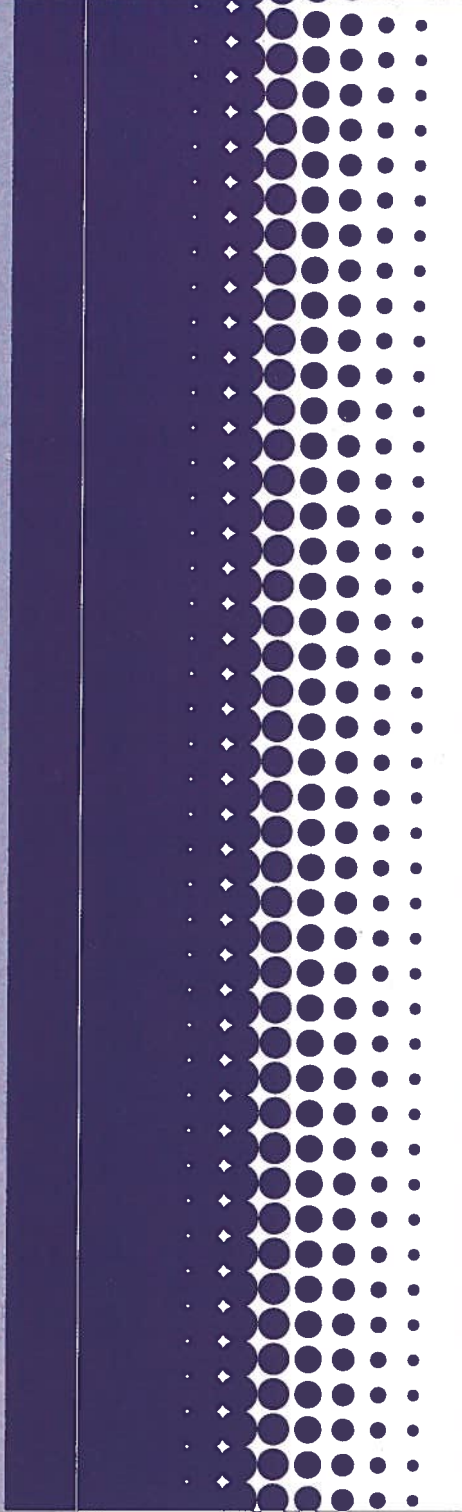
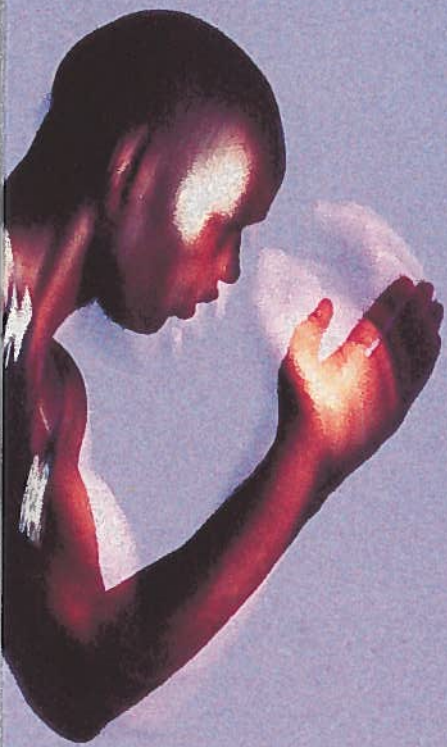


INNOVATING FOR GOLD

Today and tomorrow

NOC*NSF and TNO





Top performances are reserved for
sportsmen and companies that are
driven to excel and innovate.



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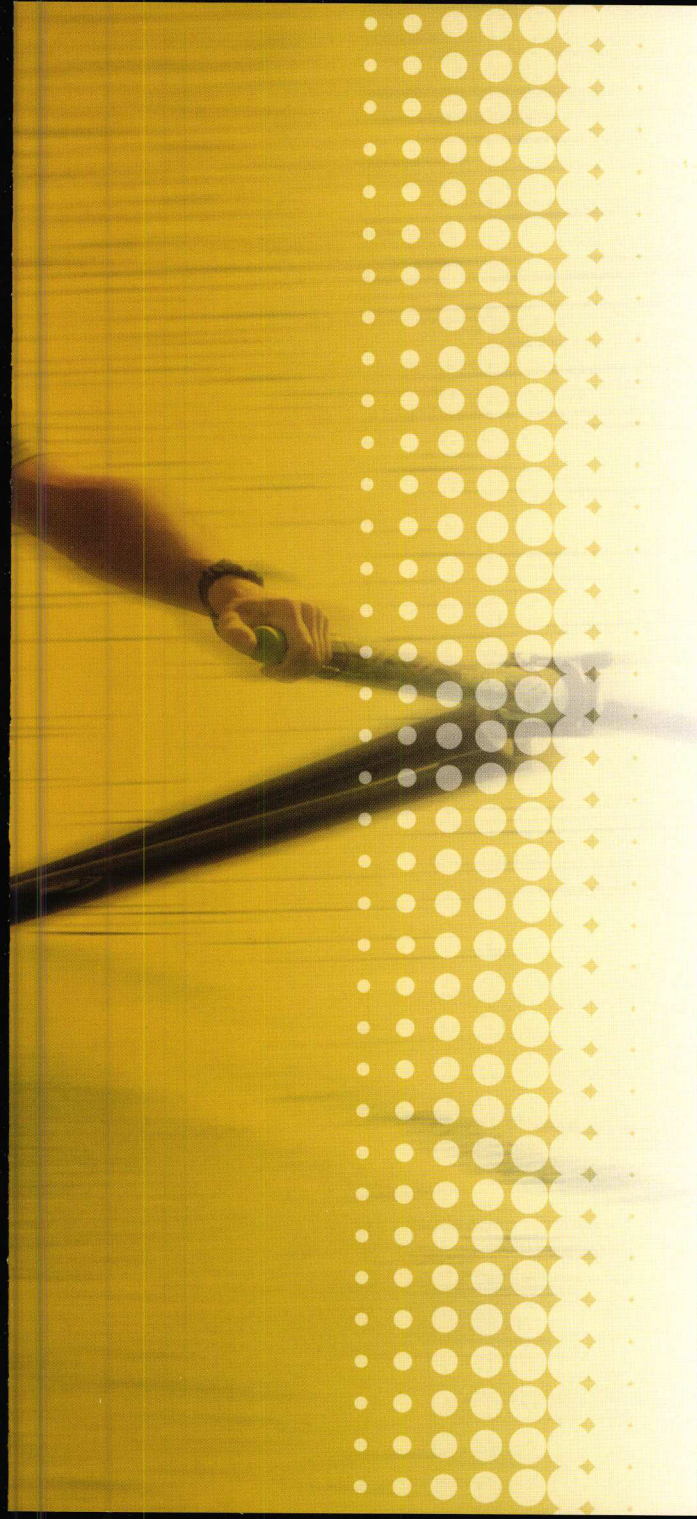
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- **Technology is a key springboard for optimum performance.**
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Introduction

Innovating for Gold

Sport offers many chances and opportunities. Not only for individuals but also for particular sections of the population, the nation as a whole and many companies and organisations. A long tradition and a solid knowledge base in sport has made the Netherlands a key player in the sports world, but it can also contribute to new successes in sportsbusiness. The ability to use the available chances and opportunities is founded on innovation – and the ability to innovate requires knowledge. This is why the Dutch research and technology organisation TNO and the Netherlands Olympic Committee * Netherlands Sport Confederation (NOC*NSF) have clustered their knowledge in the ‘going for gold together’ program. This book contains the challenging results of that program and includes practical suggestions to set you on the path to gold.



Sport can also provide a boost to economic prospects

We realise today that regular exercise can have a positive impact on public health. People who exercise regularly tend to feel better both physically and mentally. They are at less risk of developing a chronic or life-threatening illness than people who hardly exercise at all. In a nutshell, regular exercise reduces medical consumption and absence from work as well as fewer claimants under the Disability Insurance Act (WAO). Conservative estimates put the economic benefit only in the Netherlands of sport and exercise at EUR 750 million each year (Dutch Ministry of Health, Welfare and Sport, 2001). Sport also has an important social and cultural role. Taking part in sport gives people an easy opportunity to get to know each other and form social ties, with all the benefits this entails.

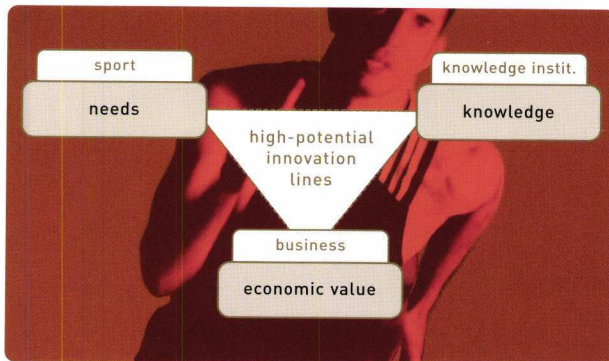
Sport is a major factor in the economy. According to estimates Dutch consumers spend over EUR 3 billion each year on sport. And this amount has been rising by between 5% and 6% annually in recent years. The sports sector is also a major employer. It provides opportunities that range from the training and management of sportsmen and women to the development, manufacture and sale of sports goods, foods and facilities.

Last but not least, sport is also an important channel for the promotion of the Netherlands throughout the world. Over the years Holland Promotion has been represented by a number of well-known sporting ambassadors. Some names that spring to mind are Bettine Vriesekoop in China, Guus Hiddink in Korea, Anton Geesink in Japan, Johan Cruyff worldwide, Ruud Gullit in South Africa and Pieter van den Hoogenband in a number of countries including Australia.

Going for Gold Together

The spin-offs from knowledge and experience gained in elite sport find a commercial outlet in sport for all. It was with good reason that the Dutch Ministry of Health, Welfare and Sport referred to elite sport as a test bed for innovations that benefits both sport for all and society at large ('Opportunities for elite sport', 1999). What is more, elite sport is increasingly becoming a smooth conveyor belt for the development of products that can be marketed later, with or without subsequent adaptation. Both nationally and internationally.

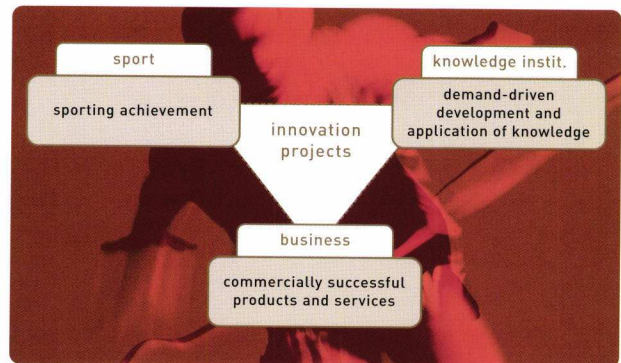
This trend is prompting serious interest in elite sport among sportsmen and women as well as companies and non-commercial organisations. The interaction between them is improving the prospects of all of them. With the knowledge and expertise of knowledge institutions providing a solid basis, sportsmen and women and companies can seize opportunities for innovation and turn them into gold.



- Sport, business and knowledge institutions together determine the playing field for the best opportunities

The 'Going for Gold Together' program being run by TNO and NOC*NSF stimulates the drive to improve innovation by:

- Coupling opportunities in elite sport and sport for all with those in industry and then spawning innovations using existing knowledge or knowledge that can be developed;
- Structuring and improving the coherence of the innovative component of the sporting knowledge infrastructure.



- Undertaking innovation projects means that everyone benefits

Roadmaps

Roadmaps help opportunities to be efficiently linked to knowledge and companies so that innovation is commercially successful. A roadmap shows where the sports market currently stands in world terms regarding products, services, technologies and knowledge. It also shows where the sports market aspires to be or could be in ten years' time and the steps that are necessary to reach that position. The roadmaps bring together the visions and activities of the sporting world, industry and knowledge parties concerning the accumulation of knowledge and the development and realisation of technology into a shared, coherent vision. The roadmaps also describe the path the various parties can and wish to follow together to reach their goal.

An analysis of sporting needs has resulted in roadmaps for the five innovation lines shown below. They partly overlap and partly complement one another:

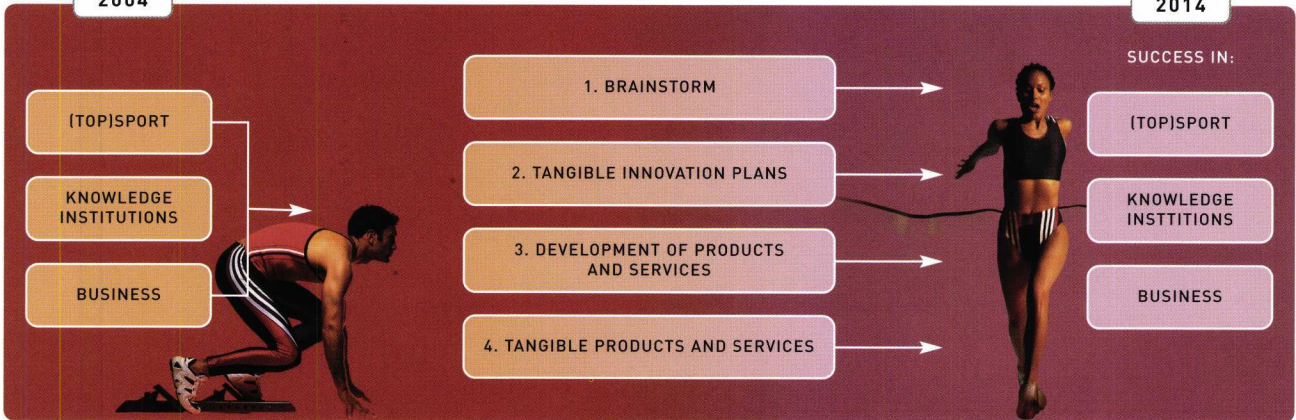
- **training**
- **materials and equipment**
- **facilities**
- **food and nutrition**
- **stimulating sport.**

For each innovation line we have selected a number of case studies that offer an insight into future possibilities. All of them have been based on the roadmaps. These are just a few examples of innovative products and services that could bring you gold in the next ten years!

Activities that will result in success

2004

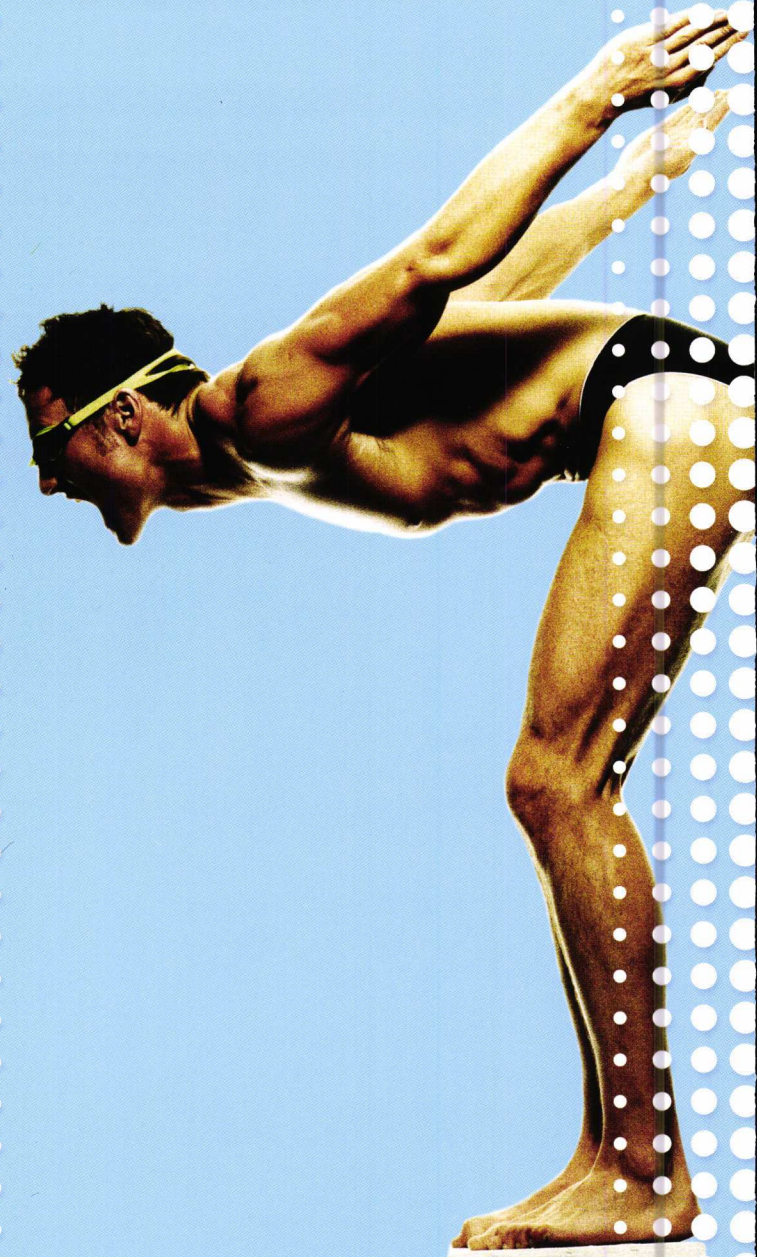
2014



This is where we begin

This is where we want to be

■ A roadmap clarifies the steps each of the three parties has to take for all to reach their goals





TRAINING

Taking the training to a higher level, too

By using the body repeatedly in a series of planned exertions, a sportsman can perform at an increasingly higher level. This training must however take place under the right conditions and be based on knowledge of the issues involved. Otherwise the opposite effect is achieved.

Training focuses on an individual or a team. In individual training, the focus is on the person's physical, mental, technical and tactical qualities. To improve a team's performance, additional work is done on the interplay and communication between the team members.

Now

The coach plays a vital role in a top sportsman's training. Often a coach starts as the sportsman's immediate supervisor and develops into the leader of a multidisciplinary team of supervisors. While most coaches adopt a role based on their own experience, the importance of good education is recognised. In performing their work, trainers are often solitary; there is little supervision or peer guidance. Given the lack of accessibility to relevant new knowledge and insight little use is made of them.

A systematic approach to training is still often limited to simply comparing the planned training with the training actually executed, especially for sports that compete against the clock. After all, it is relatively easy to record training times. Documenting the results poses greater problems. Commercial interests in highly professionalised sports continue to fill the diaries of busy sportsmen and women. This makes it difficult at times to plan training sessions.

The future

Trainers and sportsmen and women have the latest knowledge at their disposal and can use it to optimise their training. Both before, during and after the training parameters such as power, heart rate, heart rate variation, oxygen saturation and brain waves are measured and saved centrally. Performance, too, is carefully recorded. A multidisciplinary team of supervisors evaluates the data and modifies the training plan if necessary. This systematic and continuous evaluation of training and competition performance ensures that the objectives for the medium and long term can be achieved. It also indicates when adjustment is required and helps to prevent excessive training.

The recreational sportsman or woman has his or her own, individual digital coach who monitors and supervises his or her performance.

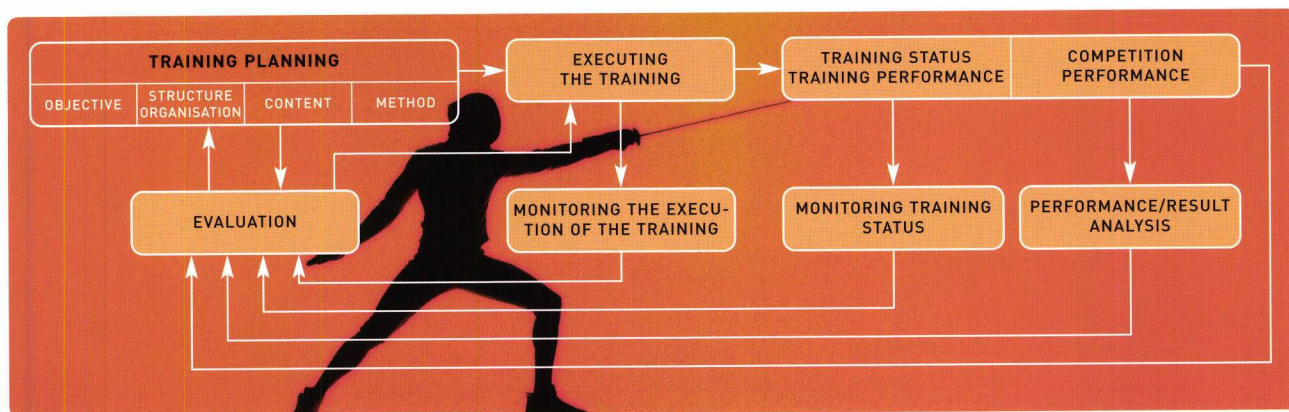
■ This training process works for individual sportsmen and women as well as for teams. Facilities and training materials are sufficiently equipped with technology to support this training process.

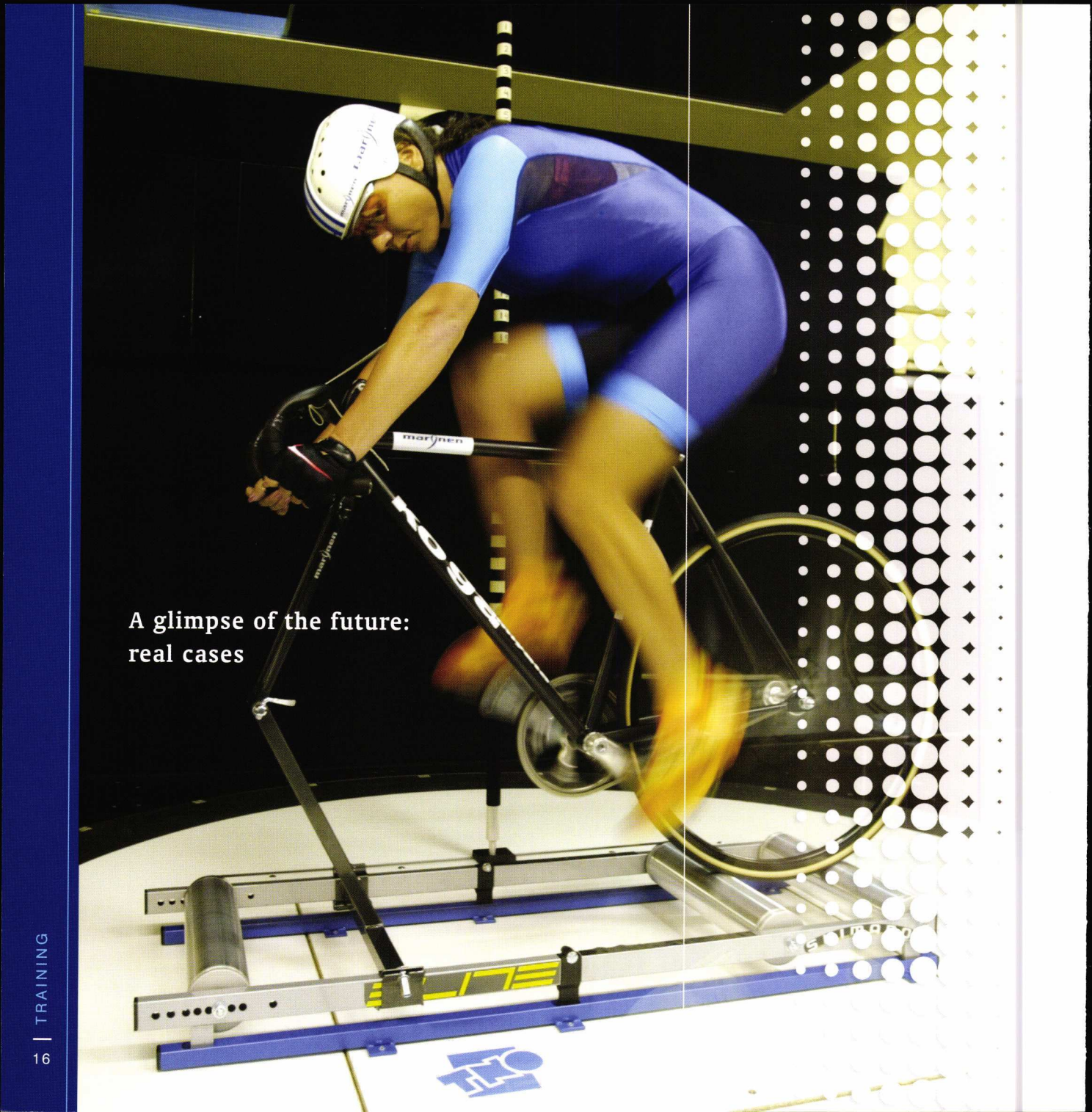
The opportunities for innovation

Given the ideal training process and actual innovation potential, opportunities exist in the following areas:

1. System for training supervision. For each sportsman a set of physical, mental, technical and tactical parameters is monitored almost continuously and saved in a system. This system advises and supports the coach in setting the training aims, devising and evaluating the training and thus managing the individual's performance development as well. Various forms of this system, including online, are possible.

2. Improving team effectiveness. Insight into the factors determining performance enables improved performance. Points worthy of attention are the communication between the participants, the exchange of knowledge within the team and with other teams and sports, as well as methods for spotting and assessing talent early on and achieving the ideal team set-up.



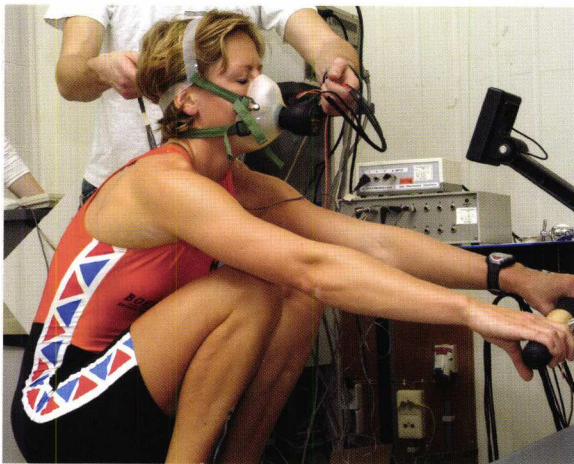


A glimpse of the future:
real cases

The knowledge to enhance performance

A set of factors determines the final performance. One weak link in the chain and the physical load is increased beyond what is strictly necessary. This may make the difference between not qualifying and winning Olympic gold. Scientific research provides a wealth of physiological and biomechanical knowledge that can be used to make calculation models that reveal a sportsman's physical load. By measuring the sportsman's relevant physiological variables against the model, any weak spot becomes evident and corrective action can be taken. This may involve adjusting the training or diet, or changing materials, clothing, indoor environment or team set-up.

An alternative approach seeks the scientific verification of new methods or products that are introduced and claim to improve performance. Scientific research can show whether or not these claims are valid.



■ **Crew coherence** - The biomechanical performance of each member of a rowing crew is monitored along with the boat's periods of acceleration and deceleration. This provides an understanding of the contribution made by each crew member in terms of their strength and power. Now the performance of each individual can be geared to suit the crew as a whole so that it performs better as a unit.

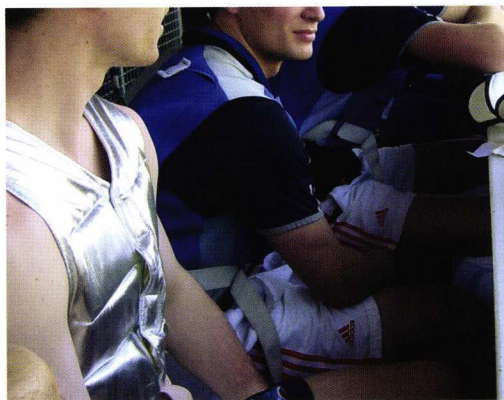
■ **Power strategy** - What's smarter: to start at full pelt and then ease up or to hold back at the start and save energy for later? Or rather, how can a sportsman optimise the distribution of his power? A major element to consider is the sportsman's aerobic and anaerobic capacity. The balance between these two capacities varies among individuals and also depends on conditions. A calculation model can be used to establish the optimum power strategy.

■ **Radiant heat** - Radiant heat is more intense on water than it is on land. The problems that this heat produces can considerably impair the performance of someone doing water sports. Simulation models can help establish the effect new clothing or resources can have.

Pre-cooled

Minimising loss of power

Even the very best sportsman can devote at most 25% of his or her capacity to the activity in hand. The other 75% is lost as heat. These latest training facilities allow a team to acclimatise to the temperature in which the competition is being held, even before leaving home. Team members wear a cool-vest until shortly before the competition and this reduces their heat emission. During the competition some team members wear clothing made of a material that cools the body passively by virtue of its ability to create air vortices within itself.



■ A coolvest is just one option

The training status under control

Keeping strain and recovery in balance

The aim of training is to improve the sportsman's performance over time. Strain and recovery must be properly alternated, otherwise the results won't be good. The training status can be revealed at the push of a button. This is based on physiological factors like the variation in heart rate that indicates the degree of stress. In addition, historical information can be used to determine when to gradually wind down the training prior to a competition.

The digital coach

Individual supervision nevertheless

When the coach is absent the sportsman can do a spot of self-coaching thanks to the digital coach. A display on the sportsman's arm issues continuous information about the distance covered, average speed, training time, heart rate, hydration status, lactic acid build-up and body temperature. What's more, the sportsman gets ad-hoc advice about the training and the tuning of his or her engine and so keep the proverbial finger on the intended performance pulse.

The coach's assistant

Two heads are better than one

Measurements taken of a sportsman and data gathered by the coach are collated to create useful information. For instance in the form of statistics on performances under certain conditions. Information that can guide the coach, based on the measurements and an expert's opinion. The coach can even be linked online with technical experts in the team of supervisors at a different location. The system acts as an assistant to the coach.



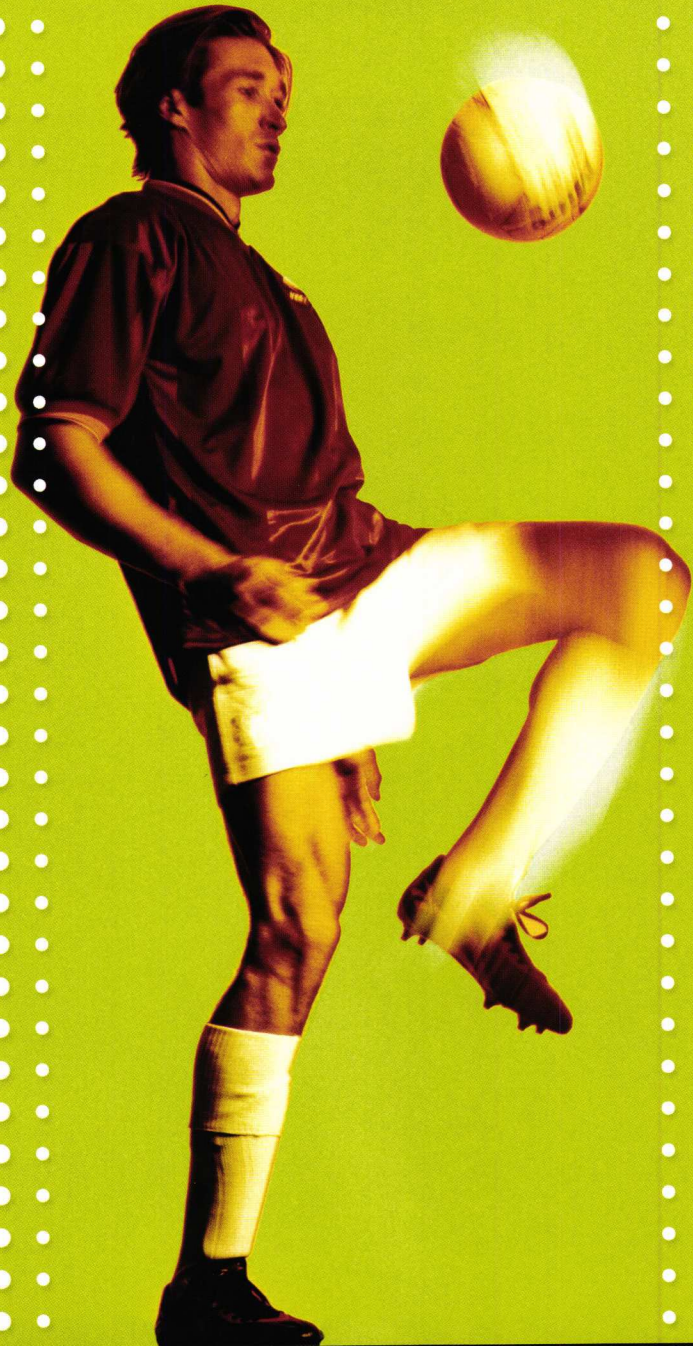
Insight into the game

Objective monitoring for better teamwork

A team's performance is clearly more than the sum of its members' physical skills such as technique, power and stamina. Leadership, communication, the exchange of information, knowledge and adaptive capacity are also factors that must be taken into account. Only by gaining an objective understanding of these factors can we estimate them accurately and control them. A 3D simulation does this by recording all the movements. Players and coach can, as it were, get inside one another's bodies to view the game from all sides.



■ Giving the game an added dimension





2

MATERIALS AND EQUIPMENT

Good equipment is half the work

Sport is a question of seeking your limits. Whether you want to go faster, higher, further, be more graceful or improve your health. It is a continuous process in which only the right materials and equipment can really help sportsmen and women of all levels to find and extend their limits.

Materials and equipment are the sportsman's tools. They can be subdivided into the following product groups:

- personal products (clothing, footwear and physical protection)
- equipment (sticks, rackets, boats, skates and balls)
- information resources (sensors and communication equipment), sometimes linked to new media and ICT infrastructure
- training equipment (gym apparatus and similar equipment).

Now

Recent decades have proven that the use of innovative materials contributes to the winning of medals. Sometimes these materials are clearly visible to the outside world: clap skates, a racing cyclist's suit or a hockey player's ear guards. But often they aren't. For example a measurement performance system, like the Measuring Active Drag (MAD) system used in swimming, is not going to be visible to an onlooker. The right material contributes not only to new excellence, but also to the pleasure derived from sport and staying fit.

The future

Today's excellence will not be exceptional by tomorrow's standards. And so the search for better materials and

equipment goes on. It is essential however, that comfort and durability remain key ingredients so that sport can be performed in a responsible, healthy way.

Materials and equipment may contribute to better performance and greater comfort both directly and indirectly. An immediate advantage, for example, can be seen in cooling clothing on a hot athletics track and a bicycle with reduced rolling resistance. But it is the competition regulations that determine what is and is not allowed. The risk of imitation is great; after all, successful innovations have great allure. Indirect improvements in results are achieved mainly through the use of materials and equipment during training. In this case, the emphasis lies on gathering the information on an individual sportsman or woman or a team to enable more effective training. This information can also be used to design equipment for a specific sport or participant, which may lead to adaptation for the benefit of the general public.

The opportunities for innovation

Given the regulations and actual innovation potential, opportunities exist in the following areas:

1. High performance materials.

In clothing, footwear and personal protection we are seeing the advent of smart materials. The material can react physically to its environment or the way in which it is used. This clothing may be worn at any time during training and even during competitions. The products are always fully geared to the sportsman's workload. As such, they offer optimum support and reduce the chance of injury.

2. Knowing through measuring. There is an ever greater need for information to optimise training, to correct a sportsman's physical movement, to improve team co-ordination, to implement game tactics or to tailor materials more precisely to the sportsman and conditions. Instruments and technology can play a major role in gathering information.

3. Customised lightweight products. Knowledge of materials, product development, production processes and the interaction between the sportsman and his or her resources ensures an improved match between a product and an individual sportsman or team. This fosters good performance and contributes to safety.

A glimpse of the future:
real cases

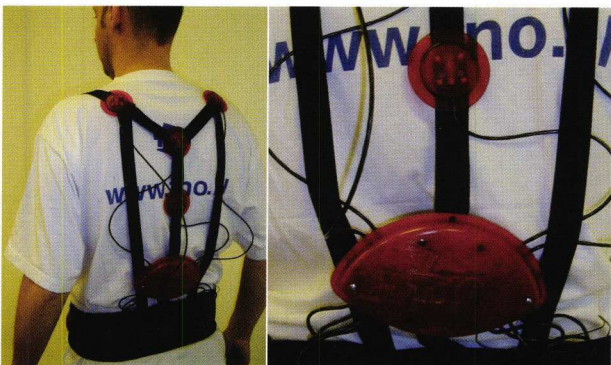


Clothing that monitors

Intuition, knowledge, experience and common sense; you can go a long way towards improving a sporting performance with just these assets but if you are making a serious bid for the top you need hard facts. This kind of data analysis lets you see exactly where things are going wrong and where improvements can be made. Sensors are becoming smaller and the range of aspects they can measure is increasing: speed, body temperature, heat emission, fluid level, posture, flexibility, stretch, pressure, location, the list goes on.

Sensors incorporated into clothing and footwear, without hindering the wearer, constantly monitor all sorts of data. The data are saved and entered into a computer at the end of the training or competition. The results are then translated into a recommendation for next time. Another option is to transmit the data immediately to a station in the vicinity using a tiny transmitter. The computer or coach then takes the processed data and feeds the information straight back to the sportsman via an earpiece, a visor display or a vibrovest.

These electronics in the clothing are initially the domain of elite sport only. Soon all sportsmen and women will have kit like this to help them improve their performance and prevent injury.



■ **Measuring power** - Sensors on the front and back of a swimsuit measure the pressure exerted by the water. The information is saved and a read-out is provided later by computer. The computer analyses the stroke and identifies the movement that generates the greatest forward propulsion and how the swimmer's position in the water can be improved.

■ **Lactic acid** - Sensors also measure physical functions, like how fast a person builds up lactic acid. Continuous monitoring affords much more insight into this process than the series of snapshots offered by blood tests does.



■ **Fluid level** - The continuous monitoring of hydration and temperature provides a personal profile, revealing, for instance, the dramatic increase in a marathon runner's heat emission between 30 and 40 km. A modification to the drinking regime (drinking more beforehand or extra at 5 km) prompts some improvement. And a change to the training programme achieves more. All done without pushing the runner beyond his or her limits.

■ **Positioning** - Hockey players wear shirts equipped with a positioning system so that the coach can track their individual movements closely on screen. If a player is not following the tactical plan, he can be informed via his vibrovest.

One ski suit for all weathers

Self-adjusting material

The alternating cold and heat felt by skiers during rest and exertion and periods at high and low altitude is no longer a problem. A brand new ski suit has made temperature fluctuations a thing of the past. The suit is made from a material that becomes thicker or thinner, more open or closed of its own accord in response to external conditions and the skier's exertion. For the skier, the climate is always optimal.

More than made to measure

Individually suited for each situation

Sports materials to suit the sportsman, tailored to his size and individual characteristics. And performance improves. The footballer gets the boots that fit just right, and we're not talking just about size. Special boots with perfectly positioned studs for the fleet-footed dribbler; boots for the keeper that help him kick the ball away. The archer gets a bow with a grip that fits the shape of his or her own hand. New technologies make it possible 'to print' a suitable product directly from a 3D-scan of the body or body part in question.

The diagnostic shoe

Medical advice along for the run

Everyone has his or her own way of walking and when an injury looms or there is some discomfort, that pattern may be changed, often subconsciously. The diagnostic shoe continuously measures the pressure, with the data obtained compared with the individual's usual pattern. Deviations are drawn to the sportsman's attention by a signal (via the coach or perhaps by the shoe itself) so that he or she can take appropriate measures if necessary. After all, the shoe is self-adapting.



■ Footprints provide useful information

Optimum posture

Body support

In the early rounds it's not difficult for the speed skater to assume the optimum posture... but then tiredness kicks in. The solution? The suit that signals when the wearer's posture is slipping. A suit that, as it were, pulls and pushes the body to train it to assume the right posture. Now the skater can focus easily on his or her posture. While the customised suit may not yet be worn during competition, the rules may change.

The intelligent racket

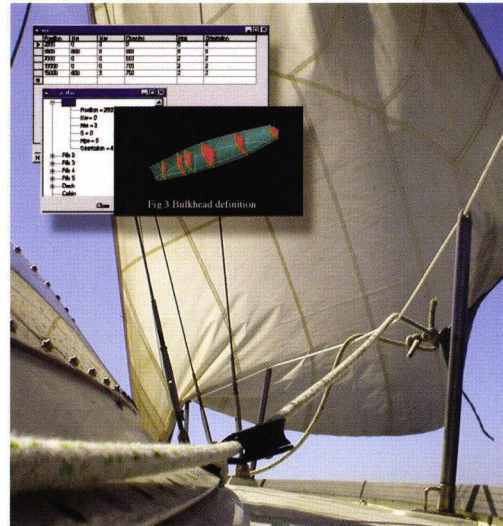
Improving technique is fun

It's not only the footwear and the clothing that tell the sportman and his coach something about the performance. So do the tools - the racket, the hockey stick, the golf club and even the ball supply information to help analyse and improve performance. And improving technique in the virtual environment is also that little bit simpler and nicer.

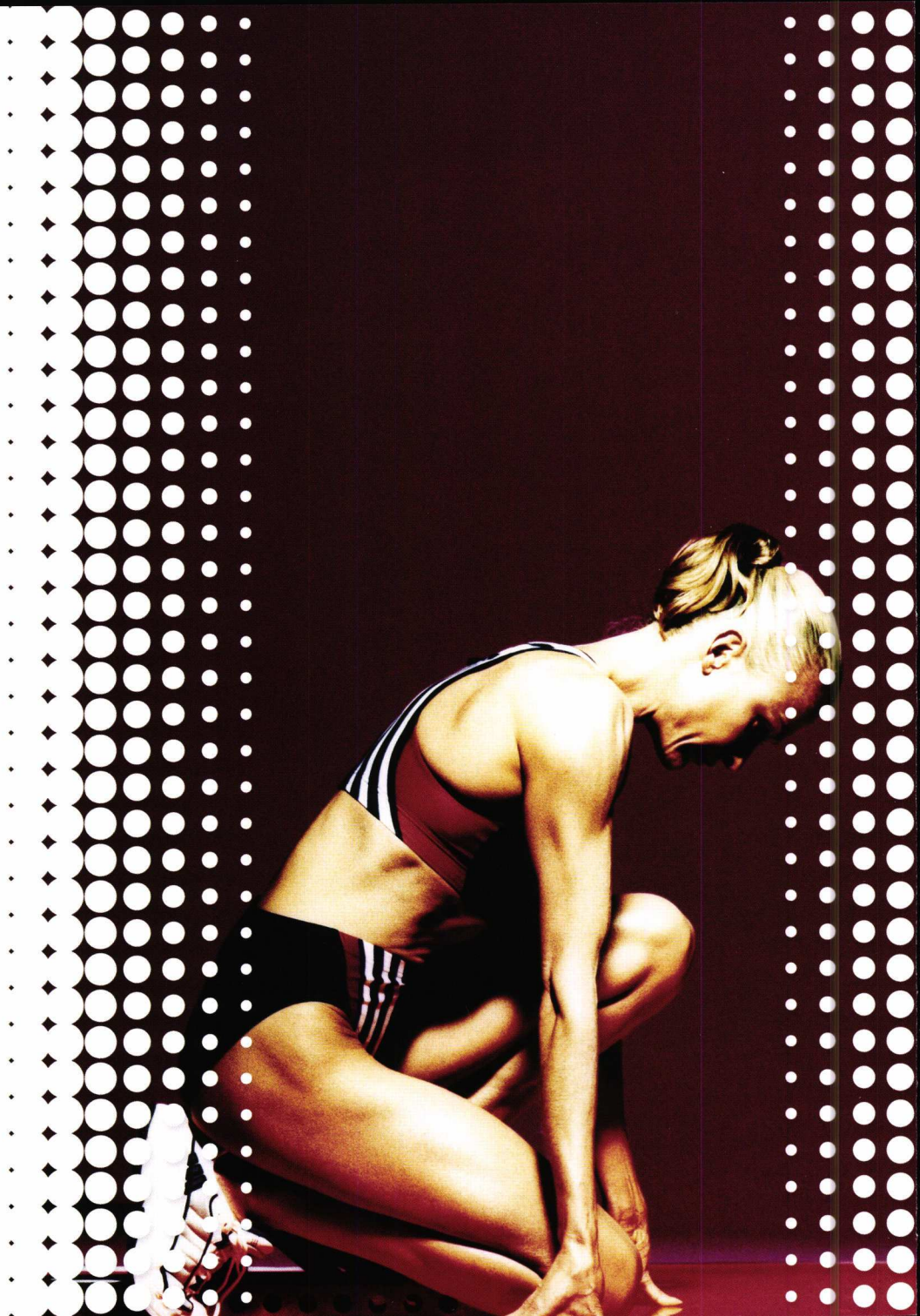
The ultralight sailing boat

New materials for better prospects

Measurements on the sailing boat, carried out under a range of conditions, identify when and where loads and stresses occur. Put this together with technical knowledge of the ultralight new polymer and the result is a modified design that combines speed, comfort and safety.

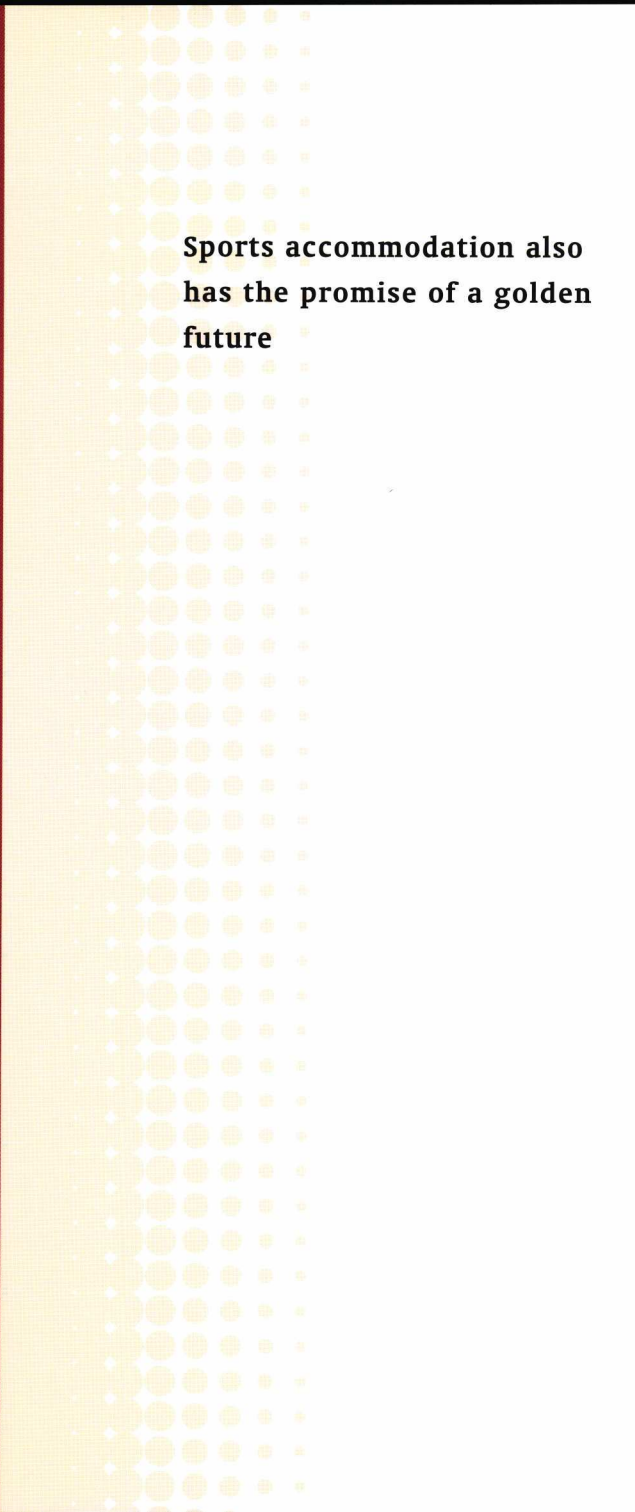


■ Knowing the stresses means designs for improved performance





FACILITIES



Sports accommodation also has the promise of a golden future

Elite sport is hard work. It makes substantial demands on the workplace and the facilities. The demands made by sport for all, although different, are no less substantial. The ideal, of course, is flexible workplaces and facilities whose use can be optimised and tailored easily to the type of sport and the individual, whether a young person, a gifted natural, a top performer or a retired person.

A facility that is optimal in all respects plays its part in achieving the best training and competitive performances. Of course, training and competition do place different demands on the facility, for example the logistics, the surface on which the sport is played or the indoor climate. From the point of view of utilisation too, there is a great difference between a competition and a training facility.

Now

Facilities for elite sport are built primarily for competition but are also able to cater for training. But they are often so large and have such good facilities for visitors that it is more profitable when competitions are not being held to rent the facility to other, non-sporting events than to sportsmen and women wishing to train. The competition facility is usually part of a complex that also houses cinemas, offices, ice rinks and the like.

While there are currently enough high quality competition facilities, there is a shortage of training facilities. Existing training facilities for top sportsmen and women tend to be tailored to suit a particular sport and are less suitable for other sports and other sportsmen and women.

On the other hand, facilities for the 'ordinary' sportsman at town-centre sites are increasingly being lost. The land they occupy is so expensive that the temptation to put the site to another use where the revenues are higher is often irresistible.

The future

Good operational opportunities are the key to the successful development of new facilities and the redevelopment of existing training facilities. Their space has designated areas for at least the following activities: training, gym work, sports medical examinations, changing, teaching and meetings. In addition, all sorts of technological equipment ensure that the space can be tailored to suit a particular sport or training need at the push of a button. As this makes the operation more profitable, more and more facilities appear at accessible, central locations. The construction is not dedicated to one particular use so when demand for the current use ceases, the facility can be used in another way, depending on the requirements and wishes of those living in the area.

The opportunities for innovation

Given the need for more multifunctional training facilities and actual innovation potential, opportunities exist in the following areas:

1. Sports surfaces. The capacity to adjust the surface, which includes its stability, shock absorbency and line markings, contributes greatly to multifunctional use. The right conditions ensure that a sensible physical load achieves optimum results.

2. Indoor climate. The indoor climate is determined by factors like lighting, acoustics, temperature, humidity and air quality (particle concentration and scent). All these factors influence not only the sportsman but also, for example, the quality of the grass or the ice rink. In addition, it is possible to set up climate zones for warming-up or cooling-down as well as simulate the altitude in other countries for training purposes in lower altitude countries like the Netherlands.

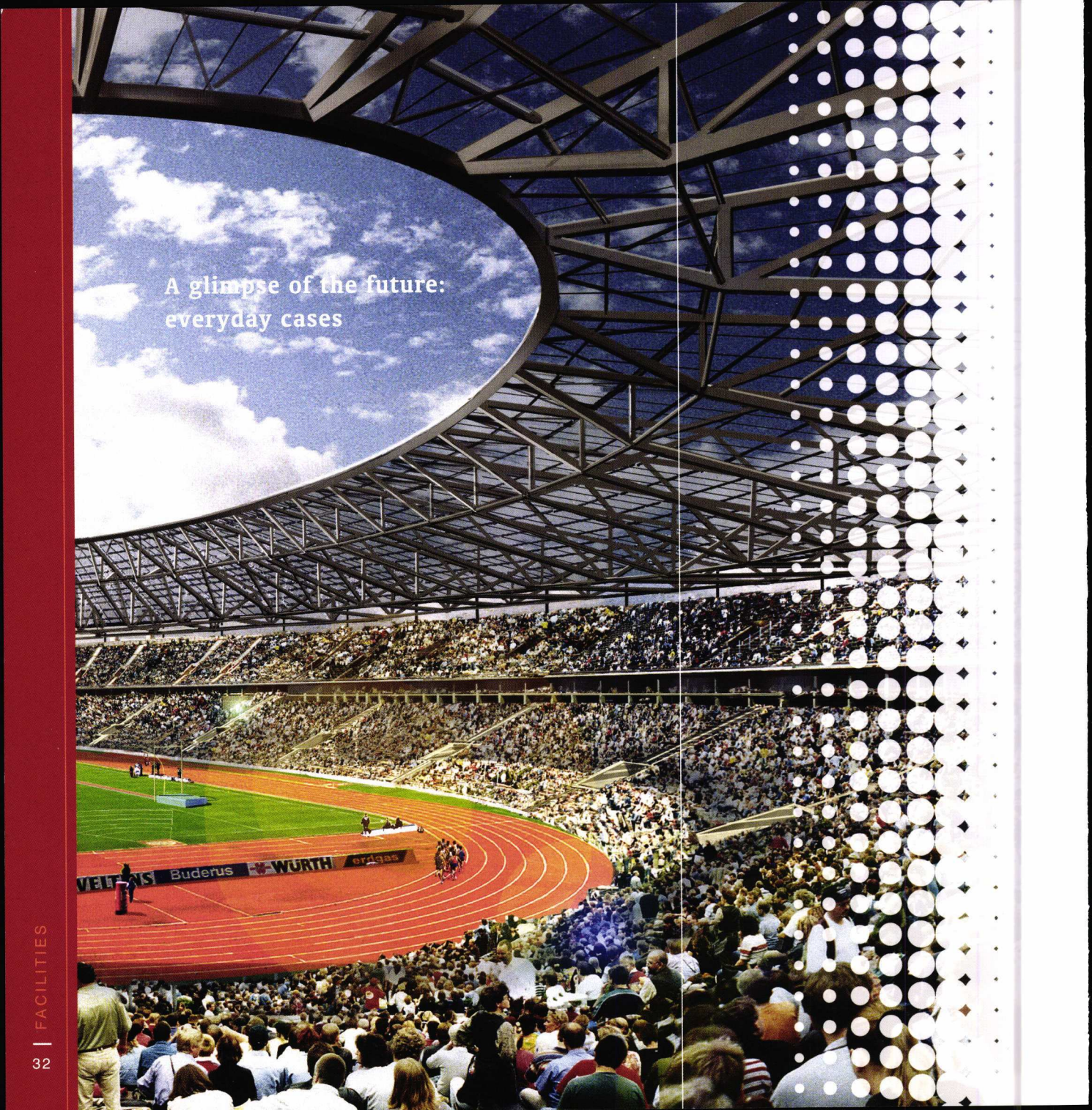
3. Sustainable energy.

Energy is a major part of the operational costs. These costs can be reduced in a responsible manner by limiting the energy requirement of sports facilities and using sustainable energy sources where possible. Clever technologies for climate management and co-operation with other facilities can also limit costs.

4. Performance measurement and improvement.

The output from all sorts of measuring instruments is processed in the facility, enabling the training to focus on vital areas. The physiology and technique of sportsmen and women are monitored continuously, affording an insight into opportunities for improvement. There are also pieces of equipment that stimulate or help them when they train to improve their movement and rhythm.

5. The sports facility's location. Information about how much use is made of space by sport in general and the various sports in particular is important for the future planning of new facilities. Scenarios mapping changes over time are useful for examining utilisation and for estimating any impact on neighbourhood development.



A glimpse of the future:
everyday cases

Flexible and sustainable

General knowledge about the interaction between the indoor environment and the sportsman is combined with information gained from monitoring the sportsman during a particular activity in a particular facility. The insight and the refined adjustment techniques can be applied to create the most favourable conditions in terms of aspects such as temperature, 'wind' speed, humidity and oxygen concentration. Conversely, it is also possible to simulate, and thus train for, less ideal outdoor conditions.

Unfortunately, the ideal conditions for grass or artificial turf, ice rink or pool water are not those of the sportsman. The construction and installation plans for the building or renovation of the facility can, however, be examined in advance with regard to these various factors, so that the optimum conditions are created for both the sportsman and sports surface.

New materials and design insights ensure that players and coaches are able to hear one another and that noise nuisance is kept to a minimum. As for light, natural light is used as much as possible and can be supplemented by artificial light when required or when the natural light is insufficient for health (biological clock) and comfort.

Last but not least: sustainability. Sports facilities with their extensive roof surfaces lend themselves very well to the use of solar energy systems. Added to that, it is increasingly common for such technology to be shared with other local users, who may well have differing peak periods in their energy consumption.

■ **Fresh air** - A local supply of fresh air ensures that the public feels comfortable. As the spectators remain longer, it may be necessary to cool the piped air and carefully siphon off the accumulating warm air. Jets of cold air blow just above the ice to keep it in good condition. The use of this highly flexible and controllable system makes it possible to create an indoor climate fit for sporting excellence in an Olympic facility located in a city that may be no stranger to smog.

■ **Clever installation** - A swimming pool and ice rink in one complex. Both devour energy but their peak consumption times differ, enabling them to share one and the same installation. This has its advantages, not the least of which is the opportunity to benefit from this cleverly designed installation with its imaginative use of space and easy maintenance.

■ **Allowing for growth** - The facility is not built to last an eternity but is geared to its users' needs. During the building's life cycle, its use changes. That's why the building offers solutions that are temporary and flexible, a whole series of them for each changing use. And so whatever the change, conditions are always optimal.

■ **Water temperature** - For people with a chronic handicap or mothers with babies the ideal water temperature is naturally somewhat higher than it is for a water-polo training session. Calculation models have been used to try out alternatives and now the weekly programme of activities has been set up such that the water temperature suits each target group and energy consumption is as low as possible.

Flexible surface

Adjustable on demand

The floor has been given a higher shock absorber factor so that the volleyball players' knees do not suffer such a battering when they land after jumping. The indoor football teams who follow the volleyball teams adjust the floor to make it stiffer and reduce its shock absorber factor. It doesn't matter to them that it is achieved with a hydraulic mechanism, as long as it is quick and easy. And it is, as is changing the line markings on the floor. This is something bowlers appreciate because their main requirement is a smooth, hard floor.



■ Various sports and different lines

Ideal for grass and artificial turf

Just the right conditions for growth

Completely covered, partially covered or completely uncovered. It makes no difference how the sports facility is built and whether or not activities are taking place, sporting or not, the grass or artificial turf must remain in good condition. A clever model calculates precisely how to create the optimum conditions using a combination of construction design and technical facilities.



■ Extensive testing reveals any flaws

The 'LED' hare

Training support

Like other fields, the sporting world has now seen the advent of LED technology. During their training cyclists, skaters and runners all chase after an LED hare. The same facility is also suitable for high jumpers and long jumpers wishing to hone their movement and rhythm so that they can improve their run-up strategy.

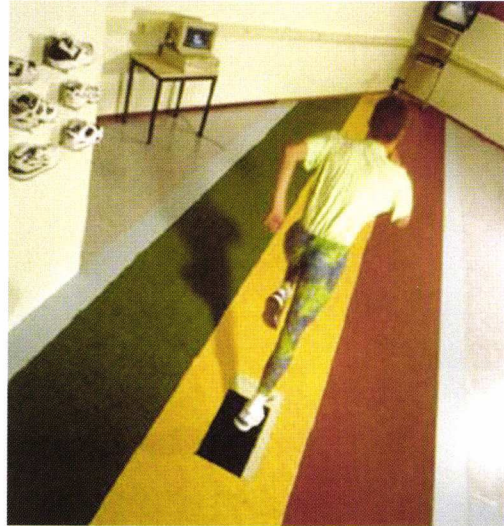


■ The fruit of the chase

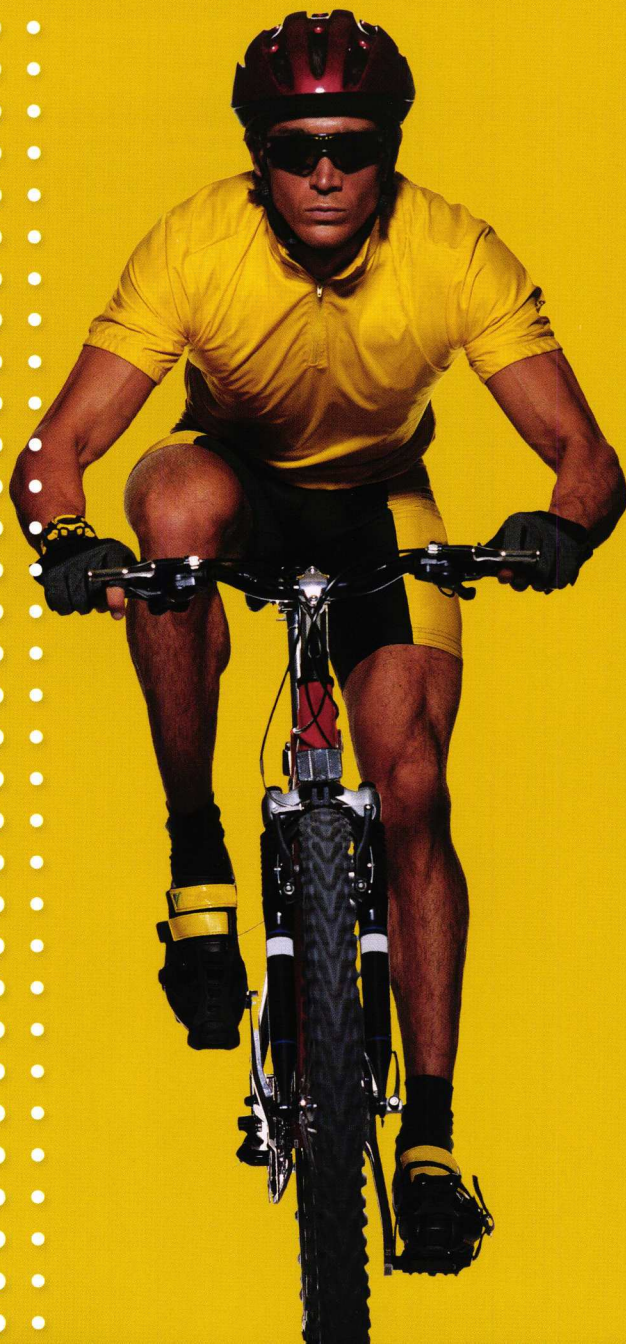
Under observation

Monitoring movement for analysis

Sports complexes have areas where observation and recording equipment is set up. Such equipment makes it possible to accurately record and later review the movements, performance and physiology of individual sportsmen and women and teams. This sheds light on how performance can be improved, injuries may be prevented and tactics can be refined.



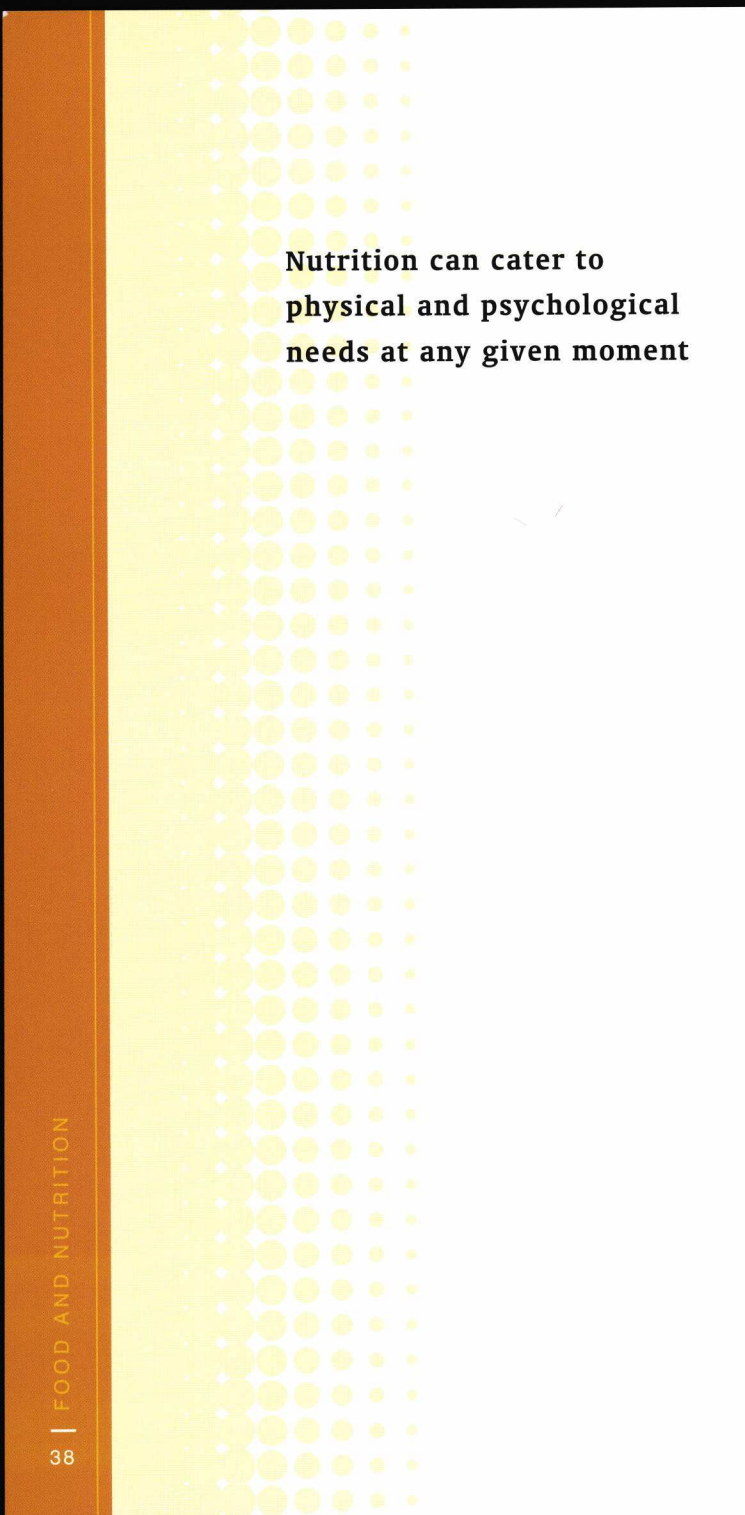
■ Observation makes weak spots visible





4

FOOD AND NUTRITION



**Nutrition can cater to
physical and psychological
needs at any given moment**

A sportsman is going to get further when he or she is burning the right fuel. The sportsman's consumption must be based on proven benefit; there's no room for delusions about 'wonder' foods. Good insight into the micro and macronutrients the sportsman requires, combined with a range of tasty convenient products, makes the fuel selection and intake easier.

The human body needs particular amounts of quantities of nutrients every day. The body's needs vary depending on what it is being asked to do – whether pre and post competition or training session or during the drive for excellence. The body's fluid level also plays an essential role in the ability to perform.

Now

Sportsmen and women, coaches and supervisors know too little about food and nutrition and their relationship with sport. A great deal of experimentation is carried out with foods, dietary systems and food supplements, yet often expert supervision and/or a basis in science are missing. Information and general guidelines are lacking and so the sportsman and the supervisor tend to implement too few good dietary rules that can improve performance. Sometimes this even leads to doping.

The range of responsible foods in solid and liquid form is insufficiently geared to the needs of each type of sport, sportsman and sporting moment (training phase, recovery, competition, tournament). An additional problem is that the limited range of suitable foods is not available in places where sportsmen and women train, compete and rest.

The future

Good information and education provide sportsmen and women and coaches with the knowledge about which foods to eat at the appropriate moment to ensure optimum condition and performance. Since individuals' needs differ, various physiological parameters are monitored continuously during activities. This makes it possible to tailor the diet to the sportsman's particular needs. The available foods include compact foods and drinks that can be easily selected for quick consumption as snacks. They also include complete tasty meals that can be easily prepared on site or en route. In addition, attention is paid to a good nutritional basis for consumption at home or in the company of others, the social connection, which after all is also important to the sportsman's well-being.

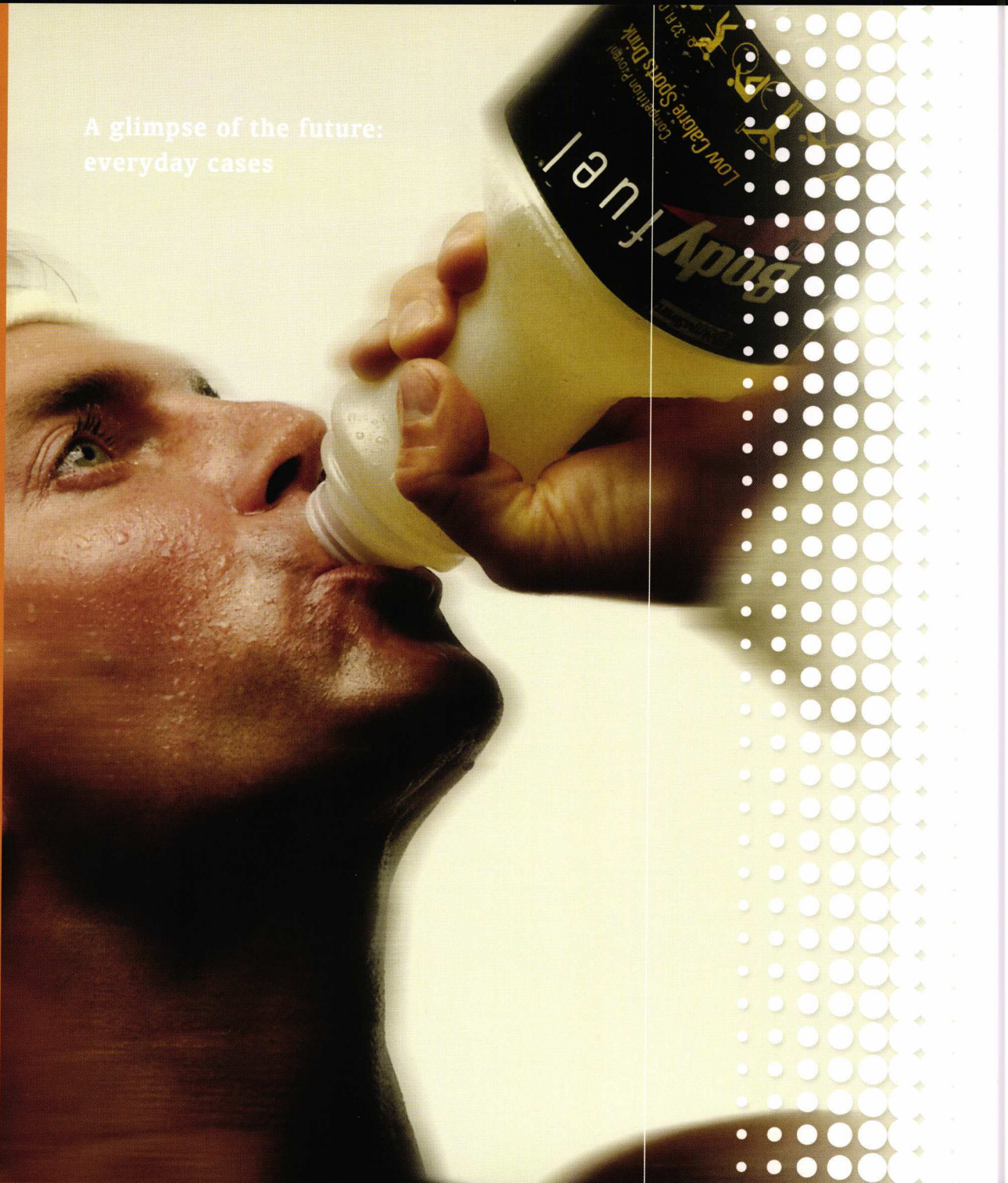
The opportunities for innovation

Given the need for knowledge and for foods tailored to particular, personal needs and actual innovation potential, opportunities exist in the following areas:

- 1. Biomarkers.** Measuring instruments and analysis equipment that measure the physiological parameters of sportsmen and women and translate the data into nutritional advice to suit the specific, identified need.
- 2. Convenience food.** Knowledge about the degree to which the frequency of meals following physical exertion influences physical recovery and about specific needs translated into products that deliver the required nutrients, are tasty and – if necessary – are easy to prepare.

3. Improving brain function. Food can influence a sportsman's mental state and thus performance. As soon as it is exactly clear how this mechanism works, nutritional advice and/or particular products can take advantage of it.

A glimpse of the future:
everyday cases



The right stuff

Suppose a sportsman knows exactly what foods he or she needs. Then there's still the question of whether the sportsman can consume them. For example, the sportsman doesn't have the time to collect all the ingredients to prepare a tasty meal because the travelling schedule for training, competitions, home and secondary commitments is prohibitive. Or the training camp is in Timbuktu and there they simply don't have the necessary products in the shops or at the market. Or the sportsman does have the ingredients but not the facilities to make something quick, let alone tasty.

Using the knowledge researchers have accumulated about the need for specific macro and micronutrients, producers can develop just the right products. The latest technological developments in packing and preparation even make a hot, tasty meal at the end of the training session possible in just a few minutes. Research institutes, the food industry and sportsmen and women regularly touch base about needs and possibilities. As a result, the range of convenience foods is growing. There is something for every occasion and every moment of the day.

■ **Little pack of micronutrients** - One sportsman needs potassium, the other needs iron or magnesium. Since the sportsman's various physiological levels are monitored, the personal coach can keep an eye on how much and when the sportsman needs to eat. That's no problem because the sportsman always carries a varied range of food bars, including food bars for strength, endurance and sprinting. Naturally, the concentrations of the various micronutrients vary from food bar to food bar.

■ **Good and tasty** - The time when food preparations tasted revolting but had to be eaten for their supposed results is long gone. The sportsman can choose from a range of complete meals that appeal to all the senses. Since they have been sterilised under high pressure, they stay fresh a long time, even when they are stored at room temperature.

■ **Quick to heat** - Sometimes a hot meal is really welcome. The sportsman has a choice of ready-to-eat meals that can be heated in a very small microwave oven in a car. But there are also training facilities where such microwave ovens are standard equipment. Other meals are packaged so that they are instantly heated when the packaging is opened.



Custom dietary advice

The right fuel per person

There are two components to the sportsman's dietary advice: the recommended nutritional basis and the intake recommended for a particular situation. The nutritional basis is related to the sportsman's DNA profile, his or her taste preferences and general guidelines on good nutrition. For example the recommendation regarding the nutritional basis may stipulate the avoidance of saturated fats or the intake of extra vitamin B2 or folic acid. The sportsman also stands on the special scales every morning and hears what he or she could best eat during the day. All this goes hand in hand with advice given at particular moments.

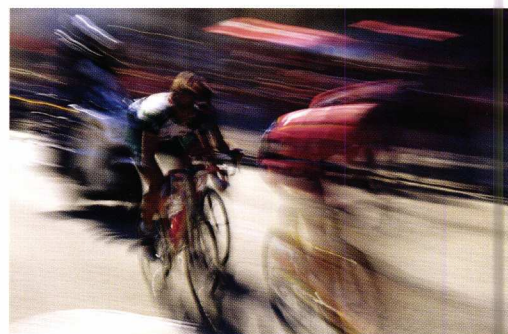


■ A market exists for more sophisticated products

Energy consumption under control

Timely signal to top up

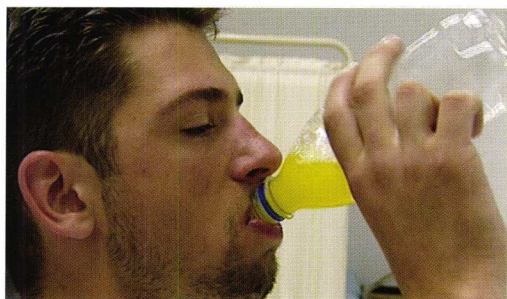
When a sportsman uses up more energy than he or she consumes in food and drink, muscle proteins can be drawn on, which is the last thing you would like to happen. Fortunately indirect methods for estimating energy consumption, such as analysing exhaled breath, are just memories. Now, the consumption of muscle degrading products is monitored continuously by a small unit known as a biosensor and inserted under the skin. The data are instantly accessible. If the energy balance is about to tip into the danger zone, the biosensor emits a signal: time to top up the engine.



Preventing thirst

Hydration always at the right level

Dehydration of just 2% of body weight is enough to substantially impair performance. Combined with the effort exerted, the air temperature and humidity largely determine the fluid loss. By the time a sportsman feels thirsty, he or she has already lost too much fluid. That's why the sportsman wears a fluid meter that announces the need to drink in good time. The sportsman is also able to drink while in action without incurring stomach or other problems. This is because extensive research has been carried out into the drink, taste and concentration of chemicals he or she can tolerate best. Moreover, the sportsman has trained how to drink during exertion.



■ The sportsman knows when he needs a drink

Psychology and food

Food for the right attitude

A positive mental attitude improves physical performance. Unfortunately, there are always factors that cause the sportsman negative stress, such as relationship problems, puberty or poor performance at school. Certain chemicals can provide just the mental boost that makes the world of difference. Coffee, tea, chocolate and Red Bull, all containing caffeine, are well-known examples of stimulants but bananas also perform the same job because they raise the serotonin level. Research into the balance between stress and food is providing more and more starting points for the development of responsible, new pick-me-ups.



■ Responsible performance boost using food





STIMULATING SPORT

Sports clubs have much more to offer society

Sport is good for everyone. It is a generalisation we can make with confidence because it has repeatedly been proven by studies into the physical, social and psychological effects of sporting activities. This is why it is so important that as many people as possible actually do sport. And since many people are not naturally inclined to do any sport, stimulation is vital.

The sports club is the ideal place for everyone to do sport in a responsible way and with enjoyment. Sports clubs offer expert supervision and the company of other participants. Together club members can achieve at a level that suits them and have a lot of fun. Beyond the clubs, many opportunities to do a range of physical activities also exist, like walking, cycling, swimming and fitness.

Now

We attach great value to our health yet few of us take our weekly quota of physical exercise. This is partly due to the fact that many people are still unaware of the value of physical exercise despite publicity campaigns. Sometimes the intention is there but people don't know exactly what sport would suit them or where to go. And sometimes good intentions come to nothing because of a lack of time, because another leisure activity gets priority or because the sports facilities are too far away.

The future

Healthy sports clubs are a core part of the community. Their qualified staff helps people choose sports from a variety on offer so that they can enjoy the activities that perfectly suit their capability and wishes. All the necessary facilities and equipment are present and, what's more, they are ergonomic and environmentally friendly. The complex is home not only to sports clubs but also to other organisations. Local people have access to all the services they may need – sport, childcare, meals, a laundrette and dry cleaners, courses and lots more – at a single location.

The opportunities for innovation

Given the wish and need to stimulate more people to do sport and actual innovation potential, opportunities exist in the following areas:

1. The effectiveness of sport and physical exercise.

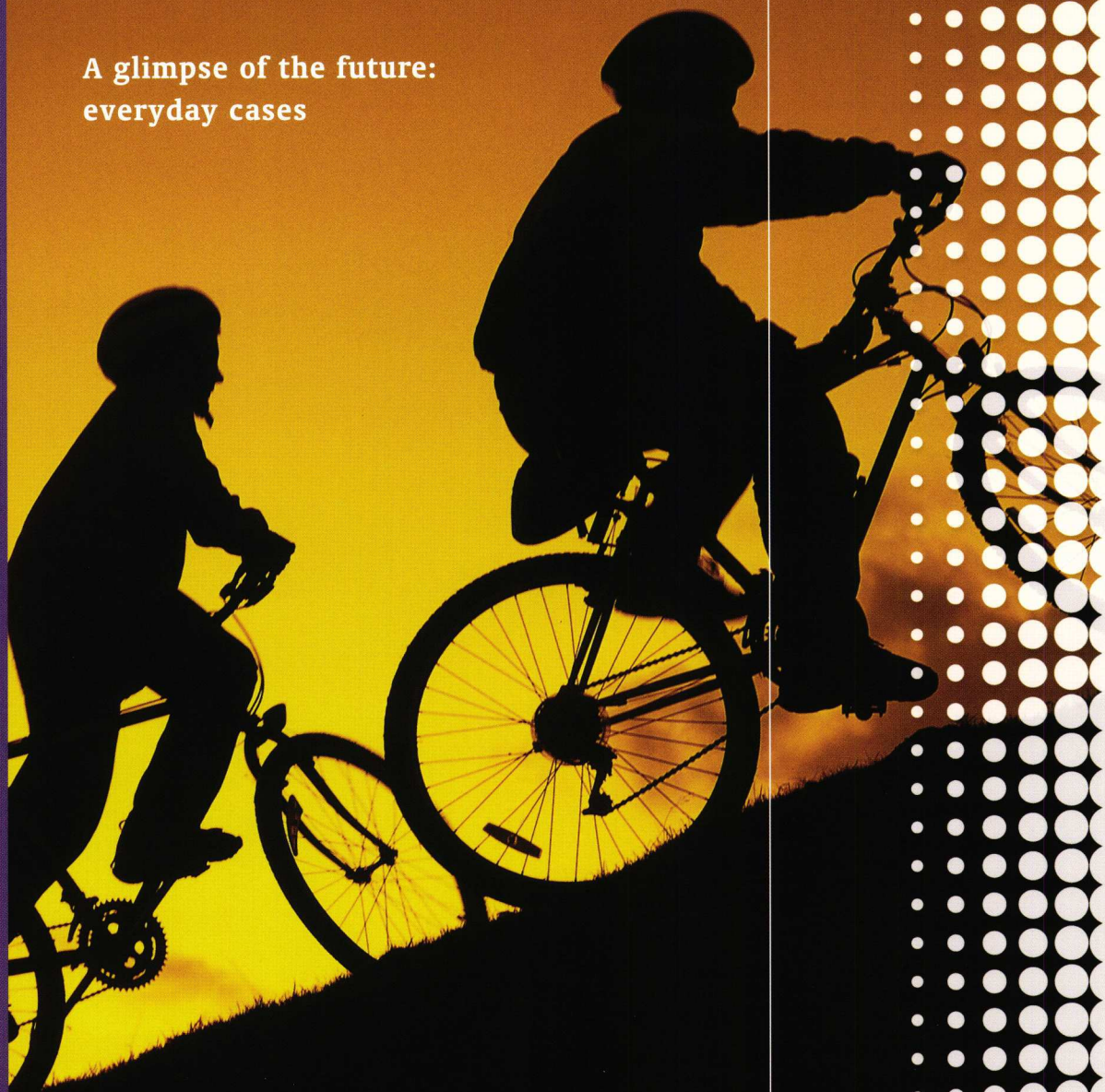
Greater insight is required into the relationship between dose and response, or rather, how the body reacts to different doses of sporting activity. This will illuminate the advantages and disadvantages of a particular sport for an individual. This information will enable people to choose the sport that suits them best and will prevent them from dropping out.

2. Specific target groups. Once suitable sports have been identified for each target group, people will be more likely to choose a sport. The right sport, that is. Target groups may be those with a chronic medical problem, young people with poorly developed motor skills or the elderly

3. Recording and preventing injury. Each year some 2.5 million injuries are suffered. An injury is unpleasant for the sportsman and has negative social effects. A reduction in the number of injuries can ensure that more people continue to do sport with more pleasure and that we limit absence from work through sickness, and reduce health costs.

4. Preventing dropout. Many sportsmen and women give up their sport. Puberty is a time during which many young people give up their activities. How this can be prevented must be investigated.

A glimpse of the future:
everyday cases



More than just sport

At a central location in a village, neighbourhood or, on occasion, an industrial park, there's a complex that houses a variety of organisations and activities. Almost every local resident goes there regularly because the complex is easily accessible. Those who come only to do sport are in the minority. The complexes don't all look the same and over time the allocation of space, the facilities and the services offered change because they adapt to the changing needs of local people.

Sports clubs, companies and other organisations work together time and again in new, highly focused collaborative arrangements. In the newly built neighbourhoods where many children live, parents are able to visit the health centre before taking their child swimming. The child may then spend the rest of the day in the day-care centre in the same building while mum or dad works at a teleworking office elsewhere in the complex. The vegetation grown on the roof of this flexible, sustainable complex adds to the 'green' in the neighbourhood.



■ **Better school performance** - The more sport school-children have, the better they can concentrate in class and boost their academic performance. As the school is right next to the sports complex, the various sports facilities – after all variety is fun – are all within a stone's throw. This proximity makes collaboration between the teachers of physical education and staff at the sports clubs quite natural.

■ **Virtual, too** - Some sports, like golf, require a lot of space, space that isn't always available close to work or home. Most sports complexes have a number of virtual rooms. Golfers can come here every day to practise their swing if they want to because their driving range is too far to get to regularly. Some virtual rooms are equipped with recording equipment so that competitive sportsmen and women can practise certain moves.

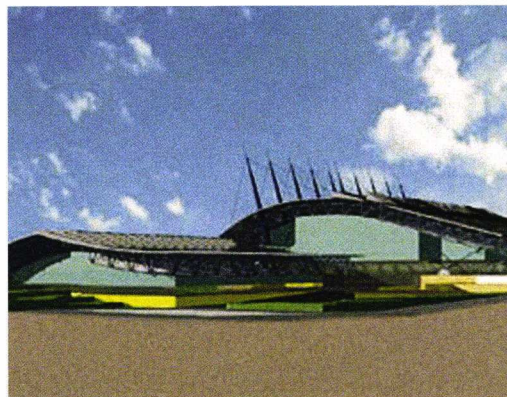
■ **Shared extra supervision** - A person wishing to return to an active life after a heart attack often has to deal with fear. Fear of another attack. These days there are little gadgets, similar to a watch, that continuously monitor systolic blood pressure and heart rate. You wear them on your wrist and they emit a signal when you overdo it. Every self-respecting complex has a number of these gadgets available for sportsmen and women. They encourage people to cross the threshold; and to return more quickly to sport.

■ **At the heart of society** - Some sections of the population aren't inclined to pull on a tracksuit. By offering non-sporting activities to a specific target group, such population groups can be introduced to the sports complex in a roundabout way. An example would be a language course for foreign women. They could get to know one another and maybe explore the other sporting activities on offer in the complex.

Economic value

Research delivers more

Sport isn't just a question of Olympic gold but also economic gold. Whereas Olympic gold may have been the only tangible result in the past, that's no longer the case thanks to research into the economic pros and cons of sport. This offers continual guidance in limiting the losses and boosting the gains.



■ Sport also has its commercial side

Professional staff

Working on quality

The number of staff including volunteers working without a qualification in sports clubs has decreased greatly in recent years and their work is now carried out by qualified staff. This change has been made possible by the systematic gathering of labour market details. Co-operation with schools and companies has enabled sports clubs to make their services more professional, specifically through staff training and by integrating the services of third parties into their customer provision.



■ Expert supervision makes sport more pleasurable and effective

Sports advisor

Customised advice for everyone

People contact the national sports advisor via the internet and indicate their sporting wishes and requirements. In response they receive information tailored to their situation, about the sport that would suit them best, the right training schedule and nearby facilities. Records are kept of people's wishes and demands and this information is used to enable sports clubs, materials' manufacturers and sports complex managers to adapt to continually changing customer needs.

Health value

Proving the value

People are innovative; they often devise the smartest products and equipment. The only question is whether you should believe all the sales talk. Take vibroplates for example. Although it has always been claimed that they are good for people with certain medical problems, we now know for certain the average percentage by which bone density increases when the vibroplates are used for 30 minutes a day for a given period. If everyone with osteoporosis were to use them, the number of bone fractures per year would decrease enormously.

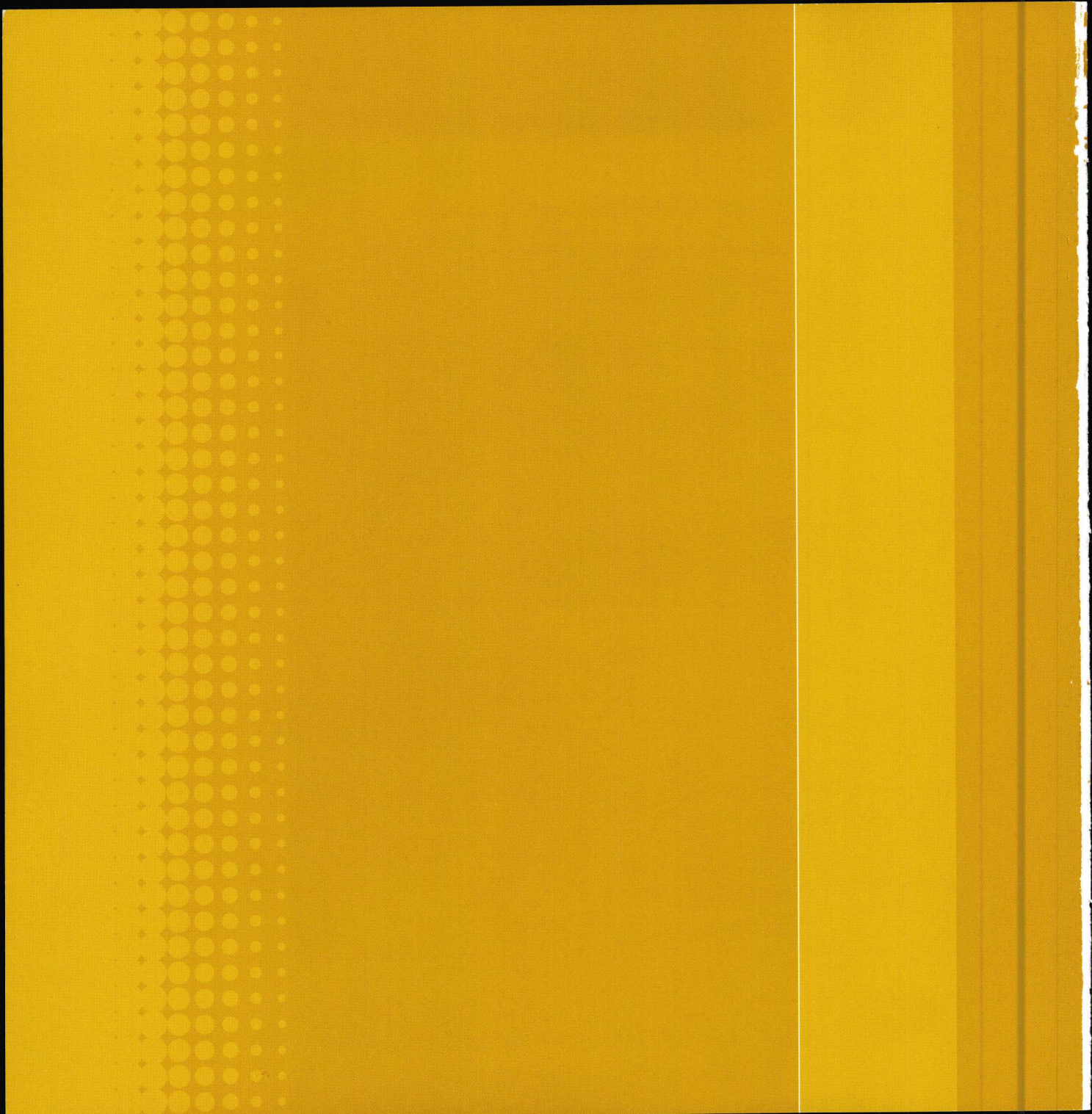
Fewer injuries

Registration helps prevention

Almost all sports clubs register their injuries nowadays. This creates a good national picture of particular sports-related injuries. From this, sports clubs can see whether they have an above-average incidence of certain injuries. If they do, they can benefit from the same system's information on treatment and prevention. Manufacturers of materials can use the database to optimise their product range and develop new products.



■ Sports clubs offer injury data for product development





Colofon

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