



# Power to the people

**T**he market for functional sports underwear has grown immensely in the past decade. What used to be the domain of the three Scandinavian inventors of the concept - Craft of Sweden, Helly Hansen and Odlo - has become common property for just about all producers of performance apparel worldwide. And industry has done its share to educate consumers in a never-ending litany on wicking processes, capillary effect, moisture management and the prevention of chilling through evaporation. Temporarily, 'power'-undergear is the latest innovation concerning the layer next to the skin and 'undergear' is, in my opinion, the precise word for the products under review.

Moisture management is a crucial challenge for the layer closest to the skin. Moisture retention lowers temperature and reduces body performance in all sports, regardless of the ambient temperature and the intensity of movement. Cold diverts the body energy into heating. But it's not only moisture and cold that harms the body. Depending on the sport, different muscles and sections of the body are stressed. Muscles stabilise the joints and ligaments and bond them into a whole unit capable of high athletic performance. The basic problem with sports is that high performance over a long period of time causes muscle fatigue, better known within sports medicine as muscle imbalance. Research shows that the condition accounts for some 30% of all sports injuries - mainly back and hamstring troubles. This insight is relatively new but has

given rise to the development of a new generation of functional sports underwear to cope with muscle malfunction. The target is to provide support for the efficient application of energy for as long as possible and equally to delay muscle fatigue for as long as possible.

 Wacoal C-WX

## Muscles imbalance - what then?

There are two main groups of muscles relevant for high performance activity: 'mobilisers' and 'stabilisers'. 'Mobiliser' muscles are those that produce movement. They are often big muscle groups with more 'fast-twitch' fibres. Although they produce high power, these muscles have a tendency to shorten. The quadriceps and rectus femoris, both located in the thigh, are examples of 'mobiliser' muscles. The tightening of a 'mobiliser' muscle leads to two major problems:

- The limited range of motion can affect movement and place greater stress on the joints.
- The tightness in the muscle may inhibit the opposing muscle group through a process called reciprocal enervation. For example, a tight rectus femoris can inhibit gluteus maximus activity.

'Stabiliser' muscles control movement and joint positions. They are smaller, deeper muscles, which often have more 'slow-twitch' fibres. They should be well co-ordinated and have good endurance capacity. The gluteals, for example, are 'stabiliser' muscles. 'Stabiliser' muscles don't tighten they lengthen and then cannot fully carry through their intended role of joint stabilisation. When a chronic lengthening occurs, the stabiliser muscle becomes inactive and joint stability is compromised.

## How power-undergear works

Power-undergear aims at reducing muscle oscillation, thereby reducing muscle fatigue and providing increased proprioception (increased awareness of movement and position) for more bodily energy and better performance. In general, power-undergear is scientifically designed in close co-operation with universities and institutes of sports medicine. It enhances the body's performance in three stages from warm-up through activity to recovery. The major areas of application are sports with long periods of intense activity, such as running, fitness walking, hiking, cycling, skiing, and snowboarding. It also has important performance implications for repetitive, intermittent, explosive sports such as track and field, volleyball, basketball and soccer. Although one is aware that muscle stabilising apparel does have a longer tradition in the spheres of bodybuilding and fitness studios training, the innovative new trend concentrates on high-energy activities.

Power-undergear comes in both women's and men's sizes. It is knitted three-dimensionally and cut to body-contours to ensure an anatomically correct fit and precisely placed compression. Gender-specificity and the correct size are very important because power-undergear should have a very selective impact if it is to be efficient. The fabric uses different compressive strengths and is a four-way stretch to specifically target the muscles and joints covered.

Power-undergear uses three approaches to boost body performance:

1. Better temperature regulation: the body performs best at a temperature of 37°C. Thus the intention is to stop the body diverting energy into temperature regulation instead of performance. Differential knitting and a mix of yarn compositions warm the body where it needs heat and cool it where overheating would cause problems.
2. Less muscle vibration and fatigue: vibration leads to rapid muscle fatigue and it follows that by preventing vibration additional energy is available to improve athletic performance. Power-undergear uses a variety of strategically placed compression panels to control muscle vibration by supporting muscle groups and joints.
3. Improved blood circulation: healthy blood circulation increases the blood oxygen level, reduces lactic acid in the muscles and reduces the muscle regeneration time between bursts of activity. Power-undergear uses different compressive strengths on muscles to stimulate blood circulation back to the heart. All this adds up to naturally improved stamina instead of muscle fatigue.

Power-undergear has been made possible with the advance of seamless knitting technology. Lack of seaming and the use of soft yarns prevent bulk, the formation of pressure points and uncomfortable friction, and facilitate a comfortable body-contoured fit with four-way stretch.

Tests have shown a significant improvement in



athletic performance for both male and female activists. Furthermore, they showed that the results were even more obvious with untrained people in comparison with trained athletes.

**X-Undergear's temperature control function explained.**

 X-Undergear

## The Lycra Power concept

DuPont – now Invista – sponsored an in-depth research from 1991 through to 1995 led by Dr. W.J. Kraemer at the Centre of Sports Medicine at Penn State University. Kraemer showed that all types of muscle fatigue – in strength, endurance, and power – could be reduced by the restriction of muscle oscillation. The 'engine' in this case was a muscle compression garment knitted from DuPont's Lycra elastane yarns. An average of 12% increase in force and power production was the result of the study that involved long term exercising by users of Lycra compared with a loose fitting garment. Furthermore, 73% of the athletes tested increased the accuracy of their movements (proprioception) or body positioning at various angles when wearing the garments.

To guarantee wearers these substantial improvements in force and power production, DuPont opened a garment certification programme in the late '90s. To gain certification, fabrics must meet strict criteria in power, stretch and modulus. The guidelines are to ensure correct muscle coverage, the proper directional use of the fabric, the second skin effect (full mobility without 'creeping' or sliding in any way) and the durability and quality of the garment. Only approved styles are certified Lycra Power in contrast to Lycra or Lycra Soft.

Lycra Power, therefore, is neither a fibre nor an existing fabric. It is not a simple matter of weave or knit. Rather it is a term of processing regarding the standards of weight (170 to 190g/m<sup>2</sup>), the content of Lycra (minimum 20%), a minimum elongation in any direction, a minimum recovery force, and a maximum power loss and seam slippage. According to DuPont, the physiological benefits of certified Lycra Power garments are an improvement in force and power production, the maintenance of energy levels, an improved sense of balance, faster response to required movement, and a 'second skin' feeling.

## Performance conditioning wear

One of the certified garment lines incorporating Lycra Power was launched in Fall 2002 by the Wacoal Sports Science Corporation, a wholly owned subsidiary of Japan's Wacoal Corporation, the largest manufacturer of women's intimate apparel in the world. Wacoal Sports claims to be the brand to have the first patented and anatomically correct functional sports apparel. It calls the product CW-X Performance Conditioning Wear, aimed primarily at running, outdoor and cycling activities.

Since 1964 Wacoal has conducted extensive research focused on kinesiology – the study of the human body in motion – and collected data from over 30,000 people in the company-owned Human Science Centre in Kyoto, Japan. One of the outcomes of this research is CW-X Performance with no less than 15 patents alone in the US.

CW-X is fully based on Invista fabrics (20% Lycra / 80% CoolMax). The Lycra provides the four-way stretch and the compression, whilst the CoolMax wicks the perspiration away from the body. This mixture of fabrics was determined by the protection required to counteract the major causes for sports injury: insufficient warm up, limited cool down, poor training techniques and bad weather.

CW-X has an integrated 'conditioning web' consisting of compression panels of different strengths to create pressure and help support muscle groups and joints. According to Wacoal's research the part 'most commonly affected' for injuries is the knee joint and the company has developed a system of panels that wrap around it but still leave a small uncovered area over the kneecap to avoid over-compression. Although CW-X consists of both tops and bottoms, not surprisingly the main focus concentrates on bottoms.

## Performance without doping

Swiss Brands' X-Undergear is another first. The first to incorporate a 37°C temperature regulating technology called '37°CCR', it aims to extend the body's natural performance range. X-undergear regards the correct temperature as the basis for increased performance. When too hot, the body wastes energy for cooling, when too cold it diverts energy into heating. Prof. Dr. Weber from the Niederrhein University of Applied Science, Mönchengladbach and Prof. Dr. Lambertz from the High-Teach Institute, Herdecke, showed that the body consists of diverging surfaces, some of which provide maximum heat conduction, while others conserve the heat for use by the rest of the body. By means of air conditioning channels, armpits and body zones on the one hand, and insulation pads on the other, the body temperature is cooled down or raised according to need.

With X-Undergear the body is said to retain energy reserves and perform better even under



cold conditions. According to Weber and Lambertz "an absolutely legal and healthy way of doping".

Based on high tech yarns developed in nano-technology research, X-Undergear consists of 92% polyamide, 6% polypropylene and 2% elastane, and incorporates inorganic bactericidal additives that inhibit mould growth and prevent bad odour. As well as the temperature regulation, X-Undergear reduces muscle vibration and delays muscle imbalance.

Third, X-Undergear aids the body in 'replenishing' nutrients and enhancing blood circulation. Both functions are caused by the wide variety of knits used to pressurise different muscles and joints. The range includes a variety of styles for men and women and is custom tailored to the specific fit for different sports.

## Ergonomic sports system

Although possibly better known for its ranges of knitwear and legwear, according to Falke its Ergonomic Underwear offers the broadest and most versatile series of power-undergear and the one with the best international distribution. This is due to the fact that the company produces four segments: Ergonomic X-Treme for low temperature and changing activities, Ergonomic Ultra for high activity and hard sweating, Ergonomic Pro for all year wear. Women wear Ergonomic Support. X-Treme and Ultra are rated as power-undergear because of the snug body fit and selective compression.

Ergonomic Support is a complete female line with sports bras and slips as well as panties – and all achieve Lycra Power certification in using up to 28% elastane. Ergonomic Extreme (56% PP, 40% PA, 4% EA) and Ergonomic Ultra (92% PA, 8% EA) operate in the same conceptual mode as X-Undergear in using less elastane than Lycra Power, but with a range of different knit structures to regulate various parts of the body, the

*Wacoal's C-WX performance tights from the Undergear range. Womens' Pro (left); Mens' Expert (right).*

 Wacoal C-WX

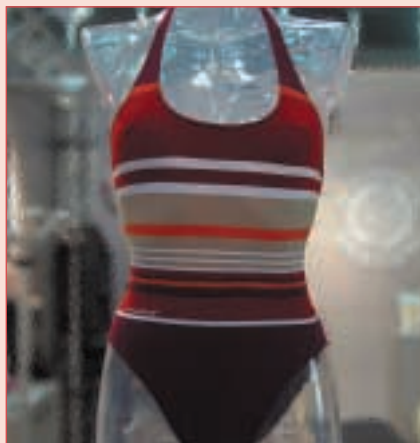
### It's a seamless world

The big news coming from the ispo textile sector was that seamless knitting machine manufacturers Santoni had at last purchased its much smaller local rival, San Giacomo, giving it a near monopoly on the expanding world of seamless knitting.

Santoni's original marketing activity was a direct approach to the international brands and retailers as the development of a push/pull strategy with manufacturing suppliers. The danger from direct contact with brands such as Nike and retailers such as Marks and Spencer was the appearance of Santoni being too dominant in the chain and consequently risking an upset with its immediate customers.

These tactics have changed recently, allowing Santoni to develop from direct marketing to a more conventional approach, as it becomes integrated into the technical channel and has achieved a better understanding of its role.

The result is a different focus on Santoni 'know-how'. The company



Santoni

continues to make money selling its seamless machines, but a retailer or consumer does not get confused into thinking they are buying a 'Santoni garment' but a brand owner's product that incorporates 'Santoni know-how'. A simple adjustment, but a clever repositioning in these times of complex supply networks, when even unintentional heavy handedness by a supplier can create a problem.

Using this approach Santoni has progressively moved its focus from traditional underwear into technical underwear where it works with the major sports brands Odlo, Tecso, Puma, and Nike. It is also involved in the new growth market for technical underwear, particularly in Diadora's Hidden Power Range.

Swimwear is also a target and the company made a recent move into the fashion market. As marketing executive Valentina Gentilin says "knitters have been the makers of the history of knitwear". And, with some adjustment to the gauge of its machines, Santoni has been able to initiate projects in the Italian knitwear centres.

This is the current theme of many Italian textile businesses that are determined to expand their activities by taking existing products or making slight adaptations into new market areas. So for Santoni we should now discuss underwear, technical underwear, sportswear, swimwear, some specialist medical wear and fashion wear. 🌐

temperature and increased pressure on individual muscles and joints. Anatomy, climate control and support are the three terms Falke use as a basis.

Falke, too, has developed this sports system in close co-operation with a scientific research institute. Body scan data collected by the Institute of Biomechanics at the German Sports University in Cologne and the circular three-dimensional knitting process-technology enabled the company to produce anatomical 3D fit underwear with selective climate and insulation zones.

### Boundary concepts rising fast

The circular knitting technology has enabled many companies to produce seamless style underwear. Rohner, Odlo, Tao, Vaude and ToESS all produce seamless underwear and are probably only the tip of the iceberg. Nevertheless, though seamless technology is often used to change the knit structure from open mesh via ribs to a closed structure according to the requirements for warmth and breathability, all these concepts are by no means power undergear as already defined.

Craft of Sweden was one of the first functional base layer companies to realise that muscle compression is an important issue for sports. Its Pro Series underwear has had snug fit from the very beginning. In fact, it was so immensely snug many people associated Pro underwear with the skin of a sausage. On the other hand Pro has been the popular base layer for hundreds of sportsmen and women. Winter Olympic medallists, world record holders, and many other champions apparently all wore Craft Pro when the occasion demanded they do so.

According to the company the compression factor of Pro has never actually been scientifically investigated, but it does argue that the tight fit avoids unintended movement of muscles and gives muscle support. Unwittingly Craft led the concept of power undergear.

Nevertheless, scientific research has brought deeper insight on the issue. Today we know that selective compression brings improved results. The possibility of stabilising selected muscle groups and joints with pressure according to need is very new. The expenditure in time and money is vast due to two challenges. First, the medical challenge is to ascertain the right amount of pressure and the correct pressure points for each muscle. Second, the technical challenge where the pressure needed is supposed to work vertically onto the muscle, but the elasticity of the fabric is purely horizontal. Only a very specific amount of compression actually does the job correctly. For those reasons, scientific research is lengthy and expensive and the acquired data kept very secret. Many companies will shy away from the costs, thus leaving the development and supply of true power-undergear limited to only a few. 🌐

*Falke Ultra series for wear in low temperatures and when undertaking a variety of activities.*

Falke

