Scientific research indicates human athletic performance has peaked

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It merited only a few paragraphs inside newspaper sports sections. Crystal Cox, a member of the gold-medal-winning U.S. women's 1,600-meter relay team in the 2004 Athens Olympics, had admitted to using a performance-enhancing drug. Cox would lose her medal and be banned from competition for four years.

On the surface, the announcement last month seemed just another episode of sports doping and its sad consequences. But to many sports scientists, the news was evidence of a broader trend. They believe that human athletic performance has peaked, and only cheating or technological advances will result in a rash of new world records.

A French researcher who analyzed a century's worth of world records concluded in a recent paper that the peak of athletic achievement was reached in 1988. Eleven world records were broken that year in track and field. Seven of them still stand.

That paper and others published in the past two years suggest that the Olympic motto -- Citius, Altius, Fortius (Faster, Higher, Stronger) -- is becoming an anachronism.

"We saw a strong evolution of performance during the past century," says study author Geoffroy Berthelot, a researcher at INSEP, an internationally respected school and research institute for athletes in Paris. "Then in the 1990s we started to see a decrease in performance. Now, there are a lot of events that don't show any progression at all."

In track and field, Berthelot found, peak times have not improved in 64 percent of events since 1993. In swimming, performances stagnated in 47 percent of events after 1990, rising again around 2000 when new high-tech swimsuits proven to improve performance were introduced.

Achievement appears to have plateaued throughout the sports world. Records in winter sports -- which are, in general, younger than many summer sports -- are still on the rise, but in ever-smaller increments, says Carl Foster, director of the human performance laboratory at the University of Wisconsin, La Crosse, and past president of the American College of Sports Medicine.

"World records are indeed flattening," he says. "The likelihood that a world record occurs is becoming less and less."

The prospect that humans have given all they've got is generating some discomfort among elite athletes, trainers, researchers and sports federation officials, as evidenced by the furious interest in training methods and nutritional enhancements that may squeeze an extra hundredth of a second off a performance.

Some sports scientists predict a greater reliance on equipment or waning public interest in individual events. Others worry about heightened pressure to cheat.

"What happens when world records cease to be achieved on a regular basis?" says Conrad Earnest, director of exercise biology at the Pennington Biomedical Research Center in Baton Rouge, La., a leading science research organization. "I think the public thinks that athletes will get better and better. That's why they tune in to watch. I don't know if people realize that athletes can't keep improving at the rates that they have been."

Using history as his guide, Berthelot doesn't expect a banner Winter Olympics. His study, published in January in the journal PLoS One, is an exhaustive analysis of track and field and swimming world records over the past 109 years. It reported that athletic prowess peaked in 1943 and again in 1958, 1968 and 1988, correlating with periods of international conflict or economic wealth that stirred competitive juices.

Italian researcher Giuseppe Lippi has also concluded that human athleticism has reached its apogee. An associate professor in morphological-biomedical sciences at the University of Verona, Lippi analyzed world records ratified by the International Association of Athletics Federations from 1900 to 2007 in nine sports disciplines. He found that "improvement has essentially stopped or reached a plateau in several specialties."

Mark Denny, a marine sciences and biomechanics professor at Stanford, says athletic achievement is constrained by basic biomechanics. According to his statistical models, the maximum attainable speed for male sprinters is only a few percentage points greater than what has already been observed. Women have already reached their top speed, by his calculations.

Further, the global portrait of athletics is changing.

In the last century, Foster says, participants from many parts of the world have begun to compete. That makes it easier to find what researchers call "extreme outliers," people blessed with the right genetics and right circumstances to excel.

And elite athletes have squeezed every ounce of advantage from their training regimens. Most devote themselves to a single sport and utilize a team of trainers and coaches in pursuit of a competitive edge.

"Everyone in Vancouver is pretty much a full-time athlete," Foster said. "Once you become a full-time athlete, the body only does so much."

Technology has become so important in athletic competitions that the winner of an event may be the person with the latest gear.

Apprehension that technology may overtake sports was reflected in the decision last year by the International Swimming Federation to ban the kind of high-performance swimsuits that Michael Phelps used while winning eight gold medals in 2008.

According to Berthelot's paper, in the 2008 Beijing Games, the swimsuit was the determining factor in 21 of 22 world records.

The swimming federation "made a decision to go away from world records," Foster said. "You can make an argument that there may never be a world record in swimming again. We may have broken them all."

In today's sports, the wild card is science, says Lippi.

"Future limits to athletic performance will be determined less and less by the innate physiology of the athlete, and more and more by scientific and technological advances and by the still-evolving judgment on where to draw the line between what is 'natural' and what is artificially enhanced," he wrote in his paper, published in 2008 in the British Medical Bulletin.

Some observers fear an era of rampant doping as athletes seek an edge.

Peter Weyand, an associate professor of applied physiology and biomechanics at Southern Methodist University, used a series of biomechanics experiments on runners to show that humans could theoretically top the world-record speed of 28 mph, set by Jamaican sprinter Usain Bolt in 2008, ultimately reaching speeds of 35 or 40 miles

per hour.

The prediction, outlined in a paper Weyand published last month in the Journal of Applied Physiology, is based on the idea that humans could run faster if they were able to apply much greater force to the ground.

The speed at which muscle fibers contract limits how quickly a runner's limbs can apply force to a running surface. The key to improved speed, Weyand says, is to identify ways to allow muscle fibers to generate force more rapidly, such as through drugs, nutrients or gene transfer.

Use of gene therapies in sports is, so far, theoretical. But researchers believe it won't be long before athletes use substances or therapies designed to enhance their DNA.

Researchers at the Salk Institute in San Diego have shown that an experimental drug can reprogram how muscles respond to exercise. Mice given the drug could run farther than with exercise training alone. In an editorial in this month's issue of the journal Science, a leading genetic researcher warned that some gene therapies may be used by athletes before they've been tested in humans.

But performance based on science, not natural ability, may have less public appeal. And athletes who never improve may no longer hold our interest.

"Today we really focus on who is the best: Who are the summiters. Who can jump or run the highest," Berthelot notes. "Maybe we need to focus more on the competition; focus more on the winner of the race, not the fastest guy on earth."

Perhaps such a focus would have prevented Cox from using anabolic steroids in her relay race in Athens and having to hand over her gold

medal six years later.

Even if athletes don't get any better, says Foster, they're still pretty darn good. Just watch the replays of Bolt or tune in to speed skater Shani Davis' races.

"These people are just different to begin with, and they have devoted unbelievable time to their sport," he says. "Sometimes you look at them and say, 'This is as good as it can be done. This is as good as the human species can get.'"