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Citius, Altius, Fortius— Purius?

Doping and Olympic Athletes

By [Diane Kightlinger](#) | reprinted from the Aug/Sep 2004 issue.

Crossing the finish line in Athens this August should mark the climax of the athletes' quest to put native ability, training, perseverance, and courage to the test in pursuit of their Olympic moment. And provided that's all the athletes bring into play, they won't mind the team waiting on the side-lines to signal the start of the next challenge—the contest between the dopers and the testers.

The result can topple victors, strip medals, and bar athletes from competing, possibly for life. For now, the competitors know only that sometime between the victory lap and awards ceremony and press conference, the doping control team will take aside the top four finishers and two other randomly selected athletes to find out if they played true.

Faster, higher, stronger—and clean?

The pharmacopoeia

Drug testing in the Olympic Games began in 1968, a response to illness and death caused by widespread amphetamine use in prior decades. Since then, the estimate of how many athletes use performance-enhancing drugs in sport has ranged from almost none to almost all.

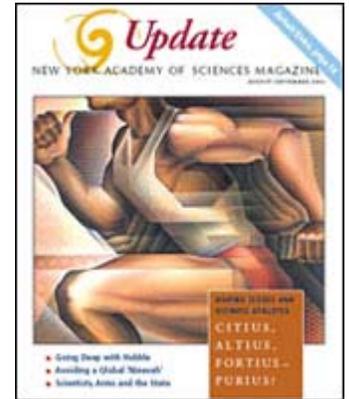
Look at test results and the dopers amount to less than 3% of athletes. Ask coaches and trainers and the number can rise as high as 90%, according to "Winning at Any Cost: Doping in Olympic Sports," a September 2000 report released by the National Center of Addiction and Substance Abuse (CASA) at Columbia University.

Today the pharmacopoeia of substances banned at the Olympic Games includes not only stimulants, but narcotics, anabolic steroids, beta-2 agonists, peptide hormones such as EPO (erythropoietin) and hGH (human growth hormone), and a shelf-full of masking agents. Add designer drugs like the steroid THG (tetrahydrogestrinone), around which the Balco scandal churns, plus the specter of gene doping, anticipated by the Beijing Olympics in 2008, and the testers face increasing odds of losing the detection game.

But don't count them out just yet. The researchers and administrators focused on catching dopers have won important battles in recent years by developing tests for THG and EPO and by using them to catch abusers.

Testers face increasing odds, but don't count them out just yet.

Testers are increasingly taking a proactive stance, anticipating their



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opponents' next moves and the techniques needed to identify illegal substances and methods. And the creation of the World Anti-Doping Agency (WADA) in November 1999 should soon result in near-universal standards for doping control across sports federations and countries.

Put to the test

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Whether in or out of competition, sample collection today is a painstaking ritual overseen by the athlete, his representative, doping control agents, and independent observers who act as the public's eyes and ears. The athlete selects a sealed collection vessel and provides a 75-ml urine sample in view of a doping control officer (DCO) of the same gender. After dividing the urine into A and B bottles, the competitor seals them securely and makes sure the DCO records the correct code on the control form. Blood tests employ a phlebotomist and similar procedures to obtain two tubes of at least 2 ml each.

On site, the DCO checks the urine's pH and specific gravity to ensure it will prove suitable for analysis, and the officer may also screen the blood sample for reticulocytes, hemoglobin, and hematocrit. Athletes must document all prescription and nonprescription drugs, vitamins, minerals, and supplements they take. Then all parties sign the doping control form, and the samples are sent by courier for analysis at one of 31 laboratories accredited by WADA.

But testing during the Olympic Games accomplishes only so much: it won't catch athletes who use steroids to bulk up during training but stop months before the Games—or those who use EPO much more than a few days before competition.

The solution is effective, year-round, no-notice testing.

According to Casey Wade, WADA education director, about "90%-95% of the solution is effective, year-round, no-notice testing. Give athletes more than 24 hours notice and they can provide a sample all right, but it's going to be free from detection."

The International Olympic Committee (IOC) requires most Olympic athletes to make themselves available for doping tests anytime and anywhere for one year prior to the opening of the Games. WADA plans some 2400 tests this year, with a selection process based on the requirements of each sport, the substances an athlete might use, when the abuse might occur, and how long the body will take to clear the drug from the athlete's system before the Athens Games start.

Once the Olympic village opens for the Games, the IOC will take charge of testing at sporting venues. WADA will continue to conduct out-of-competition tests inside and outside Greece, however, and at non-Olympic venues in Athens to determine which athletes will be allowed to take part in the Games.

The frozen finger of fate

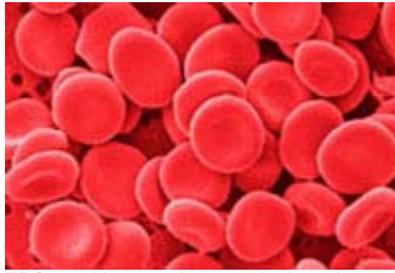
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The key to meaningful doping tests lies not just in the lab's ability to detect substances. It must also document the chain of custody meticulously enough to meet the burden of proof in court cases.

Once the samples arrive in the lab, scientists store the B bottle for use in confirmation tests and open the A bottle, withdraw multiple aliquots, and test for substances on the WADA prohibited list. The U.S. Olympic Lab at the University of California at Los Angeles, a preeminent testing facility, employs an array of mass spectrometry techniques to work through the samples.

"Mass spectrometry breaks up the molecules and sorts the resulting fragments by mass," said Don Catlin, the lab's director. "We can identify steroids by chemical moieties with characteristic masses but, for

example, THG was modified in such a way that it lacked those characteristic fragments, making it difficult to spot on conventional tests."



EPO provides an advantage by boosting red blood cell production. (Source: CMSP.com.)

THG posed only one of many challenges the lab has faced and overcome. Catlin said that the detection of EPO and hGH abuse is particularly vexing. EPO increases oxygen delivery to the muscles, and hGH enhances muscle growth. As potent substances, both appear only in minute quantities in body fluids.

"With methyltestosterone, you might have 500 ng/ml of urine. With EPO, you might have less than a nanogram," explained Catlin. "You have to extract the EPO from the urine, and the less there is, the more difficult it is to extract with good recovery."

But it gets harder. "Then you're faced with the final jolt: EPO has a molecular weight of 30,000-35,000, whereas most of the drugs we're working with have molecular weights of 300. EPO molecules are too large for our mass spectrometers, which means we have to use different approaches based on molecular biology. It's really tough work."

A long-acting form of EPO, darbepoetin, became available shortly before the Winter Games in 2002. The existing test for EPO could detect darbepoetin, but Catlin chose not to announce it—catching two gold medalists. Both were stripped of medals for events in which they tested positive in Salt Lake City and, later, of all medals they won at the Games.

For hGH, scientists, lab directors, physicians, and administrators have not yet agreed on a test, but that doesn't mean athletes can freely abuse the substance. WADA has placed hGH on the prohibited list, and DCOs will draw, freeze, and store blood samples during the Athens Games for later analysis.

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2 East 63rd St., New York, NY 10021
webmaster@nyas.org | 212.838.0230