Exercising Your DNA

You are stuck with the genes you've got—but it turns out you can change the way they behave with a good workout

BY ALICE PARK

BY NOW YOU'D THINK THERE WOULDN'T BE A LOT to add to the list of good things that can come from exercise. Anything that burns calories, builds muscle, improves mood and lowers your risk of heart disease, stroke and diabetes is pretty much doing its share already. But here's a surprising new plus: physical activity can change your DNA—for the better.

DNA is nothing less than the stuff that makes you you: the unique molecular code that dictates whether you have brown hair or blue eyes or a propensity for cancer. You are born with that DNA, and it doesn't change. But how you live your life—the things you eat, what you're exposed to in the environment—can affect what's known as your epigenome, the system that determines which genes are turned on at specific times and how long they're active. Researchers led by Juleen Zierath, a professor of physiology at the Karolinska Institute in Stockholm, have revealed that the amount of exercise you get can have an epigenetic impact. In a study published in the journal *Cell Metabolism*, she and her team analyzed muscle from a group of sedentary subjects who then exercised on a stationary bike, and the researchers concluded that even a single 20-minute workout can lead to epigenetic changes that help muscles work better.

Zierath recruited a group of 14 young men and women who first surrendered a tiny bit of quadriceps tissue under local anesthetic for a later biopsy. The volunteers then cycled on a stationary bike while the scientists analyzed their respiration to determine their exertion level. Finally, the subjects gave up one more sample of muscle within 20 minutes of completing the exercise.

It wasn't an easy day for the volunteers, but it was worth it—for Zierath and her team, at least. Comparing selected muscle-related genes before and after exercise, they found that certain ones were pumping out more metabolic proteins after the biking session. That improved performance was governed by methylation—the extent to which molecules known as methyl groups settle on top of the genes, regulating their activity. In muscles, this helps generate enzymes needed to burn calories and produce energy while you're, say, pounding away on the treadmill.

Additionally, this system turns out to be a lot more complex than a simple on-off switch. In a follow-up study, Zierath brought some of the same subjects back to the lab and had them exercise until they hit 40% of the exertion limit they reached in the initial session; on another occasion, they biked until they got to 80% of their maximum. Muscle biopsies taken after these sessions showed degrees of methylation that more or less reflected the amount of exertion.

The study is a big advance for the field of epigenetics, revealing the intricate choreography that the molecule groups follow as they dance around a muscle cell's genome. "We are trying to get at the early messages that the muscle [receives] to say, We need to coordinate so we can cope with the demands of this exercise," says Zierath. For the exercisers themselves, it's one more bit of proof that even the usually sedentary body was built for working out—right down to its genetic roots. ■

A single workout can activate genes that make your muscles perform better

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