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Super, Sure, but Not More Than Human

By [GINA KOLATA](#)

THE urban legends about Lance Armstrong have been circulating for years: He's superhuman, a genetic freak, the one person on the planet so perfectly made to ride the Tour de France that competitors don't have a chance. The mythmaking only increased last week as Mr. Armstrong headed toward Paris in pursuit of his seventh consecutive victory in the tour, a feat unmatched in the history of cycling.

Edward F. Coyle, an exercise physiologist at the University of Texas who studies Mr. Armstrong in his human performance lab, saw the hype machine in action a few years ago. Bicycling magazine visited the lab during a testing session.

"We noted that his blood lactic acid levels were low," said Dr. Coyle, who is a cyclist himself. That is often interpreted to mean that an athlete does not tire easily. "Within five days of Bicycling magazine visiting my lab, before their article was even published, there were Web sites reporting that Mr. Armstrong had the lowest lactate levels ever recorded and that he was superhuman," he said.

But is Lance Armstrong that unusual? It depends on whom you compare him with.

Mr. Armstrong, for example, can maintain a power output of about 6.8 watts per kilogram of body weight for 20 minutes. "I would say there are probably no more than 20 people on earth with that ability, and probably at least 10 of them rode or are riding in the Tour de France," Dr. Coyle said.

But are Mr. Armstrong and these other elite cyclists so different from each other that if you gave an exercise physiologist anonymous power output data and other parameters like VO₂ max, a measure of how efficiently oxygen is delivered to muscles, the scientist could pick who would win the tour?

"Unfortunately, no," said Michael Berry, an exercise physiologist and cyclist at Wake Forest University. Science, he said, does not know enough about the complex interplay of physiology and performance, and there are factors that no one knows how to measure.

For example, those who recover quickly from arduous rides can have an advantage in the tour, which goes on for three grueling weeks with the racers covering up to 150 miles each day. "As far as I'm aware, research has not looked at that," Dr. Berry said. "What variable would you look at? Would you measure VO₂ max after they've had an exhaustive exercise bout? Are you going to look at a biochemical marker in the blood?"

Richard Coast, an exercise physiologist and cyclist at Northern Arizona University, agreed.

"When you look at elite athletes, cyclists or marathoners, you have to have the physiology to get to that point," he said. "But then, if you looked at the top half-dozen, you really couldn't tell the difference."

So the legends spread as a way of explaining why one person wins consistently. It happened with Miguel Indurain, a Spaniard who won five consecutive tours in the 1990's. Mr. Indurain's VO₂ max, according to a widespread rumor, was 95 milliliters per kilogram of body weight per minute, a level so high it is unheard of. The real number was 78, Dr. Coyle said, but researchers who tested Mr. Indurain were reluctant to put the true figure in their paper for fear of demolishing the Indurain myth.

In the case of Mr. Armstrong, Dr. Coyle has the true figures and they are impressive, although not superhuman. Mr. Armstrong publishes his vital statistics on his Web site: resting heart rate, maximum heart rate, lactic acid threshold and other measures like watts of power during endurance rides, an indicator of how fast he can ride for hours on end.

Mr. Armstrong's numbers may not be much different from other elite racers, but he has the average cyclist beat by a mile. A good recreational rider could generate about 4 watts per kilogram, which would translate to a speed of about 20 miles an hour on a flat road. Mr. Armstrong, Dr. Coyle said, would be traveling at 34 miles an hour.

"The average recreational cyclist could not get up to 34 miles an hour and if you launched them at 34 miles an hour, let them latch onto a car, say, and then let them go and said, 'O.K., keep it,' they could not hold that speed for more than 5 or 10 seconds," Dr. Coyle said.

Mr. Armstrong's VO₂ max is 85 milliliters of oxygen per kilogram of body weight per minute. An average untrained person has a VO₂ max of 45 and with training can get it to 60.

"Lance would be 60 if he was a couch potato and never trained," Dr. Coyle said. "For the average person, their ceiling is Lance's basement."

"I'm sure there are other Lances out there who have the same potential," he added. But they may not know it because they never tried to train. "They could get on a bicycle right now," he said, "and if they were willing to suffer they could ride with the average person who's been training for two years."

Training can make a huge difference to those who are genetically gifted. Mr. Armstrong, for example, had a lactic acid test after he had recuperated from cancer and had just begun to train again. He had 8 millimoles of lactate per liter of blood. The average person has a value of 12. But after Mr. Armstrong trained, his levels were 6, an astonishingly low number. "He has to train hard to have those very, very low levels," Dr. Coyle said.

Dr. Coyle said the difference between Mr. Armstrong and many of his competitors may be focus and training techniques. He said there were at least 10 cyclists in this year's tour who were potential challengers.

"If they followed Lance's preparation and rode on his Discovery team with the same great teamwork that Discovery has given him, and if they can muster the right mindset to believe they can really do it when it counts, they could be equally impressive," he said.

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