

Health

[MIND YOUR BODY]

Watered-Down Thinking

An unchecked immune system may have cognitive costs.

By Andrea Bartz

COGNITIVE ABILITY is determined by a stew of everything from genetics to early experience, sleep, diet, and more. But new research suggests that the immune system, the body's task force for warding off infections and battling the common cold, could also mediate brain power in a vital way.

Chronic low-grade inflammation—the mark of an overactive immune response—is linked with lower intelligence in young people, a study from the Karolinska Institute shows. Researchers found a strong, direct correlation between inflammatory chemicals in the body and lower IQ (compared to peers of similar backgrounds) in about 50,000 young men. The effect isn't limited to those with unusually high inflammation: Men with *mild* inflammation (still within the normal range) had IQs that were, on average, three points lower than the IQs of men with no inflammation. "That may



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not sound exciting, but that's not a small number for a population IQ average," says researcher Håkan Karlsson.

The Body's Double-Edged Defense

Inflammation isn't inherently bad for our bodies or brains—it's the body's defense system against invaders. When the

immune system detects an enemy (such as a bacterium or virus), it releases two kinds of proteins: cytokines, which recruit white blood cells and rush them to the pathogen for a battle, and complement proteins, which attack invaders directly. Zooming in to the molecular level, immune cells kill invaders by

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bathing them in modified oxygen atoms—better known as free radicals.

In the short term, the system works pretty well to stamp out a cold or heal a cut. But if the immune system acts up in the absence of invaders, inflammatory proteins streaming through the body attack healthy tissues. Why might a defense system go into overdrive? Sometimes the body's threshold for foreign invaders is too low—in allergy sufferers, for example, the immune system kicks into gear in response to harmless stimuli, like cat dander. But one immune system trigger, even in the absence of pathogens, is universal: fat cells, or adipose tissue.

"We're not sure why, but fat cells actually generate the release of inflammatory proteins," says Gary Wenk, a neuroscientist at Ohio State University. In other words, that spare tire around your waist makes your immune system act as if it were constantly battling attackers. Being overweight, researchers agree, is likely the biggest contributor to a hiked-up immune system and attendant inflammation—and certainly the trigger most within our control.

Fired Up and Dumbed Down

The artillery that works so well on invaders can easily invert to friendly fire. When the immune system is in attack mode, it produces free radicals at break-neck speed. In the absence of pathogens at which to aim the free radicals, the toxic oxygen atoms strike whatever's nearby, often damaging healthy cells. Studies have linked chronic low-level inflammation to hampered function in the liver, kidney, and lungs, to name a few victims.

The brain is another target of an overzealous immune system. Experimental evidence suggests that when inflammatory proteins coursing through

the body reach the hippocampus, they interfere with how cells communicate with one another, hampering working memory and essentially preventing memory consolidation and learning. Memory impairment could explain why the young men showed lower IQs than their less-inflamed peers.

The long-term effects on cognition are troubling, as well: Chronic inflammation seems to contribute to dementia, the degeneration of mental function. A study reported in the *Annals of Neurology*

noted that, compared with middle-aged men with the lowest levels of inflammation, men in the upper three quartiles were three times as likely to have developed dementia 25 years later.

"It appears that inflammation leads to dementia in addition to hurting memory," Wenk says. "The areas of the brain that are hit hardest by inflammation are the same parts that show pathology when Alzheimer's disease develops. There's a clear regional vulnerability centered on the hippocampus."

PROTECTING YOUR BRAIN

SCIENTISTS ARE STILL searching for an anti-inflammatory drug to calm the brain's immune response, as ibuprofen and aspirin do for the body. In the meantime, here are a few steps you can take to keep your overall immune response in check—and your brain inflammation-free.

■ **WORK OUT.** Exercising keeps body fat in check—and since adiposity is a big immune system trigger, staying trim keeps inflammation under control. What's more, exercise in and of itself may diminish systemic inflammation, according to a recent review article from Wake Forest University. Contracting muscle tissue secretes chemicals that inhibit the production of inflammatory proteins.

Workouts also have direct cognitive benefits, such as better blood flow to the brain and increased levels of brain-derived neurotrophic factor, which encourages the growth of neuronal connections—key to learning and memory.

■ **EAT LESS.** Pesky free radicals (which the immune system uses as ammo) don't come out of nowhere. Think back to your high school chemistry class: The food we consume (proteins, fats, and carbs) are strings of carbon; we get energy from the bonds between carbon atoms. Once the body plucks out the energy, it's left with unwanted carbon atoms. The solution is to truck in oxygen, attach the carbon debris to oxygen as it zips by, and exhale them both as CO₂.

At least that's how the system would work in a perfect world. In reality, rogue oxygen atoms often form free radicals—sometimes because the immune system needs artillery, and sometimes due to flukes. "Oxygen is an incredibly toxic, reactive molecule," Wenk says. "You'll have less of it in your body if you simply stop taking in so much food." Obviously, starvation isn't the answer, but putting a ceiling on your daily caloric intake limits the free radicals

produced—and that means a calmer baseline immune response.

■ **PICK PRODUCE.** High-fiber foods, like fruits and vegetables, actually prevent nutrients from being absorbed from the intestine into the blood. "If you don't absorb the nutrients, then you don't metabolize them; if you don't metabolize them, there's no opportunity for free radical production," Wenk says. Colorful garden fare also contains antioxidants that absorb renegade oxygen before it destroys nearby cells.

■ **STAY CALM.** Stress doesn't spark an unnecessary immune response per se, but it does cause your adrenal glands to release corticosteroids. The stress hormones make their way to the hippocampus, where cells weakened by inflammation will die. Keeping anxiety in check (say, by meditating) protects the brain from the one-two punch of stress hormones and inflammatory proteins.