March 31, 2015 12:56 p.m.

Genetic Doping Is the Next Frontier of Cheating in Sports

By **Joe DeLessio**

Photo: Digital Vision./Getty Images

Athletes have long sought to gain a competitive edge by using performance-enhancing drugs, and suppliers are perpetually trying to stay ahead of detection methods. But the future of doping in sports could be dependent on medical advancements that are currently being made with less nefarious intentions. Genetic doping — or the introduction of synthetic DNA into a person's body with the aim of improving performance in some way — could revolutionize the way athletes cheat, and it may be coming soon.

The origins of genetic doping have nothing to do with sports. Rather, researchers have been trying to develop ways to repair muscles in people with muscular disorders. Here's how it works: A synthetic gene is engineered to secrete a specific protein, one that's normally involved in muscle growth and repair. That gene is delivered by an otherwise harmless virus, and when it reaches the cell it's designed to work with, it "turns on." With access to more of the protein than would normally be produced, the damaged muscle is enhanced. Current techniques allow this all to happen without actually altering a person's genetic makeup.

But according to Dr. H. Lee Sweeney, a professor of physiology at the University of Pennsylvania Medical School who's worked to develop such treatments, healthy athletes could benefit greatly from similar methods. "The same things, if introduced into normal muscle, would make them much more responsive to exercise and training, and much more responsive to repairing themselves following an injury," says Sweeney. For that reason, Sweeney doesn't believe sports leagues and governing bodies will allow it.

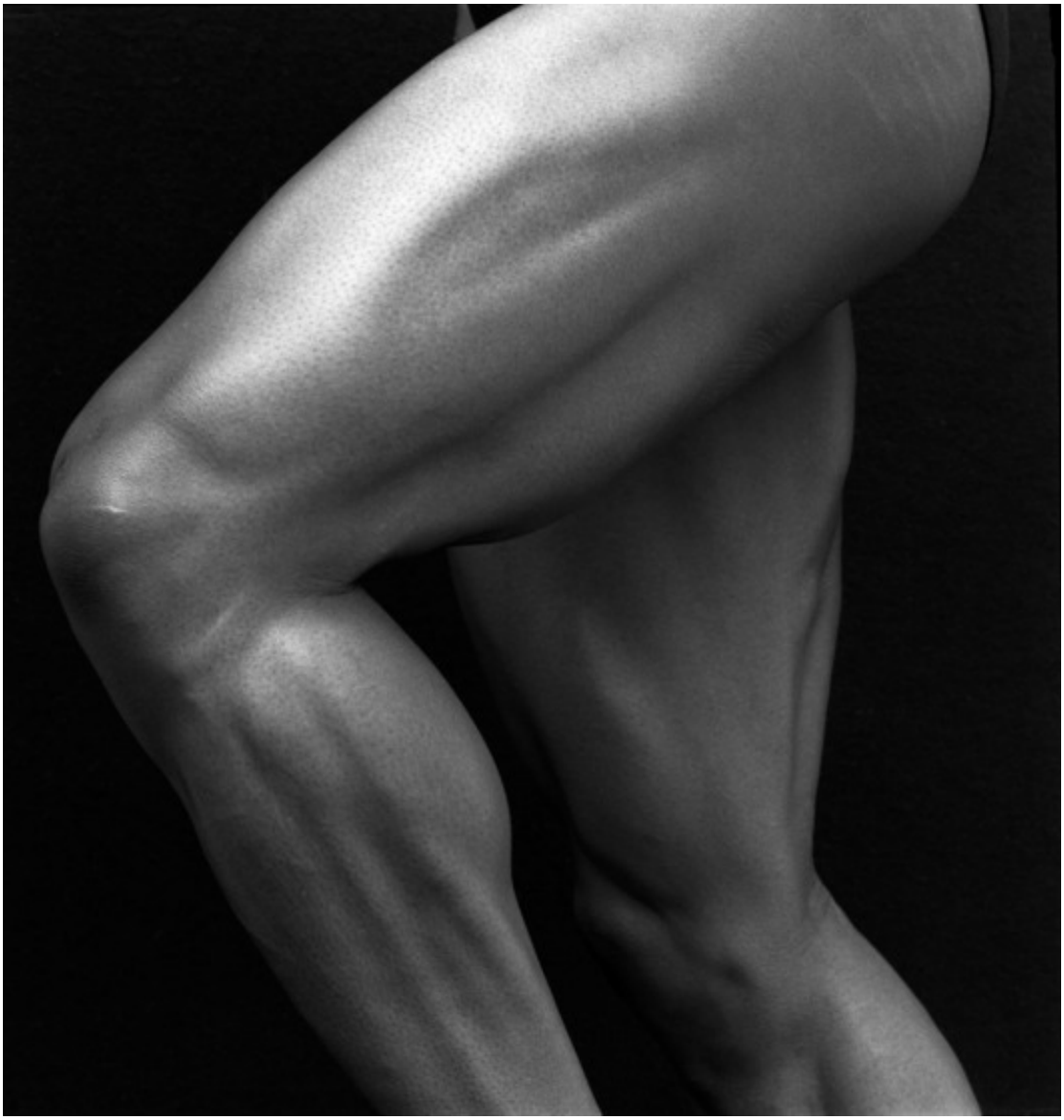

Photo: Joseph McNally/Getty Images

The change in muscle performance for an elite athlete could be substantial. The actual effect would depend on a number of factors (including the intensity of training), but in tests, lab rats who were injected and then made to do resistance exercises increased their muscle mass by 15 percent on top of what they would have normally achieved with exercise alone. More important to an athlete, the effects could last for years, if not decades. Researchers tested it on monkeys some 15 years ago and still haven't

seen the induced changes drop off.

Dr. Charles Yesalis, a professor emeritus at Penn State who's researched performance-enhancing drugs, says he expects this "cascade" method of doping — in which athletes trick their bodies into releasing more of something that would increase performance — will become increasingly common as new advances are made. And while he says there are different ways athletes could use such a method, "The No. 1 thing that comes to mind is genetic doping."

The medical advancements required to make these techniques widespread have come slowly, but progress is being made. Trials are under way for a localized procedure that would allow doctors to target specific muscles with simple injections. And while access to these viruses is limited at the moment, if an athlete could find a rogue scientist to provide him with these injections, in theory he or she could be using them right now. (A related method of doping, using antibodies to block molecules that interfere with muscular growth and repair, is even closer to approval.)

Photo: Cultura RM/JLPH/Getty Images

But in the future, instead of injecting genes into particular muscles, doctors will likely be able to deliver them to the entire body intravenously, thereby allowing an athlete to amplify the effect of training on every single muscle he or she works out. This would also allow athletes to bounce back from injuries faster — and do so in a way that would permanently enhance their muscles.

Sweeney says we're at least a decade away from such a technique, because in order for it to work, the athlete's immune system would need to be suppressed, so the body doesn't try to fight off what it identifies as a virus. It's a dangerous process that will take a long time to perfect, and it has yet to be tested on adult humans. Sweeney estimates that the earliest of those trials will take place over the next five years, and any timetable would depend on how well those trials go. "The timeline between now and when these would be available could be anywhere from ten years to who knows," says Sweeney.

In the meantime, the race is on to develop a test for genetic doping. Sweeney believes it could be done, because while the genes only activate when they interact with the desired cell, the viruses circulate into the blood stream, and would remain there for a few months. And so a blood test could be designed to prove the doping DNA is in a player's system. (While the effects are long lasting, after that months-long window, the only way to detect it would be to take a biopsy of the muscle.)

"It’s a big concern, and we’ve had the concern for a long period of time," says Dr. Don Catlin, the former director of the UCLA Olympic Analytical Lab and a key figure in the drug-testing community. But he says a reliable test is still a ways off. "The testing is way behind the times on that."