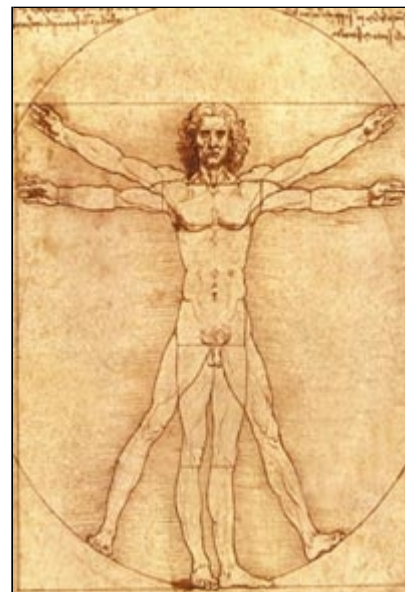
Ginkgo biloba is one of the stars of neuroprotection. No brain longevity program would be complete without ginkgo. The ginkgo tree survived even being ground zero in Hiroshima. Known to live as long as a thousand years, ginkgo is itself a metaphor for longevity. It is also the oldest "smart drug." Various preparations of ginkgo have been used in Chinese medicine for 5,000 years. The potency of ginkgo's active compounds deserves a much closer study, since besides being a brain tonic, ginkgo also shows a strong promise of being able to extend life span.

At this point ginkgo is famous chiefly for its ability to increase "brain power." Khalsa reports that in one study of patients with memory loss, a single 600 mg dose of ginkgo caused a significant improvement in short-term memory within one hour of ingestion (lower doses such as 240 mg did not produce this immediate and dramatic response). 600 mg also happens to be the dose that was shown to improve alertness and learning even in healthy young people.

How does ginkgo work? We know that it improves cerebral blood flow and peripheral blood flow, which means that more oxygen and nutrients can be delivered to the cells. It lowers blood pressure and dilates peripheral blood vessels. It decreases the levels of the platelet-activating factor (PAF), a chemical which impedes blood flow by causing platelet aggregation. In popular parlance, ginkgo makes the blood less "sticky." Hence the benefits of ginkgo for migraine sufferers. The enhancement of microcirculation in the eyes may be the chief explanation for ginkgo's ability to slow the progression of macular degeneration and other retinal damage. Ginkgo is also an effective treatment for tinnitus ("ringing in the ears") and vertigo. It is also under investigation as a treatment for asthma. In addition, men seeking an improvement in erectile function have found that ginkgo's vascular benefits are not confined to the brain.

In addition, the active compounds in ginkgo (various flavonoids such as quercetin and terpenoid lactones) act as very strong antioxidants, improve membrane fluidity and inhibit glucocorticoid synthesis (this has also been found true of other bioflavonoids as well as of human estrogens). Ginkgo has been found to blunt the response to stress, and to help prevent the age-related or stress-induced loss of a certain type of serotonin receptors that happens to be involved in learning and memory. All in all, it is not surprising that a recent study found that ginkgo not only preserves cognitive function in rats, but also extends their life span.

An interesting and somewhat unusual recommendation is “green drinks.” These are the powdered preparations of cereal grasses such as young barley or wheat grass, sometimes with addition of chlorella. Khalsa states that apart from chlorophyll and various minerals and vitamins, the peptides (protein fragments) contained in green drinks provide a ready substrate for the production of neuropeptides such as the well-known beta-endorphins. Those who try green drinks usually swear by them, since the energizing and antioxidant effects (better skin, clearer whites of the eyes, more energy, arthritis relief) can be seen within a short time. If the only piece of advice you follow is to start drinking green drinks, this alone can do a lot for you. Combined with ginkgo and other supplements, green drinks are the rocket boosters of rejuvenation.



We find it somewhat disappointing that Dr. Khalsa does not recommend fish oil and/or frequent consumption of fish. At this point there is little doubt about the enormous value of fish and fish oil for cardiovascular and neural health. Recent findings also show that omega-3 fats are potent antidepressants. In fact, they are now thought to have certain chemical similarities to lithium, and have been found effective even in bipolar disorders (the manic-depressive mood disorders). Thus, fish could be called “mood food” as well as “brain food.” In our view, anyone who is serious about preventing Alzheimer’s disease (or even depression) can’t afford to neglect fish oil.

Conclusion

This book is extraordinary in its richness. Also extraordinary is the loving, caring tone, which itself is therapeutic. The central message is simple and hopeful: we can preserve most of our youthful cognitive function by lowering our cortisol level. In addition, we can achieve further enhancement by nourishing the brain with pleasure, both physical and mental exercise, and the right diet and nutrients. Once such enhancement is achieved and optimal neurochemistry prevails, we can discover our real self—ourselves at our best, with the brain operating at its full power. “That self has been beaten and bruised by stress, exhaustion, neurological toxins and your own fear and anger,” Khalsa states (p. 83). Nevertheless, that “optimal” self can be recovered; the stress-free “magical mind” can reveal its riches not only in childhood, but also in late adulthood.

“Brain longevity programs are much more than just programs designed to enhance the longevity of the brain; they are also body longevity programs. The mind and body are one.”

Far from being dryly scientific, Khalsa doesn’t hesitate to share with readers some life wisdom. Much stress—and consequently premature brain aging—is due to various self-destructive beliefs and attitudes. Khalsa counsels making happiness, not money, your top priority. “If you give up on happiness, you give up on life,” he states. “Happiness—or joy, or hope, or contentment—is the wellspring of all energy, and the primary vitalizing force of life” (p. 289).

Dr. Khalsa emphasizes that rather than being passive victims of the lethal downward spiral, we can activate the upward regenerative spiral. And by rejuvenating the brain, we also rejuvenate the whole body: “Brain longevity programs are much more than just programs designed to enhance the longevity of the brain; they are also body longevity programs. The mind and body are one.” Khalsa asserts again and again that if we take good care of the brain by following a brain longevity program, we can stop degeneration and achieve regeneration. As proof, he cites his clinical experience with numerous patients of all ages.

To quote Dr. Khalsa as he concludes the book: “You’ve learned that aging isn’t always a process of degeneration, but can be an opportunity for regeneration. You’ve learned that if you nurture your brain, you can be intelligent and happy during every stage of your life. You’ve learned that controlling your stress can make you smarter—now, and forevermore. Don’t give up. The best is yet to come. Your life, as always, lies ahead.”—Ivy Greenwell

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