

1:

There are various theories about the origin of the term “doping”. The view that the term derives from the Boer dialect of South Africa has met with wide acceptance. In the lexicon the term “doping” does not appear before the 20th century. Today the term “doping” refers to any kind of manipulation in the field of sport, but it is also used in other areas.

2:

Doping can be taken to be the English form of the present continuous, that is, to be in a state of “dope”. In the language lexicon “to dope” is also translated as “to give a box on the ear”.

It was thanks to the International Olympic Committee that the term caught on in sport. This body published a list, for the first time in 1967, stating which substances or substance groups were prohibited in a sporting context, either because they actually facilitated an illicit enhancement of performance or because they were being used in the supposition that this would be the case.

This list of prohibited substances and methods is still today the most practical guide to the understanding of the term “doping”.

3:

As has been mentioned previously, the term “doping” is not just used in sport or in a competitive context. Anyone who is found, either in preparing for a competition or in the competition itself, to have prohibited agents in his/her body, or is shown to have used a prohibited method, must be suspected of doping.

Because of their effectiveness, effective agents that are prohibited in the field of competitive sport are also used in leisure sports. As here we do not have to do with misconduct in the sporting sense, seeing that persons who practise leisure sports do not as a rule enter competitions in order to win, but rather are concerned to attain other goals, like the athletic ideal of the ancient Greeks for instance, “drug abuse” can be taken as the most appropriate label for the misconduct that is here involved.

4:

There are many definitions of doping. None of the general definitions on its own is suitable as a means of combating doping. Consequently the list of prohibited substances remains the best working tool for the purpose. Nonetheless, the WADA has taken care to ensure that the general definition and the specific criteria referred to in drawing up the list agree with one another.

The following criteria for doping are highlighted, in the general definitions as well:

1. Artificial enhancement of performance
2. Risk to the health of the athlete
3. Contravention of the rules of ethics.

5:

Concern for the health of the sportsman or sportswoman is one of the criteria on the basis of which doping is prohibited.

Effective agents are ingested, so long as they are not supplied by the black market or other shady sources, in the form of pharmaceuticals. Effective agents in

pharmaceuticals are given to the patient in order to bring about the recovery of the sick person or to reduce pain.

Sportsmen and sportswomen as well may have need of pharmaceuticals, if they are suffering from an illness, or if their body suffers damage as a result of physical overexertion or accident. But the intake of pharmaceuticals must be shown to be necessary on the basis of medical examination, seeing that the effective agents in the pharmaceuticals have side-effects as well, which have to be taken on board as part of the treatment of the individual's condition.

The effects and side-effects of pharmaceuticals may be dangerous to health if they are taken without having been prescribed by a doctor. All the organ systems of the sportsman or sportswoman may be affected here.

6:

Even as early as the Olympic Games of Ancient Greece, historians have described attempts to enhance athletic performance through the use of all kinds of foodstuffs.

In the first Olympic Games of modern times, as well, there is proof that wine or strychnine, for instance, was taken by athletes to give them increased endurance. In 1960 there was a death at the Olympic Games which was associated with the proven intake of stimulants.

At this point the International Olympic Committee focussed with increasing attention on this phenomenon, and established a Medical Commission, which in 1964 formulated a first definition of doping. After that, the groups of effective agents were summarised in a list as long ago as 1967, being defined as prohibited substances.

Samples were taken from athletes for the first time at the Olympic Games of 1968 in Mexico and Grenoble, in order to discover whether they had prohibited substances in their bodies.

If in 1968 a total of 754 checks produced one positive result (owing to alcohol), at the summer Olympics of 1972, in Munich, 2079 checks registered a total of seven positive results. At the Winter Olympic Games in Sapporo, out of 211 checks there was one positive result (owing to ephedrine).

7:

At the time of the reunification of Germany it became evident that doping was a secret political plan in the GDR.

As early as the year 1974, those substances that went by the name of anabolic steroids were put on the list of prohibited agents. The taking of urine samples came to be an established practice, and was accepted as a means of proving the presence of the prohibited agents.

As well as gas chromatography, mass spectrometry became a part of doping analysis. Doping analysis has continued to develop to the present day, by incorporating the latest results of scientific research and the technology of analytical procedures.

As further experience showed which effective agents were being used for doping purposes, the list of prohibited agents continued to be extended through the addition of new groups of agents and methods. The increasing number of checks and sanctions meant that doping could be monitored, even if it could not be done away with completely, and "doping swamps" were repeatedly discovered which needed to be drained.

The first world conference against doping took place in Ottawa in 1988. One result of this conference was the International Olympic Charter against Doping, at which, for instance, the responsibility of sporting institutions and public administrative authorities in the fight against doping was formulated. As long ago as in the year 1989 the anti-doping convention of the European Council was drafted, and all countries urged to subscribe to it. In this convention as well the responsibilities of national governments and sporting institutions are set forth.

8:

In the period following on from this, the fight against doping came into the limelight. With ongoing pharmaceutical developments, in particular, complex substances intrinsic to the body came to be available on the market as effective agents tending to enhance performance, strength and endurance. Among these were such substances as the hormone erythropoietin (EPO), which stimulates the formation of the red blood corpuscles, as also the growth hormone and other hormones known as peptide hormones.

Prohibited substances can also bring about an effect of enhanced strength in the sphere of training. This made it necessary to monitor the abuse of such prohibited agents not just in a competitive context, but also in the phase leading up to competition, in the training phase.

Although training checks were called for at an early stage, it was some time before a system of training checks could be organised.

There is no unified system of training checks. International federations implement such training checks, as do national administrative authorities and sports organisations.

9:

In the nineties increasing attention was paid, in this connection, to the body-building scene and the rapidly growing fitness studio market.

The body-building movement has been around since the end of the 19th century: the first body-building "contests" were held in the USA in 1906.

Since the middle of the seventies fitness studios have become very popular. Body-builders as well made use of this new commercial opportunity. Fitness studios are concerned, however, to realise aspects of health by training specific parts of the musculature. All the same, it can be clearly seen that substance abuse (especially of substances that tend to develop body and muscle) has been practised by those who patronise fitness studios in their efforts to achieve a particular bodily tone.

Doping is a problem for sport and for society. For this reason the European Union approved an anti-doping code of behaviour as long ago as in the year 1993.

All the same doping goes on grabbing the headlines in a big way, as most recently in connection with the Tour de France in the year 1998. This doping scandal was the trigger for the World Conference against Doping in the year 1999, in which further proceedings to combat doping were resolved upon by national governments and international sports institutions.

10:

The list of prohibited agents and prohibited methods has now developed over a period of some decades. Today this list is based on a certain system. There are

classes of substance that are prohibited generally, and other substances that are prohibited in certain types of sport.

For various reasons it was necessary to establish critical levels of concentration for some substances.

Other substances are required for therapeutic purposes, and these are allowable if the need for them is medically attested and if notice is given that they are being used. The methods prohibited include all those measures which could either lead to a manipulation of the urine sample, or could increase the capacity of the blood to carry oxygen or change the composition of the blood.

11:

With the ongoing development of the list of prohibited substances, the classes of prohibited agents have been extended. Today we can distinguish between five different classes of prohibited agents. For each of these classes of substances a few examples are listed, while the phrase “..... and related effective agents” makes it clear that the list of examples is not conclusive.

The group of anabolic effective agents is subdivided into the anabolic/androgenic effective agents on the one hand, and the β 2 agonists on the other. Anabolic steroids are related to steroids, while the β 2 agonists are drugs which have the side-effect of enhancing the buildup of the musculature.

The peptide hormone group shows great variations in the effect produced. Here we have to do with natural hormones, the effect of which can also be produced by similar substances. For this reason they are known as “mimetics”. Prohormones, which are transformed to a prohibited hormone within the body, are likewise prohibited.

These prohormones are not subject to prescription in all countries, so that they can be freely purchased over the counter.

12:

Stimulants were the first group of effective agents which were placed on the doping list that was drawn up in 1967. This group of substances includes very different agents, both natural agents and their derivatives and those that are artificially produced.

Amphetamines were developed in the first third of the last century, and soon targeted for use by the military in particular. The effect of these substances did away with the feeling of tiredness, enhancing performance in spite of exhaustion. The side-effects of the stimulant were either not known or else they were simply ignored.

Ephedrine is a group of effective agents that are derived from a stimulant that was discovered in the Chinese plant ma huang (*ephedra sinica*). Today these substances are still included as an ingredient in many pharmaceuticals, like those prescribed for the treatment of general influenza conditions, for example.

Caffeine was discovered in coffee beans, and it is also an agent in tea. Caffeine is also found as an effective agent in other plants like the guarana, native to Brazil, and in cola nuts.

Finally cocaine, an effective agent in the South American coca shrub, may be used to alleviate pain, or misused as a stimulant to bring about a state of psychic illumination. This is an ancient drug which was already known to the ancient peoples of South America, and the use of it is widespread in society today.

Stimulants continue to be used in sport. In the doping analyses registered by the IOC over a period of three years, totalling more than 7000 substances, in around 23% of

the cases the presence of stimulants was established. That puts this group of effective agents among the most frequently misused doping substances, second only to the anabolics.

13:

Stimulants can be described as drugs which stimulate the body, acting directly on the nerves. They can pass through the barrier of the blood and the brain, and so also have effects on the central nervous system. The fact that they operate from this site explains the suppression of fear or exhaustion that they bring about. Their effect is so powerful that an athlete will no longer realise how exhausted he is, and there have been cases of overexertion leading to death, especially in top-level competitive sports. Associated with these effects, dehydration may also occur as a result of prolonged effort, and generally hyperthermia as well.

It is true that cocaine is hardly classified as a drug that has the same effect of performance enhancement as the amphetamines, but it cannot be ruled out that high levels of physical stress may be made psychically more bearable in the short term through the intake of cocaine.

Amphetamine abuse is found above all in activities that call for a high degree of staying power and consume a lot of energy.

Mountaineering amateurs, for instance, were requested to give a urine sample on the peak of a mountain. In something over 3% of the cases amphetamines were found in the urine samples.

We can assume, then, that the abuse of stimulants takes place in our society, and not just in isolated incidents.

14:

As the stimulants that have the most powerful effects, amphetamines and cocaine are also particularly dangerous because they are potentially highly addictive. In what follows, then, their range of side-effects will be described. The side-effects of amphetamines are based almost exclusively on the stimulation supplied to the sympathetic nervous system.

This has a directly stimulating effect on the heartbeat frequency, so that, depending on the dose, an increase in the heart rate results which can reach unpleasant proportions, with the heart racing. The regulation of the blood pressure is also disturbed, as is the heart's conduction system. Further unpleasant effects on the vegetative system are sweating and a sensation of cold, along with shivering. Sometimes the pupils will also be dilated. States of excitement after the intake of stimulants are widespread and have been thoroughly documented. Undesirable respiratory depression is another symptom that may occur. When the effect of the stimulant wears off, unpleasant effects may sometimes follow, such as nightmares, unpleasant states of feeling or exhaustion.

15:

The more frequently stimulants are used, the higher the dosage becomes if the desired effect is to be experienced. This can lead to lasting damage as a result of the persistent disturbance of the conduction system and over-stimulation of the heartbeat, while the temporary state of high blood pressure may develop to a chronic disease. There have also been reports of cerebral haemorrhages. Other side-effects

of chronic abuse are muscular tics, which can reach the intensity of Tourette's syndrome. A further side-effect is the inhibition of the appetite centre, which leads to a reduction in the amount of nourishment taken, while marked physical agility is shown at the same time. Chronic abuse of stimulants therefore results in emaciation. A particularly dangerous side-effect of amphetamines and cocaine is the intensity of addiction they give rise to. These stimulants are in consequence subject to particularly strict regulations everywhere: they have to be prescribed, and cannot be purchased over the counter.

16:

The side-effects of amphetamines on the heart are to be put down to the stimulation of the sympathetic nervous system. There are also reports of cerebral haemorrhages, as an occasional side-effect. Cocaine on the other hand leads to a depolarisation, and so to disturbances of the conduction system. One possible result of this is a racing heart. In a case of chronic abuse, these side-effects may issue in a chronic disease of the heart muscle (cardiomyopathy). After amphetamine abuse it can happen that the pulmonary blood pressure rises. But it seems that a certain predisposition must be present for this side-effect to develop. The misuse of amphetamines and cocaine can damage the musculature, leading to the destruction of tissue through myoglobinuria. This can result in serious damage to the kidneys. The stimulation of the sympathetic nervous system may also give rise to an increase in bodily temperature, which may go above 40° C.

Reduced appetite and dryness of the mouth are an expression of the reduced blood flow to the mucous membrane of the stomach and intestine, with the risk that ulcers may develop. In case of an overdose, nausea and vomiting may follow as an immediate reaction.

When toxic doses are taken, the side-effects listed above will be still more marked. Life-threatening states may result, and there have even been reports of death occurring.

17:

Amphetamines and cocaine act principally on the central nervous system. The latter's neurones are overstressed, so that a lowering of the sensitivity threshold comes about.

In a state where the central nervous system is over-stimulated, another notable side-effect that occurs is irritability, which may go as far as aggressive behaviour and a delusory idea of one's own powers.

At least for temporary periods, disturbed sleep patterns and a general sense of discomfort will usually occur. In cases of long-term abuse, depressions or psychoses of varying degrees of severity may develop, which may in certain cases result in suicide.

Chronic abuse, which results in ever increasing doses as tolerance of the drug develops, leads to paranoid states, hallucinations and stereotypical motor patterns. The ongoing suppression of the appetite centre leads to emaciation and loss of appetite (anorexia).

18:

Narcotics are the second group of prohibited agents. This group includes all effective agents which act on the central nervous system to bring about the desired effect, namely the reduction of pain.

These are very powerful substances. All the active ingredients that belong to this group are more or less related in chemical terms to morphine, the active ingredient in morphium, opium and heroin.

These substances produce an effect by acting on the brain stem, just above the point where the spinal cord enters the brain.

In this overall picture of the brain, the point where the substance acts cannot itself be made out. If we wanted to see the actual point where it acts, we would have to dissect the brain lengthwise.

Pain caused by over-training or other factors may be combated in a general way by the use of these powerful analgesics, but they have powerful side-effects as well. These may produce somewhat negative effects, especially in a competitive situation. Consequently the use of these analgesics as a doping agent is documented only in rare cases. In positive tests carried out worldwide over three years, an average of only around 1% revealed the presence of narcotics.

19:

The side-effects of narcotics are various. As all the effective agents from the narcotics group that are on the list of prohibited agents can be derived from morphine, they are all more or less strongly addictive.

As well as studies carried out on sick individuals, there have also been studies carried out on the effects and side-effects of narcotics using healthy volunteers. On the basis of these studies, the following results can be set forth.

Ingestion of the drug on just one occasion may already produce various side-effects in addition to the desired effect of pain relief. These do not occur in all cases, but are still relatively frequent. Among these are "doziness", confusion, dizziness and mood swings.

Nausea and vomiting are the result of the action of narcotics on the stomach and intestinal tract; in some cases slight respiratory depression may occur, and there may also be sweating and disturbed vision caused by the narrowing of the pupils.

In case of prolonged or more frequent use, as well as the effect of habituation, constipation results, and the danger of dependency increases very rapidly.

Besides the psychic and physical side-effects, other effects have been described, particularly itchy skin, which has been discussed as a genuine side-effect.

It is in any case a cause for concern that the ingestion of powerful analgesics of the narcotics class, corresponding to the IOC's prohibited list, is a danger to the health of those engaged in sport when not taken under doctor's orders.

20:

Anabolic agents accelerate the buildup of protein, in particular in the musculature. They may be substances derived from the male sexual hormones (anabolics), or alternatively other effective ingredients which have a marked anabolic side-effect, such as for example the beta 2 agonists. They may be taken in the form of tablets, or else given as an intramuscular injection.

Anabolic agents produce a positive nitrogen balance in the body, with the result that the biosynthesis of protein is enhanced.

Anabolic substances have an effect on the musculature in particular, when training is carried out under the influence of these agents.

As substances that are related to the male sexual hormones, anabolics have the side-effects that would be expected. These are also sexually specific. The beta 2 agonists, on the other hand, have other side-effects, corresponding to the site on which they act, namely the beta receptors.

As well as the anabolic steroids, the group of beta 2 agonists has also been found to act anabolically as a side-effect. Consequently this group of substances is also abused for purposes of muscle development. The side-effects are often of a general nature, including slight tremor, restlessness, possibly a racing heart and headaches.

21:

The basic chemical structure of all anabolics is the steroid. The structural formula is shown here. There is a whole range of anabolic agents, first and foremost the anabolics themselves. The anabolics were developed for people with prolonged illnesses that depleted their energy reserves, or to alleviate the symptoms of aging in men caused by low testosterone levels. As a dramatic range of side-effects became apparent at an early stage, researchers endeavoured to reduce the unwanted side-effects by modifying the substance. Thus this carbon structure may be substituted as an alternative at various points. The epidemiology of the anabolic agents shows that these are still today the substances most frequently misused in competitive sport. Around 100,000 analyses of doping tests are registered worldwide in a single year by the statistics of the IOC. In these tests more than 7000 prohibited substances were found, sometimes on their own, sometimes in connection with others, over a period of three years. Of these, 38% could be classified as anabolic agents.

Anabolics, and other anabolic agents as well, are also misused in connection with community open-air sports and leisure sports.

22:

The visible effect, leading to the formation of what is supposed to be an athletic body, is highly seductive. There is too little sense of the side-effects, which unquestionably set in even if they cannot be seen, and do not produce any visible marks which would have to be accepted alongside the desired effect.

The misuse of anabolics brings rapid training success, recognisable in an increase of weight and the buildup of muscle. This also results in an enhancement of the motivation to train, and there is an increased risk of over-training, with all the detrimental effects that this has on the motor apparatus.

There is a widely held view, too, that the use of anabolics in great quantity will produce considerable effects, while the organic side-effects will often be rendered harmless or denied.

In actual fact, however, side-effects that appear harmless make an appearance at an early stage, and these are the precursors of the much more dangerous side-effects to the internal organs.

23:

As has already been mentioned, the anabolics, being derived from the male sexual hormones, have sexually specific effects.

In women the misuse of anabolics leads in all cases to masculinisation (virilisation), to a greater or lesser degree. One of these side-effects is that the voice becomes lower, another is the increase in hair growth (hirsutism).

Naturally the anabolics also have negative effects on the female monthly cycle, which may become irregular or in cases of prolonged abuse can stop altogether.

Sexually specific side-effects in men may be the development of gynaecomastia, a fatty imitation of the female breast. As the hormonal balance is disturbed, the testicles will soften and later shrink. This is associated with the risk of a temporary or lasting infertility, because the formation of sperm (spermatogenesis) is negatively affected.

Then too there are other dangerous side-effects that are not sex-related, those on the heart and blood vessels for instance (cardiovascular effects) or on the liver, and those less dangerous but aesthetically unpleasant side-effects such as steroid-related acne, increase of bodily weight, possibly as a result of water retention, and injuries like the tearing of muscles or tendons. Behavioural changes cannot be ruled out either, such as a fanatical motivation to train or even uncontrollable outbreaks of rage, as well as depression when the intake of anabolics is discontinued.

24:

Side-effects on the heart and blood vessels are all the more likely if substance abuse is persisted in. The cause of damage in this connection is first of all the growth of the heart muscle under the action of anabolics, while the vascular supply (and therefore oxygen supply) of the heart muscle does not undergo any corresponding development. This leads to repeated lesions of muscular fibres. Other symptoms that occur are an altered heart function (cardial dysfunction), for example a disturbance in the rhythm of the heartbeat (cardial arrhythmia) and inflammation of the heart muscle (myocarditis). In persons who die young after having misused anabolics the heart muscle has the appearance of that of a sixty-year-old.

A further mechanism is occasioned by the imbalance suffered by the lipometabolism. This results in damage to the internal walls of the blood vessels, and deposits can accumulate at such damaged points (atherosclerosis) which may finally lead to a heart attack (myocardial infarction).

The frequency with which damage of this nature occurs is not known in any detail. Various surveys of groups of individuals who have misused anabolics have nonetheless succeeded in establishing that they are more subject to death and disease than are comparable control groups.

25:

Even if, up to the present time, there has not been a completely watertight proof of the direct connection between a heart attack and an earlier or current misuse of anabolics in excessive amounts, there are many factors giving rise to suspicion, and these must be taken seriously. There are studies of individual cases as well as summaries, including comparisons of the frequency of disease occurring in anabolic abusers with individuals who have never taken them.

26:

As well as the cardiovascular system, the liver too suffers damage as a result of the long-term misuse of anabolics.

Whereas the inadequate supply of oxygen is one of the main causes of damage to the heart muscles, the liver cells are generally overtaxed by the anabolics that accumulate. In cases of long-term abuse this results in functional changes, and shows up at a later stage in damage to tissue.

Inflammations of the liver, fatty degeneration of the tissue and the formation of liver cysts are examples of the direct damage to tissue that may occur.

With some anabolics there has also been talk of carcinogenic effects. The possibility that a liver tumour may develop cannot therefore be excluded.

27:

We have already spoken of the sexually specific effects of anabolics on women. This effect is triggered by the androgenic action of steroid anabolics.

Virilisation or masculinisation has various aspects for a woman. Going by three questionnaires, which admittedly were not representative, put to a total of 71 women who misused anabolics, disturbance of the menstrual cycle appears to be the commonest symptom, followed by the deepening of the voice and increase in hair growth. Furthermore the size of the breasts decreases, and it is hardly possible to cover this up on the basis of the marked development of the thoracic muscles. The decrease is so obvious to the eye that many resort to implants to correct it. As for the primary sexual organs, an abnormal enlargement of the clitoris is symptom that may occur. 10% of the women interviewed admitted that they still have general sexual problems.

Finally all the features of the body change, tending to a more masculine appearance.

28:

Anabolics tend to enhance the androgenic properties of the individual to a greater or lesser extent, but they also have an impact on the steroid metabolism. Moreover, they cause persistent disturbance to the hormonal feedback control system that affects the production of the male sexual hormone (androgen).

Some of the side-effects can be explained on this basis.

The same questionnaires which were referred to earlier can also be used to derive a picture of the side-effects with relation to the frequency of the observed symptom. As a total of nearly 700 men were involved in the three studies, the findings are more reliable in this case. The shrinkage of the testicles is the side-effect that is most frequently observed, followed by an increase in the growth of hair and the painful condition of gynaecomastia, a fatty imitation of the female breast. Men too may find that their voice becomes deeper, and some individuals who misuse anabolics also speak of non-specific sexual problems.

29:

After a prolonged period of anabolic abuse, side-effects will show in many cases in the individual's external appearance: steroid acne, which occurs most often at points on the body where heavy sweating occurs, gynaecomastia, and in some cases baldness. Overall it may be observed that the looks of a person who has taken anabolics change in such a way that they look older.

Another effect is that the rapid growth of muscle tears the subcutaneous connective tissue, which shows in pale or bluish striations (striae) on the skin.

Anabolics cause water retention in the tissue. This can lead to swelling, in the face for instance. Heavier sweating is another directly observable side-effect in most cases.

30:

The misuse of anabolic steroids also has psychic effects. Little is known about the mechanism whereby these effects operate. It has, however, been repeatedly reported that the intake of anabolics gives a push to a person's motivation to train intensively. Others have reported that when taking anabolics they became gruff, which could be described on occasion by the person they were talking to as aggressive behaviour. A particular form of this is "roid rage", of which we have reports coming from the USA. These are uncontrollable outbreaks of anger which tend to destructive behaviour to oneself, to others or to property.

When the use of anabolics is discontinued, depression also occurs quite frequently; in some cases this has probably even been a cause of suicide.

Taken all in all, a great many side-effects are known to arise in connection with anabolic abuse, some of which occur with great frequency and can be directly observed by the persons affected in their own bodies. External signs are also invariably an indication that damage to the organs may be occurring.

It is therefore impossible to calculate the likely damage to health that may be caused by the misuse of anabolics!

31:

Diuretics are effective agents which accelerate excretion by way of the kidneys. The excretion of water and electrolytes is speeded up. Important electrolytes are ions like kalium, natrium, magnesium, chloride, carbonate etc. These electrolytes are required both for many bodily processes and for the motor apparatus.

Diuretics act directly on the kidneys. The kidney tissue incorporates a great many small excretion corpuscles. In the renal cortex liquid is pressed out of the capillaries into the renal corpuscles. This liquid is then concentrated by means of complex chemical and physical processes in a channel that descends deep into the renal medulla, turns around and ascends again. This channel opens out into a number of large collection pipes which gradually form the ureter, which leads to the bladder. From there urine is excreted by way of the urethra.

Diuretics act either on the descending or ascending part of the channel, or on the part where the channel turns around. Their effect is achieved through the fact that they retain electrolytes and so ensure rapid excretion. As non-professionals are not well able to estimate the effect of the various diuretics, if diuretics are used without medical examination, and without having been prescribed by a doctor, it is impossible to calculate the side-effects on the individual's health.

32:

In the field of sport, diuretics are misused for various different reasons. A rapid loss of weight can be achieved through the excretion of water. In types of sport where competition is organised on the basis of weight categories, this makes it possible for an athlete to enter in a lower weight class.

Accelerated excretion may also be resorted to as part of an attempt to excrete other doping substances more quickly or to make it hard to prove their intake in view of the level of dilution that has been reached.

Around 4% of the doping substances registered by the IOC over a period of three years in positive A-tests were diuretics.

Diuretics are sometimes taken in body-building as well, so as to cover up the anabolic side-effect of water retention in the tissue, and to make the musculature clearly visible through the dehydrated skin. This type of abuse has been found in a few cases even in community open-air sports.

The side-effects on health will show themselves in numerous physiological processes, depending on how necessary the electrolytes are, and also in various organ systems.

33:

General side-effects occurring frequently of which we have reports are weakness, tiredness and exhaustion. For the most part this can be put down to the loss of electrolytes. A considerable loss of kalium, such as occurs in connection with some diuretics, may have a negative impact on the action of the heart. In this connection we have reports of disturbance of the heart's natural rhythm.

The loss of water means that the proportion of water in the blood will be reduced, with an increasing risk of thrombosis as a result. Too rapid loss of water following from excessive dosage of diuretics may also result in hypovolemic conditions or even shock. The loss or transposition of electrolytes may result in ailments of the stomach and intestinal tract, and in case of hard physical work may also cause muscular cramps.

The loss of electrolytes may also have an effect on the senses. Sensory disturbances and disturbances of vision and hearing cannot be ruled out. There have been numerous reports of toxic effects on the ears.

34:

The peptide hormones are a group of hormones that have various effects, and are chemically related to one another.

The hormone hCG (the 'h' standing for human) has a positive effect on the production of testosterone, and its use is forbidden to male athletes. LH likewise has an effect on the steroid metabolism, and so too on the production of testosterone.

In women these substances occur naturally in the course of the monthly cycle or in pregnancy.

The hormone ACTH enhances the body's own production of corticoids, which are banned from sport under certain conditions.

hGH, or the products of gene technology rhGH (the 'r' standing for recombinant) and IGF-1 stimulate the processes of growth in a general way. This hormone is used in medicine in connection with dwarfism, in cases where the pineal gland has been surgically removed or if there are tumours situated on the pineal body. The insulin controls the balance of sugar in the body, and makes available the energy reserves that are necessary for the processes of growth.

Erythropoietin (EPO), finally, has a stimulating effect on the production of red corpuscles in the blood, which together with the blood colouring agent haemoglobin make it possible for the blood to carry oxygen. This peptide hormone too can be created by gene technology in the form of rhEPO.

35:

Growth hormone may be derived from natural sources, or it may be produced by gene technology. With preparations of unknown origin, in particular, there is no way of determining the source they come from. Indeed, there are preparations of growth hormone actually offered on the black market today which have been obtained from human cadavers.

Consequently there are two kinds of health hazard associated with the misuse of growth hormone – on the one hand the risks that arise from the side-effects, on the other, the risk of a disease being transmitted from infected biological material.

The improper use of growth hormone in healthy individuals has a great many direct effects and side-effects, because the receptors for growth hormone which are responsible for the hormone's effect are to be found in almost all the tissues of the body. One of the effects (especially in the liver tissue) is the release of IGF-1, which enhances the action of the hormone still further.

Side-effects of improper use can include for example headaches, water retention in the tissue, sweating, exhaustion and pains in the joints. An enlargement of the hands, feet, nose, ears, chin and tongue can occur, as also of the inner organs.

Growth hormone has an impact on the metabolism, with the effect that fatty tissue is broken down and muscle built up, so that its effect is opposed to that of insulin. But it also has an effect on the metabolism of sugar, and in cases of long-standing abuse can cause diabetes.

The effect of the hormone on the heart shows in an unphysiological enlargement, which can develop into a disease of the heart muscle. There is an increased risk of dying of heart disease. It is also known that patients with acromegaly are subject to a greater risk of contracting cancer of the prostate or colon.

Finally, when the source is not known, the possibility cannot be excluded that the preparation has been obtained from cadavers, carrying a very high risk of infection. Diseases that particularly call for mention in this connection are hepatitis, HIV and Creutzfeld-Jakob disease.

36:

Alongside the perfecting of technique, the enhancement of strength and staying power is one of the most important targets of any kind of sports training.

To enhance the training effect on the athlete's staying power, a natural stimulus to the production of red blood corpuscles may be used, in the form of altitude training. Even without training, "thinner air" with a reduced level of oxygen, as experienced on a mountain, stimulates the formation of red blood corpuscles. It is now also possible to create such conditions in tents or chambers that are specially created for the purpose. The reason for the rise in the red blood corpuscle count is the increased release of the hormone erythropoietin in the body.

If a sportsman allows blood to be taken from him under altitude training conditions, and then to be transfused into him again shortly before a competition, he is using the prohibited method of blood doping.

The production of red blood corpuscles can also be enhanced on a hormonal basis through the intake of erythropoietin. Consequently the use of this peptide hormone is banned from sport, and is subject to penalties as a form of doping malpractice.

37:

The cycle of the formation of red blood corpuscles is controlled by the oxygen content in the blood, which is “measured” by receptors on an ongoing basis as a control variable. If the oxygen content is reduced and the body reaches a state of hypoxia, the production of EPO will be triggered, and following from this red blood corpuscles will be formed in the red bone marrow. The important organ in connection with this cycle is the kidney, in the tissue of which EPO is very probably formed.

As the increase in the red blood corpuscle count makes it possible for the blood to carry more oxygen, the severity of the hypoxia is alleviated and the control loop is closed.

It is possible to intervene in this control loop by introducing EPO externally, bringing about an increase in the red blood corpuscle count even without training. Consequently EPO was developed as a medical drug for the treatment of anaemic patients whose natural production of EPO was severely affected as a result of damage to the kidneys or kidney failure.

38:

Erythropoietin (EPO), whether in the form natural to the body (hEPO) or that produced by gene technology (rhEPO), has no side-effects based on its structure. All its effects that are hazardous to health are linked to the effect of the formation of red blood corpuscles.

The haematocrit is a relative value which indicates the percentage ratio of the cellular components that are present in the blood. Practically the entire proportional balance of cells is to be attributed to the quantity of erythrocytes.

In healthy individuals the haematocrit generally comes to something between 45% and 48%. Heavy sweating can certainly cause the haematocrit to rise, though values over 50% are not usually registered. At these levels the flow properties of the blood are still within the physiological zone.

Individuals with an exceedingly unusual genetic makeup can have higher haematocrit levels. Such high levels just before a competition cannot usually be explained. More important, though, is the health hazard to the sportsman in such a case, seeing that additional exertion and sweating can cause the haematocrit to reach a level that is life-threateningly high. When values over 50% are reached, the flow properties of the blood in the blood vessels deteriorate, and the blood flow can actually come to a stop in the capillaries or smaller blood vessels. The blood coagulates, and the adjacent tissue areas die off.

39:

It is now possible to prove that EPO has been taken, as there is a physiochemical basis for distinguishing between rhEPO and the naturally occurring hormone hEPO.

Doping malconduct can be suspected if the presence of what are known as plasma expanders in the blood is demonstrated, as these act to keep the haematocrit below the critical threshold in spite of the increase in red blood corpuscles.

There are simple methods for determining the haematocrit on the spot.

As the average value for the population as a whole, and also for athletes, is a known quantity, a permissible threshold value will be defined before a competition as the maximum level at which there is no risk to health. If a value above this critical threshold is registered, it will be assumed that during the competition this value has

increased to a level that represents a health hazard, justifying the athlete's being excluded from the competition.

In addition to the haematocrit, the quantity of haemoglobin can likewise be determined. This is the red blood pigment to which oxygen attaches and by which it is carried. Here too the normal values are a known quantity, and a significant deviation in an upward direction can lead to the same conclusions as an abnormally high haematocrit.

The fight against doping is not just a disciplinary measure in relation to the athlete: it also includes the aspect of preventive medicine.

40:

As well as prohibited agents, the IOC/WADA list also includes prohibited methods.

Prohibited methods serve either to give the athlete greater staying power, or to cover up the fact that doping with prohibited agents has been practised.

Blood doping, or the use of artificial oxygen carriers, gives greater staying power, while the use of plasma expanders or substances which make it hard or impossible to demonstrate the presence of doping substances belongs to the second group.

Finally the prohibited methods also include such forms of manipulation as make proper testing impossible, like handing over urine not one's own in a concealed container.

The prohibited methods too give rise to various health hazards.

41:

The practice of blood doping is a very involved business, and it is difficult to prove that it has been resorted to.

What is at issue here is a transfusion of the athlete's own blood, which has been taken from him/her in the course of what is known as altitude training in a state where the red blood corpuscle count is high, and is then given back again just before the competition. Blood doping now also covers the use of concentrates of red blood corpuscles.

The dangers to health as a rule arise when the process is improperly executed. When it is not a case of the athlete's own blood being used, none of the accidents associated with blood transfusion can be excluded in the individual case. Itching is mentioned with some frequency as a reaction to a blood transfusion, while an anaphylactic reaction is only to be expected in case of gross error. Every injection, infusion or transfusion involves a certain risk of infection: this will be more likely to occur, the more carelessly the process is carried out.

42:

The use of artificial oxygen carriers is very dangerous, as none of these effective agents yet exist in the form of medicaments. At best they are still in the testing stage. Consequently there is little known about possible side-effects. After the doping scandal of the Tour de France in 1998, the death of a racing cyclist was linked to the intake of PFC (perfluorocarbon).

To the extent that these artificial oxygen carriers are directly put into the bloodstream, the same risks apply as were mentioned in the previous slide.

43:

The use of what are known as plasma expanders has been found to occur in sport. Plasma expanders are infused solutions which have the additional effect of causing water to pass from the tissue into the bloodstream.

Ever since Finnish athletes were proved to have been doping with EPO, with the help of the demonstration that HES (hydroxyethyl starch) had been used, plasma expanders have been banned from sport.

Plasma expanders reduce the concentration of haemoglobin in the blood and lower the haematocrit after the misuse of EPO.

A health hazard can arise if in the course of competitive exertion the body's loss of water reaches life-threatening proportions. Health hazards also exist in the same way as with other infusions, especially if the process is improperly executed.

44:

The list of the groups of prohibited agents and prohibited methods includes a group that is not generally prohibited, but which may be prohibited by individual sporting federations in keeping with their regulations, or by organisers like the IOC in the individual case.

This group includes alcohol, the cannabinoids, local anaesthetics and glucocorticosteroids.

The presence of these substances has been established in doping tests only on infrequent occasions.

In limited quantities alcohol has a rather relaxing effect; for this reason it is also known as "target fluid".

'Cannabinoids' is the general term given to the effective agents contained in Indian hemp. Hashish and marijuana are the parts of the plants that are processed for purposes of drug abuse.

Only the use of certain local anaesthetics – substances, that is, designed to bring about local narcotisation – is permissible, on the basis of local or intra-articular injection, and only when acting on medical advice.

The glucocorticosteroids are likewise only allowable when applied locally.

45:

Alcohol is what is known as a social drug, and the consumption of alcohol is widespread in society. Relatively few side-effects are to be expected from alcohol consumption. When it is consumed in moderation, there is a phase of excitement with a lowering of the inhibition threshold, followed by a sedative phase. If alcohol is taken in an uncontrolled manner, states of intoxication arise and there is a diminished sense of responsibility. If too much alcohol has been taken, the drinker can also lose control of his movements. Further temporary side-effects may occur on the following day, and in common parlance the condition is known as a "hangover". Dizziness and nausea, sometimes accompanied by vomiting, are other familiar side-effects, as are headaches and diarrhoea.

High alcohol consumption may also cause a slight depression of the respiratory centre.

As alcohol is a "social drug", the later effects of chronic alcohol consumption are also included here. In sport the excessive consumption of alcohol will necessary lead to the premature termination of the individual's sporting career.

46:

Cannabinoids are the effective agents in resin and in the leaves of Indian hemp. Hashish and marijuana are consumed by many. In the Olympic games of modern times cannabinoids were first found to be present in 1989. It is often suggested that the presence of THC in urine samples is to be attributed to passive smoking.

But the side-effects of cannabinoids can also occur in a case of "passive smoking".

The place where THC chiefly acts is the brain. It enters into interaction with other neurotransmitters, and brings about a positive state of mind and an enhancement of sense perception. The short term memory, on the other hand, is impaired.

Other physiological side-effects occur besides, such as a lowering of body temperature, a slight speeding up of the heartbeat, unstable blood pressure, oral dryness and a reddening of the conjunctiva. The mechanism underlying these side-effects is unknown.

As they are usually smoked, the cannabinoids have a generally negative effect on the lung tissue. The damage caused to the tissues is more than that which results from cigarette smoking. Whether THC is carcinogenic has not been proved.

Sperm production, at all events, is reduced by cannabis consumption, and the proportion of defective sperm rises. Women may experience temporary disturbances of their menstrual cycle.

If women smoke THC during pregnancy, the child may be born with reduced body weight, and an increase in the incidence of malformations cannot be excluded.

In cases of long-term abuse, psychic or physical dependence is a real possibility.

When the drug is withdrawn after a period of intensive consumption, a complex of symptoms occurs that includes nausea, sweating, tremor and sleep disturbance.

47:

Local anaesthetics are effective agents which have the effect of relieving pain at the site to which they are applied. In this way a training programme can be continued, or a championship still be contested in spite of injury.

As the effectiveness is strictly limited to the local area of application, side-effects are not often encountered.

Besides, the use of local anaesthetics is permissible only in certain cases.

There may be a local necrosis at the site of the injection, especially in connection with adrenalin.

In a case of local application, side-effects to various organs occur mostly if an excessive dose is administered. These, then, are rather to be classified as toxic effects.

In such a case there may be an effect on the cardiovascular system, with a reduction of the heart rate and lowered blood pressure.

Side-effects that may affect the central nervous system include nausea, vomiting, restlessness, anxiety and other symptoms.

As well as rare reactions resulting from hypersensitivity, when used frequently these substances may call forth allergic reactions from the skin.

48:

Glucocorticoids may only be used locally or by intra-articular injection.

Here too, then, side-effects are only to be expected at the point of application, if at all.

In relation to sport, it is particularly significant that when glucocorticoids are applied locally over a long period, to treat an injured tendon, a spontaneous rupture of the tendon may occur.

Use of these substances over a long period, even if they are only applied locally, may lower the plasma cortisol level, as a sign that the functionality of the adrenal cortex is impaired.

As well as allergic and allergogenic reactions of the skin, there have also been reports of changes in the skin and expansion of the skin vessels.

Finally there is water retention, a side-effect which occurs in rare cases.

49:

The beta receptor blockers are a group of substances that are widely represented, but they do not stand out as a doping substance in the international statistics of the IOC. Only in isolated tests have beta blockers been found.

They work selectively, and have an inhibiting effect on the beta receptors of the sympathetic nervous system.

Side-effects may occur in practically all organ systems, but these range from rare to very rare.

The beta blockers have a damping effect on the cardiovascular system, and the heart rate may be reduced, even reaching a marked state of bradycardia.

In association with this, excretion through the kidneys will be reduced, that is to say, more water will be retained in the tissue, leading to weight gain.

There is a risk to asthmatics, as the administration of beta blockers may trigger an asthmatic attack.

Diabetics who are on insulin are particularly at risk, as the beta blockers inhibit the process of glycolysis and so may upset the balance of sugar in the body.

In men, problems with ejaculation have been observed with some frequency.

The occurrence of conjunctivitis of the eye, coupled with oral dryness and changes to the skin, may be an indication of further associated conditions such as pericarditis or pleurisy.

50:

Further information is not necessary

51:

Further information is not necessary

52:

Leisure sport in fitness studios has developed dramatically since about 1975. At the close of the 20th century, in the eleven listed member states of the European Union an average of 5% of the population was practising all kinds of sport in fitness studios. In the United States of America the rate of use is twice that.

In other parts of the world this way of practising sport has not acquired such a following. On a global scale, only about 1% of the world's population make use of fitness studios. These figures are derived from an international survey carried out by the Verband der Fitnessstudiobetreiber in Deutschland [Federation of German Fitness Studio Operators].

These studios have now come to specialise in a great variety of directions. Some studios have focussed on postural damage and conditions of the postural apparatus; other studios appeal to the one or other sex. Some studios have a high proportion of training and service personnel, in others the visitor is left more or less alone to practise on the equipment. Some studios, known as hard core studios, allow for any kind of training, even with back-up from drugs.

In selecting a studio, regard should be had to these aspects.

53:

Further information is not necessary

54:

In leisure sport, special nutritional supplements are out of place. Instead, a balanced diet is appropriate to the healthy practice of sport.

Information on the dangers of nutritional supplements, and on what are known as social drugs, can be found on the webpage www.dopinginfo.de.

This slide gives a summary, detailing some of what is known about the various nutritional supplements.

55:

For doping analysis there is a general system of organisation which is applied consistently worldwide.

First of all samples have to be taken. Until a few years ago only urine samples were taken, and the prohibited agents or their metabolic products which were excreted in the urine were determined on that basis.

A distinction must be made here between competition checks and training checks. In principle, however, the procedure is comparable in both cases.

The sportsman or sportswoman is asked to submit to a check, and remains under observation until the urine sample has been delivered. The sportsman or sportswoman can select one from a number of different sealed containers, and takes this into the toilet. The sample is taken under the eye of a controller, so that any possibility of manipulating the evidence is excluded. At least 70 ml of urine must be supplied as a sample. After this the sportsman or sportswoman can again select from among sealed vessels, each of which is labelled with a number. The urine sample is distributed between these containers. The green container is the A sample, the yellow one is the B sample. The glass vessels are sealed in another container, which cannot be opened without damage. The remainder of the sample is subjected to some simple tests. A record is kept of the sample-taking, and the name of the sportsman or sportswoman and the identifying number of the sample are noted on a form. Copies include only the number of the sample, but not the name or any other personal details. By means of this procedure the sample can be kept anonymous. Only on the basis of this form can the sample be attributed to the individual concerned. The sealed A and B samples are then sent to the laboratory, along with a copy of the sample record.

56:

At present there are twenty-six accredited laboratories worldwide. Only accredited laboratories can carry out doping analyses that will be recognised as valid. There are a number of criteria that constitute the basis for an accreditation. After accreditation has been conferred for the first time, re-accreditation follows on an annual basis. Hitherto the IOC has been responsible for accreditation and re-accreditation. In future this task will be taken on by the WADA. On delivery the samples are tested to see that they are still intact. The B sample is immediately refrigerated, while the A sample is analysed.

The findings of the analysis will be communicated to the person who has asked for the test. If the test is positive, the name can be determined with the help of the form, and the sportsman or sportswoman will then be given an opportunity to make a response to the test result.

The sportsman or sportswoman may request to have the B sample analysed in their presence, or in the presence of persons selected by him or her. If the B sample also yields a positive result, as is to be expected, procedures involving sanctions will have to be introduced.

In principle the demonstration of the presence of a prohibited substance is sufficient to result in a positive analysis. It is known however, that various substances do not have any active effect if a minimum concentration in the urine is not exceeded, and such substances may also be produced in small quantities by the body itself. For this reason limiting values have been introduced, below which there can be no suspicion on doping malpractice.

It can be seen that the sensitivity of the methods used for measurement is so high that even the smallest traces can be conclusively demonstrated.

The T/E quotient is the relation between testosterone and epitestosterone. When testosterone is given, the epitestosterone is reduced, and the T/E quotient rises. If this is slightly higher than the value of 6, then in the first instance more thoroughgoing investigations are called for.

All the statements made here relate to the list of prohibited agents and methods which applies to the period 2001-2002. From January 2003 on a new list will come into force, though this will retain most of the fundamentals of the older list.

57:

Doping is regarded as unethical behaviour towards all those who take part in competitions, whether they are involved in an active athletic role or as functionaries and organisers. A competition involving sportsmen and sportswomen who have either taken effective agents that are prohibited or made use of prohibited methods is tantamount to a betrayal of the audience and the sponsors.

The responsibility of a sporting federation in the fight against doping, both on the national and also on the international level, comprises the task of creating a basic framework whereby consistent regulations may be applied for the imposition of penalties for doping malpractice. This is an important matter with a view to ensuring a legally secure position for the athletes, their support teams and the organisers of sporting events. Up to the present time no consistent regulations have been formulated that would go beyond the sphere of responsibility of specific sports federations. Only for international sporting events in which many sporting federations are involved, such as the Olympic Games, have consistent and universal rules been defined.

The implementation of the different sets of regulations designed to combat doping, as formulated by the sports federations, does however supply a certain basis for comparison. The World Anti-Doping Agency, which is now active worldwide, is making this the basis of an anti-doping code which will be consistent and of general application.

One of its recommendations is that if an athlete is found guilty of doping, even if it is the first occasion, he/she should be barred from all competitive events for a period of two years. In the case of stimulants there has been mention of a period of six months in the first instance. The doped sportsman or sportswoman will be disqualified from the competition in which he/she has been found guilty of doping.

58:

The situation in respect of national legislation on doping is varied, even in Europe. The situation in the late autumn of the year 2002 shows that the majority of the member states of the European Union (60%) have an anti-doping law of their own in force. It can be anticipated for the future that other countries too will work out or approve anti-doping legislation.

In those countries which have passed laws against doping, as well as in countries where prescriptions against doping are made a part of other laws, there must be fundamental provisions made for the implementation of such rulings on the basis of governmental sanctions.

Some laws aim at the imposition of penalties on the sportsman or sportswoman who practises doping and on those who may be involved in the background, while others relate to the background alone.

The internationalisation of sport means that organisers, support teams and also the sportsmen and sportswomen are obliged to get adequate information about the relevant legal regulations if they travel to another country for training purposes or in order to take part in a competition.

It must be particularly emphasised that to take pharmaceuticals including most doping agents to another country will already be regarded as an illegal act, and may entail sanctions.

59:

Further information is not necessary

(60: only in German, French, Dutch and English):

Further information is not necessary

(61: only in English):

Further information is not necessary

(62: only in English):

Further information is not necessary

(63: only in English):

Further information is not necessary

(64: only in English):

Further information is not necessary

(65: only in English):

Further information is not necessary

60 (61: only in German, French, Dutch; 66: only in English):

The fight against doping is being carried on throughout the world. And this is a very necessary measure, seeing that the comparison of the performance levels of sportsmen and sportswomen internationally is a matter of the greatest public interest. There are various points of departure for carrying on the fight against doping throughout the world. International conferences are one of these possibilities. As long ago as in the year 1988 a first international conference to combat doping was held in Montreal, under the auspices of the IOC.

Many other institutions are also involved in the fight against doping in a peripheral capacity. The organisations represented here are by no means a definitive list, but may serve as a representative set of examples.

As an outcome of the first international conference an anti-doping code for the Olympic movement was worked out. This is publicised worldwide with the recommendation of UNESCO, a subdivision of the United Nations.

Among its other tasks, the World Health Organisation (WHO) also combats drug abuse, and so is involved with doping peripherally.

As a result of the fourth international conference against doping, held in February 1999 in Lausanne, it was resolved that an international anti-doping agency should be set up and a World Anti-doping Code created. The World Anti-doping Code is based on the fundamental principles of the doping chapter of the Medical Code of the Olympic movement, in association with other anti-doping regulations.

In Europe, the European Council and the European Union have also made a commitment to the fight against doping -

- the European Union in an ideal manner with an Anti-doping Behavioural Code dating from the year 1993, directed to all those who are involved in sport either directly or indirectly, and giving public notice of the possibilities available for the fight against doping;
- and the European Council with the working out of the Anti-Doping Convention in the year 1989, which can be adopted by any country in the world, and so is not just confined to Europe.

Among the national institutions involved, besides ministries and other governmental authorities there are also the national sporting federations and such institutions as the national anti-doping agencies, which have been set up in order to combat doping.

61 (62: only in German, French, Dutch; 67: only in English):

Since access to the Internet has become possible for all, there are also some thoroughly well-informed websites that deal with the fight against doping. Some of these addresses are listed here.

62 (63: only in German, French, Dutch; 68: only in English):

The theoretical fundamentals of this information campaign were put together at a scientific congress in the year 2001, convened by the Director of the Faculty of Sport and Health Promotion of the Technische Universität München [Technical University of Munich]. The lectures given at this congress are collected in the book "Biomedical Side Effects of Doping", (Peters et al., 2001), published by the Bundesinstitut für Sportwissenschaft [Federal Institute for Science in Sport].

63 (64: only in German, French, Dutch; 69: only in English):

When presenting graphic materials, you are requested to name the source in each case.