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Study Finds Link Between Brain Energy Production and Your Psychosocial Experience

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Your brain is highly energy-dependent, consuming 20% of your body's energy. Recent studies show a bidirectional relationship between mental well-being and mitochondrial function, with positive experiences boosting cellular energy production

Chronic stress can lead to mitochondrial dysfunction, increasing your risk of mental health issues like anxiety and depression. Breaking the stress cycle is crucial for optimal mitochondrial function and overall health

Strategies to manage chronic stress include regular exercise, consuming healthy carbohydrates, engaging in creative activities, practicing self-soothing techniques, optimizing sleep and maintaining a positive outlook

Diet also plays a significant role in stress management. Consuming healthy carbs can help lower your cortisol levels, while avoiding seed oils high in linoleic acid (LA) is recommended to prevent mitochondrial dysfunction

Rewiring your brain for happiness and cultivating Joy is important. Joy is described as an active pursuit of life's purpose, distinct from passive happiness, reflecting engagement with life and personal growth

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Did you know that your brain is the most energy-dependent organ? It consumes up to 20% of the energy used by your entire body, despite making up only 2% of your bodyweight.[1] Your brain regulates your mental and emotional state, so when you don't produce enough cellular energy, your brain function is severely affected — as a result, you experience changes in your behavior and how you respond to stress.

But did you know that these processes work both ways? According to a recent study,[2] your experiences, whether positive or negative, can affect your energy production by changing how your mitochondria work.

Your Mental and Social Well-Being Are Linked to Your Brain's Energy Production

The mitochondria are the powerhouses of your cells and are responsible for more than 90% of your body's energy production.[3] I've previously discussed how optimizing your mitochondrial energy production can help rewire your brain and allow you to cultivate more

Joy in your life. Now, there's evidence that shows it works the other way as well.

According to a 2024 study published in the Proceedings of the National Academy of Sciences (PNAS),[4] experiencing positive life experiences can impart changes in the mitochondria, which then boost cellular energy production. Conducted by scientists from Columbia University, the study involved examining the brains of elderly adults who have donated their brains to research postmortem.

For nearly 20 years, the participants also conducted "periodic psychosocial self-assessments"[5] — basically, they recorded their mental and social experiences for later analysis.

Through these assessments, the researchers observed a link between the psychosocial experiences of the participants and the amount of proteins in their brains, which the mitochondria need for energy production, noting that "positive psychosocial experiences are linked to greater abundance of the mitochondrial energy transformation machinery, whereas negative experiences are linked to lower abundance."

According to their findings, the participants who reported feeling happier and more content during their lives had higher amounts of these proteins. On the other hand, those who had bad experiences had fewer proteins.

One factor that shows how this mechanism works is OxPhos (oxidative phosphorylation) protein abundance. Not only are OxPhos reactions essential for mitochondrial energy production, but they also help keep age-related disorders at bay.[6] According to a report published in Lifespan.io:[7]

> "In the dorsolateral prefrontal cortex (DLPFC), a brain area that is involved in executive functions and emotional regulation and is known to be sensitive to psychological stress, this factor showed marked correlation with both positive and negative psychosocial experiences.
>
> The positive psychosocial aspects most associated with increased OxPhos protein abundance were well-being and late-life social activity. On the opposite side of the scale, negative mood and negative life events had the biggest effect sizes."

Caroline Trumpff, the lead author of this study, notes that this is the first time that subjective psychosocial experiences have been related to brain biology. "We're showing that older individuals' state of mind is linked to the biology of their brain mitochondria," she commented.[8]

The Effects Could be 'Bidirectional'

The study authors noted that there are limitations to their findings, as the specific cause-and-effect relationship is yet to be determined. It's possible that the effect could be the other way around, and that having more proteins in the brain (and therefore better mitochondrial energy production) could be the reason why some participants report being happier and having better mood than others.

However, they noted that the effects could be bidirectional, too, and that "chronic stress

exposure directly affects an individual's mitochondrial biology and subsequently affects their perception of social events."[9] This is entirely possible; in fact, some of the researchers involved in this study also previously published an animal study[10] that looked at how mitochondrial activity in different parts of the brain affected stress response.

Published in the journal Nature Communications, the researchers looked at 17 different brain areas of mice that correspond to different behaviors.[11] They found that these different patterns of mitochondrial activity account for differences in behavior between individual mice and how they respond to stress.

> "This study synergizes with recent work providing the technical and empirical foundation to bring mitochondrial biology into brain-wide, network-based models of neural systems in mammals … Developing a spatially resolved understanding of brain mitochondrial biology will help to resolve the energetic constraints on brain function and behavior," they said.[12]

Mitochondrial Dysfunction in Your Brain Can Raise Your Risk of Mental Problems

Although the cause-and-effect factor is still not confirmed, one thing is certain — there is a definite link between your mitochondrial health and stress. According to Trumpff, their findings give valuable insight into why chronic psychological stress and bad experiences can be harmful for the brain, saying, "They damage or impair mitochondrial energy transformation in the dorsolateral prefrontal cortex [DLPFC], the part of the brain responsible for high-level cognitive tasks."[13]

Previous studies showed similar results; for example, a 2022 review published in Neuroscience and Biobehavioral Reviews[14] found that chronic stress can lead to poor mitochondrial function and can be a risk factor for various psychiatric and mood disorders, including anxiety, depression, autism and schizophrenia.

According to the researchers, being in a state of constant stress can cause "mitochondrial allostatic overload" — this refers to the functional and structural changes that your mitochondria experience, which then leads to "oxidative stress, inflammation, mitochondrial DNA damage and apoptosis."[15]

They then highlighted evidence linking mitochondrial dysfunction to mental health issues. For example, in patients with major depression, neuroimaging studies found a reduced energy metabolism in brain areas, including the prefrontal cortex, insula and basal ganglia.

> "The evidence presented here suggests that alterations in mitochondrial function do impact on cognitive processes and may be causative linked to the onset of psychiatric disorders such as anxiety, stress-related disorders as well as social interaction deficits in the domain of autism and antisocial personality disorder.
>
> Understanding the connections between mitochondria and cognitive functions could pave the way to next generation approaches targeting mitochondria to alleviate neuropsychiatric conditions, aging and cognitive decline in general," they concluded.

Escaping the Stress Cycle Is Key to Optimal Mitochondrial Function

Stress is a "silent killer."[16] Being constantly exposed to it weakens your immune system, increasing your risk of numerous health issues like heart disease, obesity and cancer.[17] In a 2022 survey by the American Psychological Association (APA), 34% of U.S. adults report feeling overwhelmed by stress brought on by multiple factors, such as work, relationships, health issues and financial concerns.[18]

These studies give better insight as to why stress is so detrimental to your health, as it hinders proper mitochondrial function and affects your cellular energy production. If your mitochondria are not functioning well, no doubt your risk for chronic degenerative diseases will radically increase.

Furthermore, since your brain is the most energy-dependent organ, it becomes particularly susceptible to impaired energy production due to faulty mitochondria. And when cellular energy production decreases, you have less energy overall, including for brain processing. Since your brain regulates your mental state, it can also affect your emotional well-being.

I recently wrote an article about the stress cycle and how you can break free to improve both your physical and mental health. There are three phases to this cycle:

1. Alarm phase — This is your body's immediate reaction to a perceived threat.

2. Resistance phase — This is your body's attempt to return to a state of balance, either by resisting or adapting to the stressors.

3. Exhaustion phase — Your body experiences reactions to the stress, including decreased immunity and fatigue. You may also become more likely to experience illnesses, due to stress hormones and cortisol taking their toll on your body.

Manage Chronic Stress with These Strategies

Everyone will experience stress in their lives — it is unavoidable. What isn't advisable, however, is chronic and prolonged stress, as it can be highly damaging to your well-being. The good news is there are healthy and proactive strategies that can help you manage stress to keep it from wreaking havoc on your physical and emotional well-being:

Get regular exercise — Being physically active can positively contribute to your physical and emotional equilibrium, mainly because it improves your mood and helps lower cortisol levels, which is your body's primary stress hormone. According to a 2022 study:[19]

> "Regular physical activity has a positive effect on the central nervous system (CNS) functions, contributes to an improvement in mood and of cognitive abilities (including memory and learning), and is correlated with an increase in the expression of the neurotrophic factors and markers of synaptic plasticity as well as a reduction in the inflammatory factors."

Being physically active can also promote longevity and reduce the risk of stress-related health complications.[20] One of the best low-impact, moderate-intensity exercise you can do

is walking outdoors in bright sunlight, which can multiply the benefits, as you also get to optimize your vitamin D levels.

Consume healthy, clean carbs — Your diet plays a significant role in your chronically elevated cortisol levels, and one primary reason is you may not be getting enough healthy carbs.

I've been following the work of the late Ray Peat, and one of the foundational health concepts that I've radically revised my thinking on as a result is the idea that eating a low-carb diet long-term is the best way to optimize your metabolic and mitochondrial health. It's not. Your body needs carbohydrates for optimal function.

Your body breaks down carbs into glucose. If you don't have enough glucose in your bloodstream, your body makes up for it by secreting cortisol. The cortisol breaks down your bones, lean muscles and brain to produce amino acids that are converted by your liver into glucose (gluconeogenesis).

However, elevated cortisol levels can increase inflammation and impair your immune function. As long as you're metabolically flexible, consuming more carbs will help lower cortisol. But don't be confused — don't choose refined sugars and carbs from processed foods. Instead, go for healthy carbs like white rice and ripe fruits.

In addition, I recommend avoiding seed oils, which are loaded with linoleic acid (LA), the most destructive ingredient in our modern-day diet. LA is far worse than refined sugar and is highly pernicious to your health because it prevents your mitochondria from working properly, causing oxidation, inflammation and mitochondrial dysfunction. I recommend reading my article on LA to discover why it is so damaging.

Stay creative and start new hobbies — Engage in activities and hobbies that not only encourage creative thinking, but also provide mental diversions to help rejuvenate your mind and body.[21]

Painting, writing or even learning how to play a musical instrument can all provide therapeutic benefits by stimulating your brain's creativity centers and reducing stress hormones. They also increase your feelings of happiness and satisfaction.

Incorporate self-soothing techniques — If you're dealing with difficult, heavy emotions, self-soothing techniques like meditation may help curb the intensity of stress responses. Practicing controlled nasal breathing slows down your heart rate and lowers blood pressure, activating your body's relaxation response. To help you build better breathing habits, check out my interview with Dr. Peter Litchfield.

Autogenics is another self-soothing technique, and it involves a series of exercises in which you focus on sensations of warmth and heaviness in different parts of your body to induce a sense of deep relaxation. Developed by German psychiatrist Johannes Heinrich Schultz in the early 20th century, it's based on the principle that physical relaxation can lead to mental calmness.[22]

Even crying may help soothe you, as it provides an outlet for pent-up emotions and stress. According to a randomized controlled trial published in the journal Emotions:[23]

> “Crying may assist in generally maintaining biological homeostasis, perhaps consciously through self-soothing via purposeful breathing and unconsciously through regulation of heart rate.”

Optimize your sleep — Getting sufficient, high-quality sleep not only allows you to rest, but also helps repair and rejuvenate your mind and body, enhancing cognitive function and improving mood. It makes you more resilient toward stress.

Make sure you establish a regular sleep schedule and create a conducive sleep environment so you can maximize the benefits of sleep. Exposure to bright light during daytime and complete darkness at night is also essential, as it helps boost your melatonin production.

Practice positive thinking and laughter — Maintaining a hopeful and optimistic outlook encourages your brain to produce stress-busting chemicals. Some of the best activities include mindfulness, spending time in nature and journaling.

I also encourage you to make it a habit to laugh and smile more. Laughter triggers the release of endorphins, your body’s natural stress-relievers, making it a potent antidote to stress.

Rewire Your Brain for Happiness

Being in a state of chronic stress is like living with a dark cloud hanging above you. It casts a gloomy shadow over every aspect of your life. It strains your relationships, messes up with your decision-making skills and ultimately puts your physical and mental well-being in jeopardy. That is why instead of always giving in to stress or stressful situations, I advise you to try the strategies above to rewire your brain for happiness and cultivate more Joy in your life.

One of the key lessons from my upcoming book, “The Power of Choice,” is that life is about creating Joy. I believe there is an important distinction between Joy and happiness. While happiness can be passive, Joy is active — it’s a verb representing the ultimate pursuit and realization of life’s purpose.

You hold the ultimate authority over the experiences you encounter, as they are entirely shaped by your individual choices. If your life lacks fulfillment, then it could be your true Self telling you to make different choices that could steer you toward a more satisfying existence.

I intentionally capitalize “Self” and “Joy” to indicate their deeper, transcendent nature. Self represents unlimited, immortal consciousness, while Joy denotes a profound state of contentment that emanates from within yourself.

Choosing to rewire your brain for happiness can be considered an act of Joy because it reflects an active engagement with life, a pursuit of meaning and a commitment to personal growth. It involves making conscious decisions and taking intentional actions that ultimately lead to happiness and a more fulfilling, satisfying existence.

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Notes

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