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THE NEWS

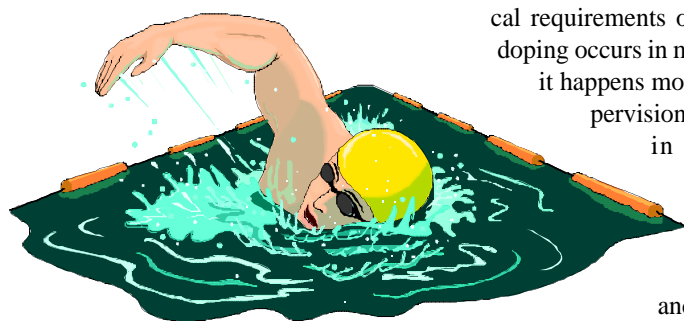
THE GAMMA SERIES OF THE ROYAL SOCIETY OF NEW ZEALAND

DRUGS IN SPORT

To compete in the modern Olympic Games, to win gold, to stand on the rostrum as the flag is raised and the national anthem played, is the dream of many. Every Olympic competition is a race to find the fastest, strongest and most determined athletes. Unfortunately, some are so determined to win that they resort to drugs to boost their performance. But these drug cheats are being outrun by scientists developing the latest drug tests, in a race without winners and with fair competition coming in last.

Ever since the first sports event at Olympia in Greece, athletes have been pushing the limits of physical performance. Today the top achievers' accomplishment is so close to what is the maximum possible for humans, that breaking a record often means being faster by just a few parts of a second. Some say we are so close to what the human body can ultimately do that even those who are most talented and subject themselves to the most rigorous training won't be able to go much further.

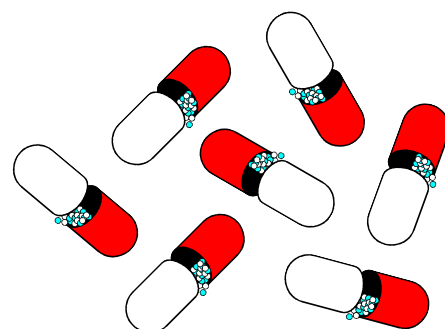
Modern sport is plagued by suspicions that many elite athletes use drugs to enhance their performance artificially. The use of performance-enhancing drugs has long been one of the darkest aspects of sport, but the shadow has grown longer in recent years as evidence accrues that athletes are turning to new drugs which are increasingly more difficult to detect.



At each Olympic Games a number of athletes are disqualified and banned from their sport because of doping. Many of the drugs used in sports doping are hormones, a group of chemicals found naturally in the body. Others are pharmaceuticals which are normally used only under medical supervision.

What is doping?

Doping in sport refers to the use of any banned method or substance that artificially improves an athlete's sporting performance to give an unfair advantage over other competitors. The fundamental ethos of sporting competition is the rivalry between highly skilled athletes who have attained their expertise through hard work and natural ability, rather than through banned doping practices. As some athletes want sporting success at any cost, they forgo any such ethical requirements of fair play. Clandestine doping occurs in many sports, and because it happens mostly without medical supervision and the drugs are taken in unintended amounts, every drug cheat risks serious injury and negative health effects. Many performance-enhancing drugs alter



the natural physiological balance of the body (often irreversibly) and can damage the body's immune system. Strategies for controlling doping are therefore necessary as a way of protecting athletes' health, ensuring equal opportunity for all competitors and deterring athletes from violating the ethics of sport and medicine.

Without a drugs-free sporting environment, there will always be doubt over whether an athlete's winning performance was a true reflection of natural ability or arose from a bottle of pills.

Which drugs are being abused?

Several drugs are used in sports doping. Some of them are medicines which have been developed to treat certain conditions, others are hormones, naturally occurring chemical messengers that regulate many of the body's functions. Used inappropriately or in high amounts, any of these chemicals will have negative health effects.

In an attempt to deter sports people from taking performance-enhancing drugs, the International Olympic Committee (IOC) has developed a set of rules which specify the substances banned from use by athletes.



Prohibited classes of drugs

Stimulants are used to increase alertness and hide feelings of

tiredness. They also raise body temperature, cause faster breathing, and an increase in blood pressure and heart rate.

Examples include ephedrine, once a remedy for asthma which increases blood flow through the working muscle, amphetamines which mask feelings of tiredness, and caffeine, an addictive stimulant which boosts the heart rate and blood flow to the muscles.

All can cause problems with co-ordination and violent behaviour. Caffeine also increases tremor and can cause sleep disturbances, chronic insomnia, anxiety, and depression.

Narcotic analgesics act as strong painkillers masking the pain of an injury. This group includes heroine and morphine. Both compounds cause loss of balance and a decrease in the ability to concentrate, sleepiness and slow breathing. An injured athlete who is taking painkillers so that they can continue to perform, risks seriously aggravating the injury.

Anabolic steroids are manufactured substances based on testosterone, a hormone produced in the testes of males and, to a much lesser extent, in the ovaries of females. Testosterone is partially responsible for the developmental changes that occur during puberty and adolescence and controls the build-up of muscle tissue. Because testosterone and related drugs affect muscle growth, raising their levels in the blood could help athletes increase muscle size and strength. Athletes who use anabolic steroids also claim that they reduce body fat and recovery time after injury. However, steroids can also cause acne on the face and back, high blood pressure, and violent and aggressive behaviour. Women may grow prominent hair over their faces and back and develop deeper voices, while men may develop breasts and a decrease in sperm production leading to impotence.

Diuretics are used to increase fluid loss from an athlete's body in an attempt to decrease body weight for sports with weight categories, such as boxing, weight-lifting and equestrian events. However, losing weight through loss of water can lead to dehydration and loss of essential minerals.

For a person competing in a physically demanding activity this can lead to circulation problems and collapse. Diuretics are also used in attempts to dilute an athlete's urine to avoid detection of steroids. But the use of these drugs can cause dizziness, headaches, and cramps, and can result in kidney and heart failure.

Peptide hormones are synthetic versions of hormones that occur naturally in the body. The body's hormones are produced by glands and are transported around the body in the bloodstream. Because of their importance in the growth and development of organs and tissue, hormones are the main target in the development of performance-enhancing drugs. Examples include human growth hormone and erythropoietin.

Human growth hormone (hGH; also called somatotrophin or somatotrophic hormone) promotes physical development – particularly the growth of bone – during adolescence. It stimulates the synthesis of collagen, which is necessary for strengthening cartilage, bones, tendons, and ligaments, and also stimulates the liver to produce growth factors. In adults, hGH increases the number of red blood cells, boosts heart function, and makes more energy available by stimulating the breakdown of fat.

Erythropoietin (EPO) hit the headlines in 1998 when the Festina-sponsored cycling team in the Tour de France was disqualified after being caught red-handed with large quantities of it and other banned substances. Manufactured naturally by the kidneys, EPO stimulates the production of red blood cells in bone marrow and thus regulates the concentration of haemoglobin in the blood. Red blood cells shuttle oxygen to the cells, including muscle cells, enabling them to operate aerobically. By injecting EPO, athletes aim to increase their concentration of red blood cells and, consequently, their aerobic capacity.

The fact that these drugs occur naturally in the body sometimes makes detecting their abuse difficult.



Restricted classes of drugs

Some substances are only banned by certain

sports. For example, alcohol and marijuana use is prohibited in motor sports, and drugs known as beta-blockers, which steady hand

movement, are banned in sports such as shooting, snooker, and archery.

Of course, sometimes athletes take certain drugs legitimately. For example, antibiotics are used against infections, diabetic sports people rely on insulin, and some athletes need to take medicines to prevent asthma attacks. Athletes taking drugs legitimately are required to provide declarations from a medical professional that the use of such drugs is necessary for medical reasons.



History of sports doping

The use of drugs to assist sporting performance has a long history. From 400BC, the role of sport in

Greek society was as prominent as today. Mass spectator sport was the order of the day and rich prizes for winners led to the demise of amateurism and the emergence of professional athletes. Victory in the ancient Olympics ensured rich rewards in the form of money, food, housing, tax exemptions and release from army service.

Not surprisingly, bribing and cheating became commonplace, and there is evidence that competitors were willing to take performance-enhancing substances, including mushroom and plant extracts. Drug use was ultimately one of the major reasons for the dissolution of the ancient Olympic Games.

There is also evidence of drug taking in the Roman Empire. Gladiatorial competitions and chariot races were a major source of public entertainment; chariot racers fed their horses substances to make them run faster, while many gladiators were “doped up” to make their fights sufficiently vigorous and bloody for the paying audience. The Christians found the bloody nature of many Roman sports unacceptable, and all forms of “pagan” competition, including the ancient Olympics, were banned. The idea that physical development hindered intellectual development was widely encouraged and accepted, and sport did not re-emerge until the 19th Century, in rural England.

During the 1800s, doping substances used by athletes included caffeine, alcohol and opium. During the early 20th Century, boxers were given strychnine or mixtures of brandy and cocaine to help them fight, and oxygen gas was given to footballers to improve their performance.

During the 1950s, amphetamines were taken by some cyclists, followed 10 years later by the widespread abuse of steroids by athletes in events requiring strength, such as weight-lifting. Most recently, swimmers and athletics competitors were caught using EPO. In 1998, the Tour de France, the world's pre-eminent bicycle race, was thrown into disarray as investigators found caches of the drug in team vans, in car trunks, and in the hotel rooms of competitors; a subsequent investigation concluded that use of the drug was endemic among cycling's elite.

The use of human growth hormone may be just as widespread. In 1996, some athletes dubbed the Atlanta Olympics the "hGH Games". Around that time, a Latvian company was doing brisk business harvesting hGH from human cadavers and selling it for athletic use. In early 1998 a Chinese swimmer on her way to a competition in Perth was detained at the airport when she arrived with 13 vials of hGH packed in a thermos bottle.



Doped to death

The first recorded death as a result of sports doping was in 1879 when an English cyclist in a race in France died from an overdose of amphetamines. At the

1960 Olympiad in Rome a Danish cyclist died from taking the same drugs. EPO is blamed for the deaths of about 20 European riders since 1987. Although there is no hard proof that EPO caused the deaths, some doping experts believe the riders' blood thickened fatally after they took too much of the drug. Despite the 1998 Tour de France scandal and the deaths, experts say EPO is still ubiquitous in cycling and is also widely used in cross-country skiing, long-distance running and swimming.

The televised death, probably due to amphetamines, of cyclist Tommy Simpson in the 1967 Tour de France kicked the IOC into action against doping.



Testing for drugs

Testing for stimulant abuse started in 1968 at the Olympics in Mexico City,

and the first wide-ranging drug testing regime was set up for the 1972 Games in Munich. The issue of doping was highlighted at the Seoul Olympics in 1988 when champion sprinter Ben Johnson tested positive for the anabolic steroid Stanozol. Johnson, along with two gold medal weight-lifters also found to have used the drug, was stripped of his medals and banned from further competition. In 1999, Linford Christie, Britain's 1992 100-metres Olympic champion, tested positive for nandrolone, a banned anabolic steroid. New Zealand swimmer Trent Bray also tested positive for the drug and the subsequent furore turned the spotlight on the laboratories that strive to keep athletics free from illicit drugs. Athletes claim that positive results for nandrolone can occur as a result of natural metabolites in the body or the consumption of food supplements. Anti-doping scientists, meanwhile, say their tests have been expertly calibrated to avoid such pitfalls.



Test methods

Anabolic steroids and their by-products can generally be

detected quite easily in urine, using mass spectrometry. However, since they occur naturally and their levels vary from person to person, setting a threshold above which an athlete is deemed to be "using" anabolic steroids remains a subject of debate.

Testosterone and a related compound, epitestosterone, are eliminated from the body in urine. When an athlete takes anabolic steroids, the ratio of testosterone to epitestosterone (the T/E ratio) increases. The IOC states that an athlete is guilty of doping if his/her urine sample shows a T/E ratio above six.

But there are problems with this test. For example, British athlete Diane Mohdahl had a 4-year competition ban lifted after demonstrating that a high T/E ratio detected in her urine sample could have been caused by bacterial contamination. Another problem is that some athletes have been shown to have a naturally high T/E ratio, so that the threshold of six could be set too low. Alternatively, athletes with a naturally low T/E ratio may not go above six even if they are taking additional testosterone.

Scientists have been working to develop more reliable tests. One promising approach involves the use of an isotope ratio mass

spectrometer, which can detect differences in the ratio of carbon isotopes in different compounds. This technology can distinguish between testosterone produced naturally by the body and synthetic compounds.

Once **human growth hormone (hGH)** is injected by a drug-user it breaks down quite quickly into other products. Scientists in Australia and elsewhere have monitored changes in the bodies of athletes following the administration of hGH and have detected molecular "markers" – usually breakdown products detectable in urine or blood – that could be used as indirect evidence of doping.

Erythropoietin (EPO) levels in the blood do not remain elevated for long, making detection difficult. The standard test doesn't measure EPO levels; rather, it measures the concentration of red blood cells in a blood sample. But because this test is only an indicator of possible EPO abuse, more reliable tests are needed.

Scientists have also developed techniques to distinguish molecular differences between the EPO produced by the body and that manufactured in the laboratory. Yet another method being developed by Australian scientists uses blood profiles to detect athletes with a disproportionate number of young and maturing red blood cells.

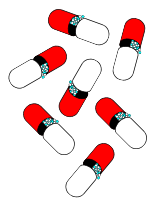
Testing in New Zealand

Sports doping control in New Zealand is co-ordinated by the New Zealand Sports Drug Agency (NZSDA). The IOC instigated regular drug testing of New Zealand athletes in 1989, before the 1990 Commonwealth Games in Auckland. The NZSDA was set up in 1995 as a Crown Entity with a board of directors appointed by the Minister of Sports. Around 1000 athletes are now drug-tested annually. Anybody taking part in a sporting competition can be randomly selected for a drug test. Sporting organisations also provide the NZSDA with names of elite athletes so they can be tested between competitions. From 1994 to 1999, the agency conducted 3915 tests for drugs with 49 positive results.

An athlete selected for a drug test is required to provide a urine sample. From the time of the request until the sample is collected the athlete is supervised by a chaperone so that any manipulation of the sample is prevented.

The urine sample is then split into two bottles which are sealed by the athlete. Both bottles are sent to a drug-testing laboratory in Sydney (one of only 27 such laboratories

world-wide holding IOC accreditation), where one bottle is tested for the drug. If the test is positive, the second sample is also tested as a control. If the positive test result is confirmed, the athlete is usually banned from competition for 2 years after a first offence, and for life after a repeat offence.



Is doping worth it?

Perhaps more than in other countries, governments of communist states used to encourage coaches to feed athletes a cocktail of drugs to secure as many gold medals as possible – at any cost. Now,

with increasingly more accurate tests available, the drug cheats are being caught, and the health consequences are catching up with those who chose to abuse drugs. Several sports officials from the former East Germany face prison sentences, but the athletes fare even worse. Many have developed liver and heart problems several years after taking the drugs – often unwittingly – and some are suffering from cancer.

The call for clean sports competitions is now supported by the sporting community and governments the world over. Australia and New Zealand are part of a group of countries to have established government-sponsored independent drug-testing

agencies, and many sport clubs are emphasising fair competition and personal achievement as the main values.

On an individual level, how could anybody be proud of a medal won with the artificial help of pills and lies?

Acknowledgements

Author: Veronika Meduna

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Websites: www.nzstda.co.nz

www.ausport.gov.au/asda/

www.olympic.org

Editors: Gill Sutherland, Colin Walker

Table Classes of drugs and their effects.

	Anabolic steroids	Diuretics	Stimulants	Narcotic analgesics	Beta-blockers	Blood doping	Peptide hormones
Examples	Nandrolone Stanozol	Frusemide Spironolactone	Amphetamine Cocaine Caffeine	Heroin Codeine Methadone	Atenolol Oxprenolol Propranolol	Erythropoietin	Growth hormone
Effects	Increases muscle mass, aggression, training ability	Weight reduction, masks other drugs	Increases alertness, delays fatigue	Kills pain, induced feeling of euphoria	Slows the heart beat and steadies movement	Increases number of red blood cells	Increases muscle mass
Sports	Weight lifting, football, swimming	Weight lifting, boxing, wrestling	Most sports, counterproductive in shooting	Shooting, not useful for endurance sports	Archery and shooting	Cycling, long-distance running, cross-country skiing	Power sports, track and field
Testing	Urine test	Urine test	Urine test	Urine test	Urine test	Blood test	Urine test
Complications	Menstrual irregularity, deeper voice, acne	Dehydration, stomach cramps, loss of minerals	Restlessness, anxiety, faster heart rate	Aggravating injury	Causes asthma symptoms		Enlargement of fingers, toes, facial features; diabetes
Severe reaction	Heart, liver disease, sterility	Cardiac arrest kidney failure	Severely high heart beat, addictive	Overdose may cause stupor or coma	Severely slow heart rate	Blood thickening	Not yet known

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