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EDITORIAL MISSION STATEMENT

The editorial mission of the EWF – Scientific Magazine is to advance the knowledge of human movement based on the assumption that it is firstly, by any standard, the expression of muscular strength and secondly, a way of life and an ethical approach entrusted to professionals who not only are highly qualified, but also have full knowledge of the scientific facts, as well as being specifically competent. From its first issue, EWF – Scientific Magazine, has set itself the ambitious goal of bridging the gaps between the scientific laboratory and the operator on the field, enhancing both the practical experience of the coaches and the results of applied research. Consequently, the editorial rule will be a constant reference to practice and the publication of recommendations on how to apply the results of research to the practice of movement and sport.

SUMMARY

The ability to develop power is a major differentiating factor of success among athletes, and training at or near peak power is a critical component to training athletes for competitive success.1-4 Peak power, defined as the highest instantaneous power value during a range of motion under a given set of conditions.

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The differences between the sporting performance of man and woman have always intrigued scientists, coaches and all those who live or have lived in the realm of sport. However, training and performance differences still remain a subject of discussion.

EDITORIAL

Escaping the misunderstanding

I am often invited to take part in, or attend conferences and seminars that address - in any capacity or at any level - insights on sports issues (of various nature). On these occasions I often hear phrases such as:

- Sport is educational
- Sport fosters socialisation
- Sport is good for you
- Sport favours integration
- Sport is culture

But is it really so? Does sport fulfil all these roles? Is it actually capable of doing so? Even when the most common models say and do completely different things, exploiting popular communication skills? Does the historicity of these values make them still valid today? I personally believe that, as always, taking time out to stop and think can only be positive. It is a way, like others (reflection), of catching our breath, pausing to see if what we believe, we hear, we say and we tell ourselves, still corresponds, always corresponds to reality, and then we can resume our daily routine in the same, or in another direction. Well, I don't think modern society gives much thought to reflection, we are so intent on racing forwards that we lose the perception of what we pass alongside and what we overtake. But where are we heading towards?

This is why, precisely on these definitions, I feel the need to pause and catch my breath. And to reflect. I am no longer convinced that only "sport" bears within itself the magical powers to change the world and make it more beautiful and purer: I'm struggling because I'm missing some pieces to complete the puzzle I'm working on, to finish my mosaic, to make my point of view more steadfast, a point of view that I want to share with you today.

I have tried to give a dimension to the term sport, a dimension that is not only the etymological derivation, which of course we must not forget, but that does not explain well and thoroughly the points mentioned above. Indeed it seems to me that it does not explain it at all.
Sport is a form of movement organised and structured by rules that impose or prohibit, that should establish, once and for all, what to do, how to do it and when to do it. Very restrictive, not permissive, highly specialised and not very inclined to transversality.

Therefore, the first question arises (and how could it not?): how can such a structure be educational? According to etymology, the word educate comes from the Latin "ducere", which means "**draw, conduct**" and from particle "ex", which means "**out**." So, we could easily deduce that the word "education" has its origin in the ex-ducere, or "draw out." Here is where I get more confused.
Because if it is true that educating means "drawing out", there is absolutely no sense in seeing and hearing (continually, repeatedly, obsessively) teachers, parents, institutions, coaches and trainers who, in every way possible, try to fill the heads and souls of children with concepts, behaviours, habits, old traditions and often mistakes. Children are stuffed like turkeys on Thanksgiving Day. Filled until they burst, erupting into something they are not, are not at all, because they were not given the chance, the opportunity to "emerge". This is what sport does, it does so continuously and diligently, you might even say passionately. But it is a fatal error. The quintessential mistake. A trainer rarely (or maybe you have had a different experience?) lets athletes think independently or be proactive, encouraging them to draw out a personal point of view, their anxieties and certainties, sometimes their ability to help find their own development and training process. None of this! In many cases, athletes are subject in somewhat violent ways, to rules and laws that have little to do with the "drawing out" of the term education. Actually, quite the opposite mis-education.
Let's consider another axiom: sports = wellbeing. If we read the statistics, this axiom would be dismantled in an instant. As direct consequences of practicing sport, you can die, be severely injured, develop chronic conditions which can be more or less severe or disabling. Statistics report on traumatic events in every sport and at all levels. So, how can we define sport as a means that favours and promotes health?
Cultural aspects. Sport is culture, that is what we hear all around us, but it is always said that sport fosters culture. But what does this mean, what exactly is sports culture? Perhaps knowing the dates and results of races or biographies of champions off by heart? I think this can be defined as factual knowledge (**in other words, knowledge of the concepts of a discipline, pursued and achieved through a study free of structure and order**) and sport is full of knowledgeable people. Sports culture is precisely the opposite of factual knowledge and can only be achieved through consistent, systematic and multi-disciplinary study. In addition, conducted over a long period of time, from an early age.
But is it true that sport at least promotes socialisation and integration? I repeat: is it true? When we see episodes of gratuitous violence inside or outside stadiums, on the streets, in cities, integration and socialisation do not spring to mind. As much as we make an effort to have confidence and truly wish it were so, it is not that easy.
So? Where are we heading? We must escape the misunderstanding. It is not sport that promote the above points: the only element that has these characteristics is the knowledge, practice, learning and teaching of movement. Movement? Yes, movement that was born and has developed with man, educating him to "draw out" the elements for the survival, evolution and success on our planet. It is the study of movement that produces culture, it is the sharing of movement that produces socialization and integration. It is the constant practice of physical movement which, if carried out freely, without obligations and restrictions, produces (and then maintains) health and well-being.
So should we demonise sport? No, we just have to escape the misunderstanding: it is not the Lord of the Jungle. Yes, it plays an important role in the socio-economic sphere, it is spectacular and exciting to watch, but it's a far cry from having the miraculous qualities some would have us believe.

Antonio Urso
EWF President

The official journal of the European Weightlifting Federation

COMPLEXITIES OF PRESCRIBING LOADS TO TARGET PEAK POWER

BY ANNA SWISHER


#instrengthwetrust

The ability to develop power is a major differentiating factor of success among athletes, and training at or near peak power is a critical component to training athletes for competitive success.[1-4] Peak power, defined as the highest instantaneous power value during a range of motion under a given set of conditions,[2] has been reported to occur across a wide range (0–90% of 1 repetition maximum (RM)) in various resistance training exercises.5-10 The relative load at which peak power output occurred in a jump squat has been reported at 0% 1RM (no external load),10 whereas peak power has been reported at 45% 1RM in a bench press. In lower-body exercises peak power has been reported to occur between 50% and 70% of 1RM in a squat,11 and between 30% and 60% of 1RM in a split squat.11 The load that maximizes power output in a power clean and the Olympic lifts has been most frequently demonstrated to occur between 70% and 80% of 1RM.[8,12,13]

These findings have rightfully caused a lot of confusion among coaches when it comes to training prescription. The wide range of reported values that maximize power output likely exist because power output appears to depend on the interplay between numerous factors such as the exercise being performed, absolute strength levels, anthropometry, training status of the participants, methodology (i.e., unloaded versus loaded movements), training modality (i.e., free weights or machines), and equipment used to measure power output.[4,5,11,14-18] Comparing results from investigations examining power is also complicated by the fact that power is not static and fluctuates in response to training demands, training volume, and fatigue.[2,19,20]

In addition to the dynamic nature of power output with respect to training loads, power values are also difficult to compare between investigations because they depend largely on the device(s) used for measurement as well as the mathematical method used to calculate them.[4,9] Power has been assessed via wireless accelerometers,[21,22] force plates,[23] video analysis, linear position transducers,[24,25] 3D motion capture,10,26 and a combination of force plates and linear position transducers.[8,13] The lack of agreement between power values obtained by different measurement devices and calculations may contribute to the very large range (0–90% of 1RM) where peak power output has been reported.

There is tremendous practical value to coaches and athletes in identifying the load where power output is maximized; training with loads that produce maximal power has been shown to cause the greatest increases in power.[1,2,8] When selecting exercises, set and repetition schemes, and loading to enhance power, consideration should be given to the precise demands of the sport.[2,8,27] For sports where athletes need to produce high velocities with low or no external load, such as sprinting or volleyball, performing a jump squat with a light (0–30%

FIGURE NO. 1 FORCE-VELOCITY CURVE WITH POWER CURVE

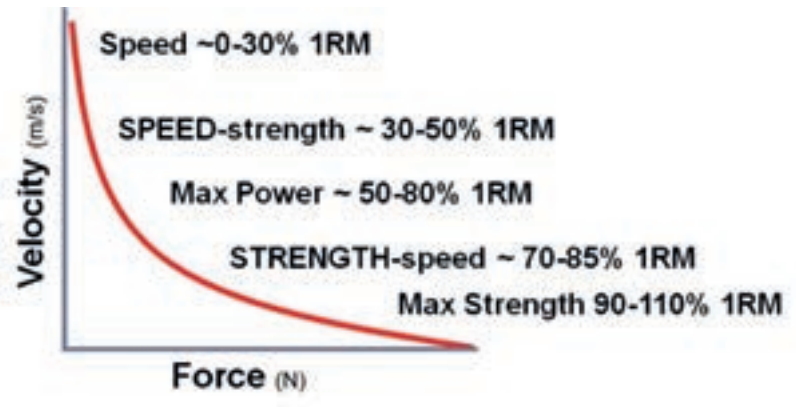

FIGURE NO. 2 FORCE-VELOCITY CURVE WITH APPROXIMATE RANGES OF RELATIVE INTENSITY NECESSARY TO TARGET DIFFERENT PHYSICAL ABILITIES.

1RM) load may have the greatest specificity to sport performance.[2,8,10,18,27] For athletes in sports such as weightlifting, American football, or rugby, where high velocities must be produced against large external loads, performing power cleans with 70–80% of 1RM may have high carryover to sport performance.[8] While understanding how power output fluctuates across the loading spectrum for a variety of lifts is important, selecting exercises that produce high power outputs are likely to be of greater importance to coaches and athletes aiming to maximize power production capabilities. For example, if the goal is to maximize an athlete's power output, it is unlikely that an exercise such as a bench press or a squat would be selected given that the peak power output for a bench press is considerably lower than a snatch.[2] The exercises that likely make the biggest impact on speed and power development are weightlifting movements, such as the clean and jerk, and their derivatives.[2]

Clearly identifying the relative load where peak power occurs in a snatch or a clean based on the current literature is exceedingly difficult because of the limitations of methodological and computational assessment of power and barbell velocity. For an exercise like a power clean from power position, where the barbell moves independently of the body, the system velocity measured by a force plate may not be representative of the barbell's velocity. As a result, when power output is calculated from a force plate only, and system velocity is used rather than a direct measurement of barbell velocity, it is possible that the power output from a clean or snatch is misrepresented.[8] Currently, a combination of displacement-time data of the barbell and ground reaction force-time data is regarded as the most direct and valid method for assessing external mechanical power output during a dynamic movement such as a power clean.[15,31] Unfortunately, very few studies have used this method to examine changes in power and velocity with varying loads in weightlifting movements.[8]

Despite these challenges, a well-trained coach can determine an optimal working weight by carefully observing his or her lifter. In fact, having a range of 70–80% 1RM for an Olympic lift may be a sufficient guide for a seasoned coach who is cognizant of the training age, absolute strength levels, and fatigue levels of her athletes. While power output itself is difficult for a coach to detect, barbell velocity can be observed. Barbell velocity is the primary factor that influences changes in peak power,[32] so finding a load at about 70–80% 1RM where the barbell is moving well is a good approximation. An experienced coach can rely on her eyes and rapport with an athlete to determine an appropriate load for a given day. If a coach is less comfortable with the "eyeball" test, another strategy is to do ladder sets, with at least one set at 70%, 75%, and 80% of 1RM. This provides some assurance that training will be done at and near the load that maximizes peak power.

While there are numerous wireless accelerometers and field-based devices that purport to assess bar-

bell velocity and power output, to date none are valid or reliable enough to be used on very fast, complex movements such as the Olympic lifts. Basing training decisions solely on data collected from these devices is unwise. When considering a new monitoring tool for weightlifting, coaches should assess the device's value by ensuring that the device is both reliable (i.e., provides consistent values) and valid (i.e., values are reflective of quality being measured). For more detailed information on selecting devices to assist with weightlifting training, please read "Coaching Weightlifting in the Age of Sport Technology" in EWF Scientific Magazine volume 2, year 1.

SUMMARY

During the phases of training where power development is a priority, coaches should select a load of approximately 70% to 80% 1RM for weightlifting movements. A coach should consider how fatigued an athlete is as well as the quality and speed of the warm-up sets before settling on a load to use in training. From a wider perspective, training for power development should occur across a broader load-power spectrum that combines high-velocity and low-load exercises (e.g., plyometrics, jump squats) with high-force and moderate-velocity exercises (e.g., power cleans, squats) to facilitate a more complete adaptation across the force-velocity curve.[2,4,33] To further optimize power development and sport performance, this mixed-method approach to training for power development should be done within the context of a periodized training plan.[2,29,33]

ANNA SWISHER

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THE ANKLE AND AN ASIAN PULL

"The arch of the foot is linked up by elastic ligaments that can store elastic energy when deformed and later reutilize it as mechanical work."
(Alexander, 1988)

BY ANDREW CHARNIGA JR


CHINA
Nomad oil

The official journal of the European Weightlifting Federation

Questions were raised in a previous article concerning suitability of prolonging the loading on the lumbar spine, characteristic of the Russian pull technique. Also, the question as to whether knowledge of training and weightlifting techniques which were the products of research in era of special enhancement is in need of revision in light of current testing protocols.

Moreover, the question was raised as to whether an Asian pull technique, characterized by an atypically large shifting of the shoulder joints and a premature, significant rise onto the toes in the pull phase represents a significant error in technique. In all probability, the most significant deficit in our knowledge of weightlifting sport, especially as it pertains to our acceptance of the protocol of the Russian pull is the role assigned the foot lever and the musculature of the ankle. This is not surprising since the collective role of the foot, the ankle joint, and the muscle- tendon – ligament linkage is one of, if not the least understood aspects of weightlifting.

1. THE INITIAL CONTRIBUTION OF THE MUSCLES OF THE SHANK: INERTIA COUPLING

Inertia coupling is an important concept to understanding the complexity of human movement. Essentially it means muscles can accelerate joints their tendons do not cross. And, this concept is very relevant to weightlifting technique.

When we think of straightening the legs in pulling the barbell from the platform, or in squatting, we automatically think quadriceps group because these four muscles cross the knee. This muscle group acts to straighten the knee joint. However, the soleus muscle and other single joint plantar flexors are virtually never mentioned in textbook discussions of knee, let alone hip extension; because they are muscles of the shank, which do not cross the knee joint. They cannot produce torque on the knee. Either absent or very insignificant in other mammals, (Alexander, 1988) the soleus muscle is an overlooked, poorly understood, synergist of the quadriceps group. When the shin is tilted forward away from the vertical in pulling or in squatting, soleus contracts in what can be described as a reverse origin insertion action to return the shin to vertical.

Contraction of soleus pulls the shin backward assisting the straightening of the knee and even hip, because shin bones are interconnected to thigh bones and hip by means of the knee joint. Consequently, when this muscle straightens the shin, thigh and hip are accelerated into extension; because, ankle, thigh and hip are interconnected by couplings.

"In a flat –footed posture near the vertical position the soleus acts to accelerate the knee into extension twice as much as the ankle because the thigh is accelerated into extension as much as the shank, i.e., the soleus acts to accelerate the thigh clockwise as much as it acts to accelerate the shank counterclockwise." F. E. Zajac, 1993

Soleus and the other single joint plantar flexors are very active synergists from the instant a weightlifter begins applying force to the barbell in the start position; up until the shins approach vertical. This is the initial major contribution of the shank muscles.

Once the weightlifter straightens the lower extremities in the pull and the shins shift to a vertical disposition the quadriceps - shank muscle synergy can contribute little to the upward movement of the barbell. The lifter is forced to raise the barbell with the muscles which straighten the trunk. This action in the Russian pull in comparison to the Asian pull; with its prolonged shifting of the shoulder joints in front of the vertical line of the bar.

Lifters react to the large moment on the hips and trunk as the lower extremities straighten, and "the toppling over moment force of gravity of the force of the barbell" (R. A. Roman, 1986) by re – bending the knees. This action re – introduces the quadriceps - shank - muscle synergy into the work of raising the barbell. When the shins tilt forward the muscles of the shank are re – introduced into the work to act in concert with the quadriceps and trunk extensors to create the most powerful disposition of the human body to complete the pull phase of lifting.

A rapid knee re – bend activates the soleus and other plantar flexors in a reverse origin insertion contraction to work in synergy with quadriceps while at the same time stretching the Achilles tendon, the body's largest, strongest spring.

So, the muscles of the shank are already used twice in the act of pulling by means of inertia coupling; all the time from a flat footed posture.

2. BI – ARTICULAR MUSCLES: TRANSPORT OF POWER

Many authors have studied the role of bi-articular muscles in human movement. The important question behind such research is why does the body even have such things? The tendon connections of bi – articular (also referred to as two – joint) muscles cross two joints such that as they lengthen under tension; these muscles create torque at two joints simultaneously.

Furthermore, these muscles can transfer muscle force from one part of the body to another by a process known as transport of power (Van Ingen Schenau, 1989).

The gastrocnemius portion of the triceps surae muscles are bi-articular. These muscles connect ankle and knee. The gastrocnemius muscles and soleus are relegated a relatively minor role in weightlifting technique. These muscles are expected to come into play when the athlete endeavors to raise the heels in final portion of the pull: pretty much after the knees and trunk have fully straightened.

As already noted the soleus is a very active in synergistic straightening the knee; pulling shins to a vertical disposition. However, for the most part, the Russian pull stipulates a specific sequence:

"The execution of the explosion involves a rapid extension of the legs and trunk followed by raising onto the toes and elevating and tilting the shoulder girdle slightly backwards. An earlier inclusion of the arms and rise onto the toes will reduce the realization of strength potential." R.A. Roman, 1974

"There is a rapid straightening of the legs and torso with a subsequent lifting onto the toes and raising of the shoulder joints up and back during the explosion." R.A. Roman, 1986

Moreover, at least part of the rationale of the Russian technique protocol to remain flat – footed until the knees have all but ceased to straighten is the assumption a premature heel raise will have a dampening effect on the force generated by the quadriceps and trunk extensors. And, of course, this circumstance would diminish the effectiveness of the support reaction. Consequently, according to the Russian protocol a "premature", (before knees and trunk have all but stopped straightening) prolonged raising of the heels characteristic of an Asian pull would be considered an error of technique.The Russian technique stipulates pulling flat footed as long as possible before rising onto the toes. This flat – footed delay of heel raise is supposed to prevent the force produced by the muscles straightening the trunk and knees from being dampened by the muscles of the shank. The same circumstances apply to a premature bending of the arms and raising the shoulders before legs and trunk have straightened. One can even find some ambiguity of opinion amongst the experts:

"A full and stable rise onto the toes certainly is a technical error, because one delays the "switching" to the squat under (however, it is unclear if the athlete should forego rising onto the toes)." A. Vorobeyev, 1988

Some of these ideas, which actually sound good on paper; and, however well intentioned, are often coupled with misguided advice:

"Beware of executing the shrug and rising onto the toes too early. If these are done before maximum hip extension is achieved, then the bar will not be pulled high enough". (Brown, L. Baechele, T. , 2000)

In point of fact what would be considered a "premature" heel raise in the pull is not an action; it is a reaction, regardless of Russian stipulations or an Asian technique. Research of intermuscular coordination of the vertical jump has practical application to weightlifting, if for no other reason, power is generated in jumping and lifting over the much the same joint angles. Subjects who raised heels such that they pushed off on their toes, jumped higher in vertical jump tests than in the opposite case where feet remain flat until trunk and knees have all but straightened. (Van Ingen Schenau, 1989). Moreover, although mathematical models would seem to affirm the correctness of remaining flat footed up until push off in jumping, the body's protective reactive mechanisms prevent this. Hence:

"Of course jumpers might not want to implement exactly the optimal strategy for jumping as high as possible because they might want to jump again (e.g., their joints might otherwise be seriously injured because of hyperextension." (Zajac, 1993)

Well then, animals, vertical jumpers and weightlifters alike, can be observed generating explosive force with heels raised and knees flexed, from a base limited to the toes. It is common knowledge the human body has geometric constraints to movement. For instance, normal full extension of knee and elbow joints is about 180º. Some are unable to achieve 180º while others, in the elbow for example, can straighten this joint beyond 180º. In this instance, an elbow joint which straightens beyond 180º is said to hyperextend. The same circumstance can also be present in the knee joint.

One of the body's reactive protective mechanisms called anatomical constraint is activated to prevent hyperextension of joints. This mechanism slows or otherwise redistributes mechanical energy to prevent damage to joints from straightening with excessive speed. The mechanism of transport of power is interconnected with anatomical constraint. When a jumper or weightlifter generates explosive force with the lower extremities tension is created in the lengthening biarticular gastrocnemius muscles as the knees straighten.

In weightlifting (or vertical jumping for that matter) a premature rise onto the toes with knees still flexed in the pull; in effect bends knees further. Since the heel raise stiffens gastrocnemius muscle, this action allows transport of power from the quadriceps muscles to the support.

In weightlifting this premature rise onto the toes, which can be exaggerated in the Asian pull; is both an effective protective mechanism while at the same time transports (instead of braking) the power of the quadriceps to contribute to the support reaction by means of raising the heels. Consequently, the weightlifter is using quadriceps to transport lifting power to the feet even as knees are bending:

"The work of the knee extensors "is not used for the increase of knee extension velocity but for plantar flexion since the knee extensors pull on the calcaneus via the gastrocnemius… " in other words the gastrocnemius allows transport of power from knee to ankle joint" (Van Ingen Schenau, 1989)

This mechanism of transport of power allows the shank muscles to produce power they would otherwise be incapable:

"For jumping this transport of power is part of the explanation of the extremely high net power values found in plantar flexion (up to 2000 watts per leg)." (Van Ingen Schenau, 1989)

The power produced by means of raising the heels (plantar flexion) especially as this is displayed in the Asian pull; in theory can produce forces against the support greatly exceeding a mere rise onto the toes after legs have all but straightened. Simulation models indicate the extremely high net power values referred to by Van Ingen Schenau are produced by a combination of transport of power from quadriceps (25%), another 25% from muscle contraction; and, the remaining power produced by recoil of elastic tissues of the shank (Bobbert, 1986), i.e., an action significantly more intricate than a

mere heel raise with straight knee. Concepts such as inertia coupling and transport of power shed a radically different light on the role of the ankle muscles in weightlifting technique. Traditionally these muscles are assigned a rather minor role in the weightlifting literature, i.e., a heel raise at the end of the pull phase. However, the activity of these muscles is significantly more intrinsic with the thigh and trunk extensor muscles throughout the entire motion of lifting. The single joint soleus is an important synergist with quadriceps in straightening the knee joints in a flat footed posture. The bi-articular gastrocnemius muscle likewise participates in delivering power from the quadriceps while stiffening to prevent knee joint hyperextension. So, the role of so – called triceps surae (gastrocnemius and soleus) group in weightlifting technique is far more complex than the average weightlifting coach or sport scientist has even imagined. The minor role assigned the muscles of the shank in the special weightlifting literature is unjustified. Consequently, an exaggerated heel raise coupled with an exaggerated shifting of shoulder joints behind the vertical line of the bar characteristic of the Asian pull, can be viewed as a shifting of the emphasis to the lower extremities to raise the barbell and a diminished role for the trunk extensors and the trapezius muscles.

3. THE FOOT AS A SPRING: THE WINDLASS MECHANISM

The role of the foot - lever in weightlifting sport has received insufficient attention as most of the research and focus of weightlifting technique has been on such areas barbell trajectory, power output, intermuscular coordination, goniometry and so forth. The weightlifter activates the so -called windlass mechanism of the foot when the heels are raised in the pull; the more so, the more the big toe is bent back. This action stretches the plantar fascia activating the so-called windlass mechanism; a taut, elastic lever is formed from which the athlete is able to push the floor away. The activation of the windlass mechanism turns the foot into a stiff lever with elastic properties to store and release strain energy against the support. The athlete compensates for the obvious problem of balance by shifting the trunk away from the vertical; in effect, counterbalancing the athlete – barbell system. The greater the heel raise especially would most weightlifting experts would consider a premature rise onto the toes the greater the lifter's trunk is tilted away from the vertical. The stretched, stiffening plantar fascia of the windlass mechanism of the foot link this "spring" to the body's largest, strongest spring the: Achilles tendon. Although the muscle forces from hip to foot do not appear linear with heels raise, knees bent and shoulder joints behind the bar, sufficient force is nonetheless delivered to the support through the rigid yet elastic foot lever. In virtually all cases one can observe a "premature" heel raise even in the Russian pull. But for the most part, the athlete's shoulder joints are over the bar. This means the center of mass of the system is moving forward. This is why many practitioners of the Russian pull are forced

to hop forward in the descent under the barbell to fix the weight in the snatch or clean. The idea to remain flat footed as long as possible to perform the Russian pull is to avoid dampening the force of trunk and knee extensor muscles through the shank. Which is much the same idea to keep the arms straight. However, it is all but impossible to keep the feet flat in either Russian or Asian pull until the trunk and legs have all but stopped straightening, because the reactive protective mechanism known as anatomical constraint kicks in to prevent this. The gastrocnemius stiffens as the knees straighten, the athlete's heels rise. That being said, the exaggerated heel raise characteristic of the Asian pull takes full advantage of a typically overlooked, yet significant potential of the muscles of the shank to deliver force to the support.

4. VARIATIONS IN STRENGTH POTENTIAL RELATIVE TO THE WEIGHTLIFTER'S POSTURE

For a long time, there has been a general consensus among the weightlifting specialists the weightlifter must effectively use of the strongest muscles to raise the barbell in the pull. This of course means the lifter should utilize the work of the thigh extensors (quadriceps group) and the extensors of the trunk with maximum efficiency. Soviet era testing of the elite weightlifters established the strongest disposition of the body's links in the pull. Weightlifters can develop a force (measured on a force plate) of up to 300 kg in the starting position of the clean. The largest force of up to 500 kg was recorded in the explosion position with hip angles of about 60-70° and a knee angle of about 135 - 140°. Measurement of leg extension in a squat position (vertical trunk) with a knee angle of 135° was 265 – 300 kg for lifters in the 110 kg class (Vorobeyev, 1988). Measurements revealed maximum isometric force is greatest when the lifter is in the pulling positions where thigh and trunk extensor muscles are working together. However, maximum force varies according to different knee angles and inclination of the trunk to the vertical. Less maximum force was recorded when the trunk is vertical and only leg extensors working. In all three cases recordings were made with the athlete pulling from a flat – footed posture and knees flexed. The Russian protocol to delay the re-bending of the knees (see photos) in the pull is not in conformity with these measurements of maximum static strength. The reason being the knees are almost straight with bar above the knees, i.e., the prolonged loading is all on the trunk extensors with a prolonged moment on the lumbar spine. Picture of Aramnau and Albanian By allowing the knees to rebend sooner the lifter is able to use extensors of the lower extremities simultaneously with the extensors of the trunk to perform the explosion. Consequently, some research data of static strength potential is part of the logic behind the protocol of the Russian pull. Less force is produce in the pulling postures with the arms bent and likewise one can logically assume less force would be produced if the measurements in the start and explosion phase positions were made with heels raised instead of flat - footed.

It is highly unlikely anyone has measured an athlete's static force potential with the subject grasping the bar in a clean grip, heels raised and trunk behind the vertical line of the bar. In all likelihood the static force produced would be less than the Russian measurements. However, this knees bent, heels raised, trunk leaning backward disposition of the body in all probability suffices to accomplish the task under the dynamic conditions of cleaning or snatching a barbell.

CONCLUSIONS

The main distinctions between a Russian pull technique and an Asian pull are the premature heel raise with knees bending and significant deviation of the trunk away from the vertical in the explosion phase of lifting. What would be generally considered a pre – mature raising of the heels in the pull phases of the snatch and the clean on closer examination activate a complex interaction of the body's reactive mechanisms. Concepts such as inertia coupling, transport of power through biarticular muscles and the activation of the windlass mechanism of the foot challenge long accepted ideas of the relative importance of the various muscles and levers to modern weightlifting technique.

"We measure the strength of the weightlifter's muscle in poses the lifter assumes during the lifting of the barbell. For instance, sportsmen can generate a force of 300 kg and more in the starting position (A.N. Vorbeyev's data).

Weightlifters can generate the largest force in the explosion phase when the knee angles are 130 - 140° and the hip angles are about 60 – 70°, with the barbell at mid – thigh level. Sportsmen can develop a force of 500 kg and more in this position. When the barbell is raised to pelvis level and the elbow angles become 160° the force developed is sharply reduced (200 kg and less).

Note: This is an isometric pull flat footed and combined effort of thigh and trunk extensors.

Measurements on a force platform have shown that the force developed by qualified weightlifter of the 1st heavyweight class during extension of the legs is 265 – 300 kg (knee angles 135°)."

Why shift trunk back behind the vertical line of the bar; raising heels to perform the explosion phase of the pull, instead of employing the Russian protocol, i.e., have the strongest muscles act in concert to raise barbell by straightening legs and trunk with shoulders in front of the barbell. Because the back is weak? Consequently, the Asian pull is poor technique; a manifestation of trunk weakness. Or, on the other hand, the body of the Asian pull devotee, especially the female organism, senses the heel rise and dramatic shifting of the trunk backward is the path of least resistance – overcoming gravity by circumventing a vertical effort.

PLANTAR FASCIA AND THE WINDLASS MECHANISM OF THE FOOT

"It should also remind us that expert consensus isn't always correct." Chrystia Freeland Reuters.com 2012

"It has been determined that the speed of the squat under contributes to the lifting of a heavy weight." I.P. Zhekov, 1977

"We found that during the execution of the amortization phase (shifting knees under bar in snatch) the muscles in the upper posterior region of the thighs (biceps femoris, semi tendonosis, sartoris, semi membranosis) are actively working.

AN ASIAN PULL: Speed of descent under the barbell
It has been determined that the speed of the squat under contributes to the lifting of a heavy weight." I.P. Zhekov, 1977

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The official journal of the European Weightlifting Federation

PROTEIN TIMING FOR THE STRENGTH/ POWER ATHLETE

BY JAY R. HOFFMAN

One of the benefits associated with protein consumption following an intense resistance training session is in its ability to enhance the recovery and remodeling processes within skeletal tissue (Tipton et al. 2004). A number of investigations have reported an attenuation in the extent of muscle damage, force decrements, and an enhanced recovery from protein ingestion following resistance exercise (Hoffman et al. 2010; Hulmi et al., 2009; Kraemer et al. 2006; Ratamess et al. 2003). In addition, when protein is consumed prior to, and immediately following a bout of resistance exercise an increase in messenger RNA (mRNA) expression is observed (Hulmi et al.2009). This is thought to accelerate muscle adaptation and enhance muscle recovery from the training session. Thus, timing of protein ingestion appears to take on greater importance in stimulating muscle adaptations that occur during resistance training programs. This review will focus on the acute effects of protein timing and then direct its attention to the potential benefits arising from the chronic effects of protein ingestion surrounding the training session.

Protein timing – acute effects

When protein is consumed following a training session the anabolic response is greater the closer the protein was consumed to the workout. Rasmussen and colleagues (2000) provided untrained subjects 6 g of essential amino acids with 35 g sucrose following a bout of resistance training. No differences in net muscle protein synthesis were seen in comparisons of protein ingestion periods of 1 or 3 h post-workout. However, when this same combination of essential amino acids and carbohydrate was infused immediately before exercise, the increase in muscle protein synthesis was significantly greater compared to infusion that occurred immediately following exercise (Tipton, Ferrando et al. 1999). Amino acid infusion immediately prior to a training session has been shown to result in a 46% increase in amino acid concentration within skeletal muscle immediately following exercise and an 86% elevation 1 h after the training session. These elevations were significantly greater than that seen from the same amino acid and carbohydrate infusion occurring immediately following the bout of exercise (Tipton, Ferrando et al. 1999). The primary benefit from pre-exercise ingestion of amino acids is likely related to an increased rate of delivery and subsequent uptake by skeletal muscle during exercise. A 2.6-fold greater increase in the rate of amino acid delivery to skeletal muscle is reported when the protein was consumed before exercise compared to post-exercise (Tipton et al., 2001).

Evidence from several studies have demonstrated that only the essential amino acids are necessary for stimulating protein synthesis, and that increases in muscle protein synthesis were relative to the essential amino acid composition of the supplement (Borsheim et al., 2002; Tipton, Ferrando, et al., 1999; Tipton, Gurkin et al. 1999). The use of nonessential

amino acids as part of any nutritional supplement does not appear to be supported by any scientific evidence. In addition, differences in the clearance rate of amino acids following ingestion appears to alter the composition of the essential amino acids absorbed by the muscle. Leucine and isoleucine appear to have a more potent effect than the other essential amino acids on muscle protein synthesis (Borsheim et al., 2002; Dreyer et al., 2008).

Effect of timing – whole proteins

The two most common whole proteins used in dietary supplements are casein and whey. The differences in these proteins are generally related to differences in their digestive properties and amino acid composition. Casein accounts for 80% of the protein in milk. When ingested it forms a gel or clot in the stomach that makes it slow to digest. As a result, casein provides a sustained but slow release of amino acids into the bloodstream, sometimes lasting for several hours (Boirie et al. 1997). Whey protein is the translucent liquid part of milk that remains following the cheese manufacturing process (coagulation and curd removal), and accounts for 20% of the protein in milk and contains higher amounts of the essential and branched chain amino acids (Hoffman and Falvo 2004). In addition, whey protein has been shown to have a faster absorption capability than casein, which may have important implications for increasing the rate of protein synthesis following a training session.

One of the first studies comparing casein and whey protein supplementation was conducted by Boierie and

colleagues (1997) who examined protein synthesis rates following a 30 g feeding. Their results indicated that whey protein ingestion resulted in a rapid appearance of amino acids in the plasma, while casein ingestion resulted in a slower rate of absorption, but provided for a more sustained elevation in plasma amino acid concentrations. As a result of the faster absorption of whey protein, a more rapid increase in protein synthesis was observed (68% within 2-hours of ingestion). Casein ingestion though stimulated a more sustained elevation in protein synthesis, with a peak synthesis rate of approximately 31% above baseline. The sustained effect of casein ingestion though resulted in a significantly higher leucine concentration in the muscle by the end of the study period compared to whey consumption. The fast and slow increase in muscle protein synthesis occurring from whey and casein ingestion, respectively, was supported by a subsequent investigation by Tipton et al., (2004). They suggested that although whey protein consumption may result in a more rapid increase in protein synthesis, a large part of this protein is oxidized (used as fuel), while casein consumption, due to its slower absorption rate, may result in a greater protein accretion over a longer duration. Interestingly, Dangin and colleagues (2002) compared multiple ingestions of whey protein (over 4 h) to a single serving of whey or casein (total protein consumed was equivalent). The multiple ingestion periods resulted in a greater net leucine oxidation than a single feeding of either casein or whey. Whey protein's fast rate of absorption and high concentrations of leucine may make it the appropriate protein to consume immediately following a workout. Recent work by Burd and

colleagues (2012) compared whey and casein protein at rest and after exercise and found that whey protein significantly increased muscle protein synthesis significantly greater than casein in both conditions. Considering that there may be a heightened sensitivity in skeletal tissue following a workout (Esmark et al. 2001; Cribb and Hayes 2006; Hoffman et al. 2010), ingestion of whey protein immediately following the training session may enhance muscle remodeling and recovery.

Studies on performance effects of whey versus casein ingestion in athletic or trained populations are limited. Kerksick and colleagues (2006) examined resistance trained men for 10-weeks. Study participants were randomized into three groups; a carbohydrate placebo group, a combined whey (40 g) and casein (8 g) group, or a whey (40 g) amino acid (5 g of branch chain amino acids and 3 g of glutamine) per day. The group ingesting the whey and casein combination experienced the greatest increase in lean body mass, but no differences were noted between the groups in strength gains. Another investigative team compared a daily whey (24 g) protein ingestion to the same amount of daily casein supplementation in collegiate female basketball players for 8-weeks (Wilborn et al., 2013). Significant improvements were noted in both groups in lean tissue, strength and power improvements. However, no differences between the groups were observed in any of the body compositional or performance measures suggesting that both proteins are beneficial.

Amino acids versus whole protein: which has greater benefit?

The use of either essential amino acids or whole protein ingestion appears to be beneficial in stimulating muscle protein synthesis. However, is there a benefit of one form of protein versus the other? One group of investigators suggested that the combination of whey and casein

may be more beneficial in eliciting lean tissue gains when compared to a whey and essential amino acids combination (Kersick et al., 2006). However, there does not appear to be sufficient data to provide any conclusion. Interestingly, one study compared pre- and post-exercise whey ingestion and reported no benefits between the two feedings in muscle protein synthesis (Tipton et al. 2007). This was in contrast with investigations that reported a significant benefit from pre-exercise amino acid intake compared to post-exercise consumption. These differences are likely related to the difference in absorption rates and subsequent delivery of amino acids to exercising muscle. Tipton et al., (2007) showed that arterial amino acid concentrations are approximately 100% higher than resting levels following ingestion of essential amino acids but only 30% following whey protein ingestion, indicating a greater amino acid availability to active muscle. In addition, the effect of adding some carbohydrate to the amino acid blend (no carbohydrate was included with the whey protein) likely enhanced the uptake of amino acids into the muscle by stimulating a greater insulin response.

Protein timing: Training response

The initial training study providing evidence that protein timing may exacerbate the training effect examined older adults (> 70 years) (Esmarck et al., 2001). The investigators reported that muscle cross-sectional area and individual muscle fiber area were significantly increased following 12 weeks of training in the participants who consumed the supplement (10 g of protein) immediately following each workout, but were not altered in the participants who ingested it 2 h post-workout. In a subsequent study on young (21 – 24 y) recreational male bodybuilders, 40 g of whey isolate and 43 g of carbohydrate were provided both immediately before and after each resistance training session or in the morning and evening. (Cribb and Hayes, 2006). Significantly greater gains in lean body mass, cross-sectional area of type II fibers, contractile protein content, and strength were reported in the pre- and post-workout feeding group compared to the morning and evening feeding group. A subsequent study examined similar feeding times in competitive athletes was unable to support the previous studies examining the benefit of the timing of the ingestion (Hoffman et al., 2009). In that study, experienced, competitive college football players were provided a 42 g protein supplement. Participants were randomized into three groups. The first group consumed the supplement pre- and post-workout; the second group consumed the supplement in the morning and evening; and the third group were not provided the supplement and served as the control group (e.g., they performed the same workout, but were not provided any protein supplement). Significant strength and power improvements were reported in all three groups, with no between-group differences observed. The average daily protein intake for all three groups ranged from 1.6 – 2.3 $g \cdot kg^{-1}$ body mass. In addition, all three study groups were in a positive nitrogen balance, suggesting that protein intakes were sufficient in meeting the athlete's protein needs. The results suggested that if daily protein intake (either consumed as part of the meal or as supplement) is at, or exceeds recommended levels for a strength–power athlete (1.6 $g \cdot kg^{-1}$), the timing of ingestion may not be as critical.

How much protein should be consumed per ingestion?

Research on protein supplementation has used various quantities of protein per ingestion. These studies range from 6 g of amino acids to more than 40 g of whole protein, amino acids or proprietary blends in various combinations. However, little research has been conducted on whether there is a ceiling on the effectiveness of the quantity of protein that can be effectively used per ingestion. One study examined post-exercise protein drinks containing 0, 5, 10, 20, or 40 g protein (Moore et al., 2009). Protein was ingested following an acute bout of leg extension exercise, while whole-body leucine oxidation was measured over 4 h. The results indicated that muscle protein synthesis increased with each increase of protein quantity up to 20 g. No difference in protein synthesis was seen between the 20 g and 40 g dose. Whether a multi-joint structural exercise such as the squat, or a normal training routine (6 – 7 exercises using 3 – 4 sets per exercise), would stimulate further increases in protein synthesis at higher doses is not known. However, how much protein is consumed per ingestion may be less important that the pattern of protein ingestion.

Recent studies have examined the pattern of daily protein intake (Moore et al., 2012; Areta et al., 2013). Moore and colleagues (2012) pro-

vided 80 g of whey protein per day to young, resistance trained men. Participants were randomized into three different dosing pattern groups. One group consumed the protein in a pulse fashion (8 x 10 g of whey protein every 1.5 h); another group used an intermediate ingestion fashion (4 x 20 g every 3 h); and the final group consumed the protein in a bolus fashion (2 x 40 g every 6 h). Ingestion occurred following an acute bout of knee extension exercise (4 set of 10 repetitions using 80%1RM). Whole-body protein turnover was significantly greater (~19%) during the pulse ingestion format than the bolus ingestion format, and trended towards being greater than the intermediate format (~9%). Rates of protein synthesis were significantly greater for the pulse ingestion format compared to the intermediate and bolus formats (32% and 19%, respectively). Thus, the pattern of protein ingested appears to impact whole-body protein metabolism. Areta and colleagues (2013) examining myofibrillar protein synthesis, cell signaling and mRNA abundance using the same research methodology as the previous study reported that all three ingestion protocols increased myofibrillar protein synthesis, throughout the 12 h recovery period (ranging from 88% - 148%). However, the intermediate ingestion pattern elicited the greatest levels of myofibrillar protein synthesis than the other two ingestion patterns. Thus, it does appear that protein ingestion every three hours has the potential to maximize muscle mass development.

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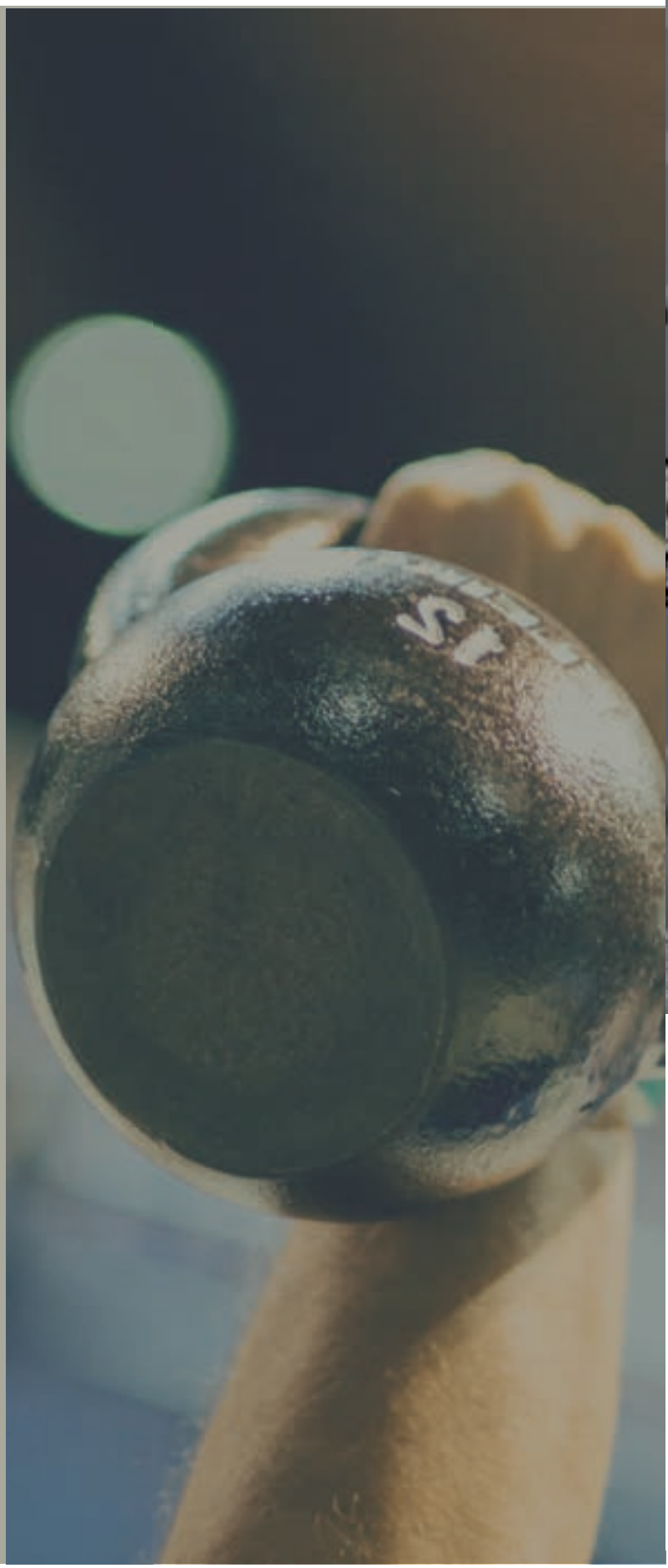

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The official journal of the European Weightlifting Federation

INFLUENCE OF THE MENSTRUAL CYCLE AND ITS PHASES ON THE PERFORMANCE OF OLYMPIC WEIGHTLIFTING ATHLETES

BY ANTONIO CAPORALE

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1. INTRODUCTION

The female athlete, because of her peculiar organic and psychic characteristics, seems more affected by technical aggravations. In fact, what we observe is that there is often the tendency to compare her performance to that of a male athlete, thus exacerbating the sports performance goals. The female body, however, has form and development characteristics that are clearly different from those of her male counterpart.

Naturally, therefore, the influence of the menstrual cycle has great importance on the female athlete's physical ability. Gynecological problems such as amenorrhea and secondary dysmenorrhea, the voluntary suspension of the neuro-endocrinological menstrual cycle, and nutritional issues (during the cycle there may be significant variations in weight): it is a well known fact that, on average, already five days prior to menstruation, "low performance" is characterised by tension; a gradual improvement occurs during the 5 days of the cycle, with maximum efficiency in the following 8/9 days, and then 10 days mark the gradual decrease up to the sharp deterioration of the new tension phase. So, when preparing a female athlete, firstly one needs to acquire the scientific knowledge, regarding the economy of the human organism conducive to achieving the best performance, and secondly, one also has the "duty" to acquire an in-depth knowledge of those factors that, especially in certain "sensitive" periods, can stimulate changes emotionally, affecting the balance of the personality which can indeed influence competitive behaviour. A common mistake is therefore to train women with the same methodology and technique used for male athletes, ignoring the psychological and physiological differences existing between the two genders. For this reason, nowadays, the importance that these factors may determine the difference in sports performance is widely recognised. Even more so, when using maximum loads with female athletes, such as weightlifters, during the period of the menstrual cycle, one notices changes that would require a flexible training structure in the loads and recovery times, based precisely on the hormonal phases of the cycle.

This research, thanks to the availability all those who contributed to it, especially in the sharing of its purpose, has provided a significant amount of data. Not all the data collected were elaborated, as some are not strictly inherent, however, they were most certainly useful in providing an overall, and therefore more complete assessment of the changes related to female athletes and their performance.

Obviously, these data leave the door wide open to continue the investigation in future research, because it is clear that a global study, all the better if carried out by experts and if analysed individually for each athlete, can produce more reliable results that help us to understand the phenomenon better and encourage the improvement of sports performance of the athletes in question.

2. FEMALE WEIGHTLIFTING

Until the 1970s, weightlifting was considered a sport exclusively reserved for men, even if, from the 60s, women devoted to any kind of sport, had begun to insert sessions with weights into their training programmes, to increase their strength and, consequently, their performance.The next natural step was, of course, to fight for recognition of women's weightlifting also at a competitive level.In the 70s, with the affirmation of feminism, and in conjunction with an ever increasing emancipation of women in all fields, female weightlifting became more and more popular. Since then, female weightlifters, have consistently shown, similarly to what occurs in other sports of power and explosive force, that their performance differs from that of men only in terms of quantity, not of quality. Female athletes make up for their reduced ability to produce force by having greater elasticity and a strong propensity for maximum dynamic force.

In women, however, the ability to adapt is substantially different than in men, because of the different endocrine and hormonal characteristics that govern the processes of muscle development and adaptation.

Today, women's weightlifting, is a reality that has conquered the most representative audience of the sport with participation in the Olympics, as an official sport in 2000, producing results of authentic athletic value, proof that they have all the attributes to compete that are on a par with their male counterparts.

3. WOMAN AND SPORT

The differences between the sporting performance of man and woman have always intrigued scientists, coaches and all those who live or have lived in the realm of sport. However, training and performance differences still remain a subject of discussion.

While there is widespread agreement on the latter point, and browsing through the records of the various sporting disciplines, one can "enjoy" all the statistics and differences, many doubts remain about the applicability of all the physiological conditions of these differences when planning and implementing a training programme.

At the base of differences in performance, are clearly all the aspects related to performance, both organic and muscular, and coordinative, technical and tactical.

The real differences in performance abilities (especially those related to muscle power and speed strength performances) can be seen at the onset of puberty. From the 1930s, studies by various authors showed that the variations in explosive force found in both sexes of the same age follow in a parallel manner the changes in the plasma concentration of testosterone.

Those who were working illegally in the field of doping realised this, and more: in 1985, Strauss et al. noticed that in all the female athletes who had used anabolic steroids, there was an increase in muscle combined with an increase in strength.

These changes were associated, among other things, with changes in voice, increased facial hair and menstrual irregularities.

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While the physiological aspect is clear (and one would expect training programmes that assess in detail the relationship between the production of testosterone and the training load), many experts apply similar working protocols for men and women, changing only the intensity of the load.

For example, in an experiment in which male and female sprinters were subject to a maximum physical load, Bosco verified that the blood levels of testosterone immediately after the test were lower in men, while in females there was no alteration. Surprisingly, the data from that study reported that the effects induced by a maximum strength training session was completely different in the two sexes.

Interest in this work stems from the authors' ability to have evaluated precisely the type and intensity of the load, the hormonal dosage at different times of the day, and taking into consideration the neuromuscular aspect. It lacks, however, an indication of what was the state of the menstrual cycle during the experiment, which we know is critical to hormone levels in female athletes. And this, unfortunately, to our knowledge, is common practice when preparing training programmes for female athletes.

4. THE MENSTRUAL CYCLE

The female reproductive system undergoes, from puberty (between 8 and 12 years) to menopause (between 45 and 50 years) regular cyclic changes: in other words, the menstrual cycle, which lasts on average 28 days, counting from the first day of menstrual flow, and brings about changes in key areas of the body due to hormonal activity. From the clinical point of view, we simplistically divide the phases of the cycle into two different moments: the follicular phase, which comprises one part of the phase flow (the menstrual cycle, as already noted, starting from the first day of flow) and the proliferative phase, and subsequently the luteal or secretory phase, which begins with ovulation. Variations of concentrations of the hormones follow these phases, as well as body temperature changes and, logically, other aspects strictly related to the development of the egg, the follicle, etc. From the sports point of view, as briefly summarised previously, emphasis should be placed on the hormonal aspects: although the phenomenon is certainly more complex, as described below. Indicatively, in the first two phases, there is a relatively high value of the follicle-stimulating hormone (FSH), while the second stage is preceded by a peak concentration of the luteinizing hormone (LH) and then the FSH again.

The balance of these two hormones, but not only this, determines the greater or lesser regularity of

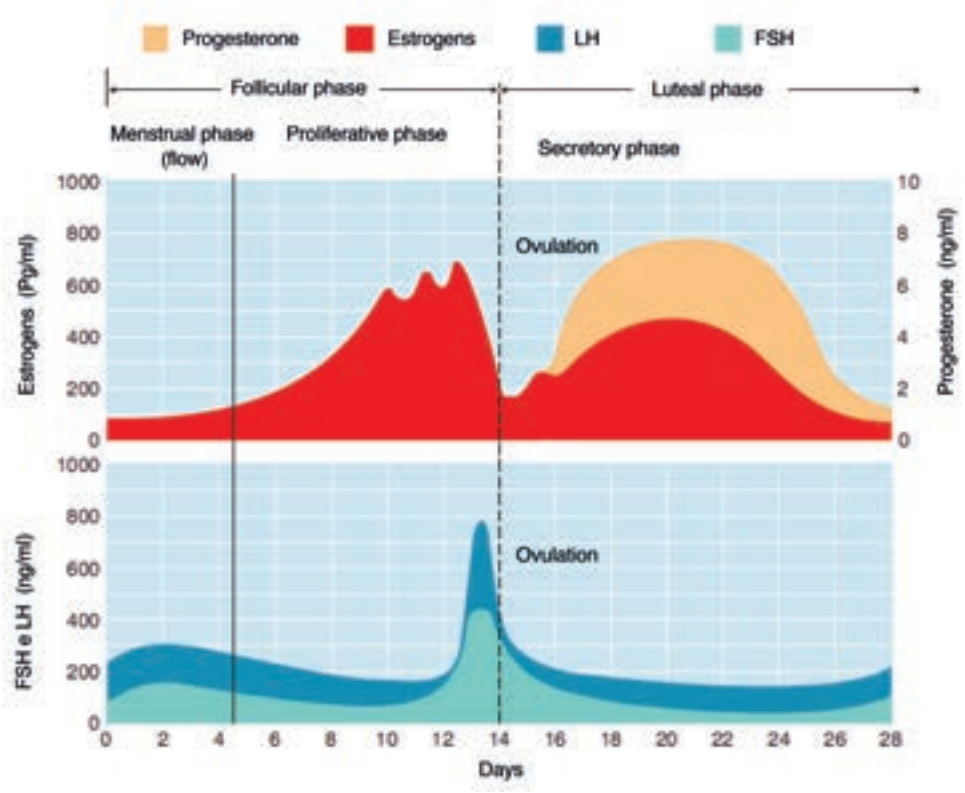


FIGURE NO. 1
PHASES OF THE MENSTRUAL CYCLE AND RESPECTIVE MODIFICATIONS OF THE LEVEL OF PROGESTERONE AND ESTROGEN (ABOVE) AND FSH AND LH (BELOW). NORMALLY, WE DISTINGUISH THE FOLLICULAR PHASE, WHICH STARTS AT THE TIME OF THE OCCURRENCE OF BLEEDING DURING THE MENSTRUAL FLOW, AND THE LUTEAL PHASE, WHICH BEGINS WITH OVULATION (FROM WILMORE & COSTILL 2005).

the menstrual cycle. The release of these hormones, produced by the pituitary gland, is stimulated by the hypothalamus through the GnRH, gonadotropin-releasing hormone, which in turn is influenced by various factors, as well as by other hormones such as estrogens, endorphins, dopamine, catecholamines and the stimulating hormone of the adrenal cortex. Testosterone also enters this chain of events, with its peak concentration coinciding with that of the other sex hormones, in other words, just before ovulation (between the proliferative and the secretory phases).
In the second phase, the luteal phase, there is the maximum concentration of progesterone.

5. TRAINING AND THE MENSTRUAL CYCLE

A relatively high number of athletes do not experience significant changes in their performance at any time during the menstrual cycle, while others actually find themselves in difficulty, in the different phases of the cycle.
On the basis of what has been briefly expressed with respect to the menstrual cycle, a number of observations and reflections may be made on the possible implications concerning training and performance in general. As mentioned, the possible feeling of discomfort, due to adaptation to the various phases of the cycle, is variably subjective, but certain women suffer from an authentic premenstrual syndrome, which includes phenomena such as weight gain, water retention, increase of uterine volume, increased intra-ocular pressure, abdominal swelling and pain associated with menstruation, headaches, nausea and other symptoms that affect daily life, to a greater or lesser extent and, therefore, also the athlete's performance (both in training and in competition). This clinical picture, defined in declared cases also as dysmenorrhea, may therefore reduce - and considerably so - the athlete's ability to perform. The limitation of the clinical disorders occurs in different ways, ranging from the classical assumption of more or less common drugs (such as painkillers and/or muscle relaxers), to therapies based on herbal products. Ultimately, the therapeutic choice is often contraceptives. Working with athletes who suffers from this kind of disorder requires both a clinical approach to the symptoms, but also an adequate programming of the work loads, not just in the short term, but taking into account monthly planning. Although this article does not make an in-depth study of the endocrinological aspect, bear in mind, that during the normal menstrual cycle, the estrogenic activity (which coincides temporally with that of testosterone) produces an increased anabolic effect, while the opposite behaviour occurs when there is relative hyperprolactinemia (with its catabolic effects).

Based on these considerations, in principle it would be possible to exploit this alternation of hormonal behaviour over the cycle in training programmes for women, concentrating on training muscle power with loads in the first and second phase (listed above), and maintenance and resistance sessions in the third stage.
One approach would be as suggested by Reis: "menstrual cycle triggered training", which - by and large - respects what we have outlined above. Certainly those working with athletes intensely engaged in sport should, in principle, be aware of the opportunity presented by athletes with a regular menstrual cycle, precisely because of the crucial role that hormones play in the different phases of the same.
Therefore, to increase the athlete's strength and power, rather than increasing the workload, the number of reps or maximal strength sessions, it would be appropriate - a view shared by many experts - to try to recreate an hormonal "fundus", for example a drug therapy with oral contraceptives, in the presence of dysmenorrhea. In this way, any disorders related to the menstrual cycle would be reduced, regulating the menstrual cycle, and even being able to synchronise it, in some way, with competitions. However, as in the case with any pharmacological therapy, it also has disadvantages and can involve some risks (risk of phlebitis and infection, predisposition to venous thrombosis), so in order to safeguard the spirit of sport, resorting to medication is quite a debatable topic.
The approach should still be very cautious and as customised as possible when selecting the right medication, in elite athletes, requiring the support of a gynecologist who is also an expert in the sports field and, not least, by verifying the feelings that athlete perceives, and the overall compliance.

6. EXPERIENCE WITH OLYMPIC WEIGHTLIFTING ATHLETES OF THE FIAMME AZZURRE

The differences in performance observed among male and female athletes in the sports, substantially due to the different physiological/endocrinological characteristics of the sexes, has stimulated interest in a discussion about these specific aspects, and the influence they have the highest level of performance, specifically in the field of Olympic Weightlifting.

Our work was conducted on the four athletes of the women's team of the Fiamme Azzurre Olympic Weightlifting team, for a period of ten months of training, which ended with the "Italian Championships", held on December 8, 2013 in Modena. The period analysed represents an entire competitive season of an Olympic weightlifting athlete, which ends with participation in the most important national competition of the year.

The work methodology followed throughout the study, carried out on lifters who we can define as professional, involved the acquisition of data through the continuous monitoring of quality and quantity results (VALID performances / null performances and weight diary); test and field evaluations; competition analysis; surveys of the training programmes; interviews; awareness and "complicity" of athletes and coaching staff.

The fundamental object of the study was the detection of the presence of the menstrual cycle and the influence it had throughout the period studied. For this reason the athletes were requested, before the beginning of the trial, to suspend the use of any birth control pills.

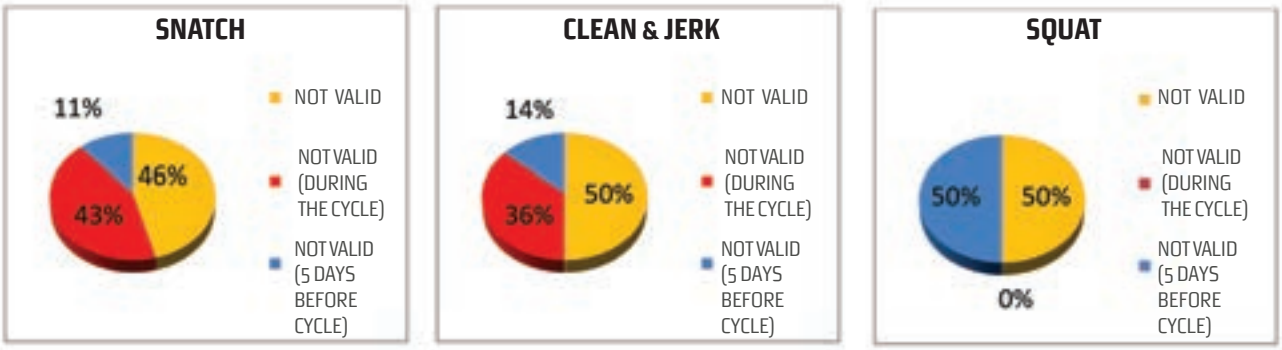
7. METHODS OF DATA DETECTION AND DESCRIPTION

For the survey, it was necessary to develop tables where all the data related to the athletes measured month by month, were organised and consequently cross-checked, producing the results that the presence of the menstrual cycle could possibly influence. Snatch, Clean & Jerk and Front Squats were performed with loads from 80% to 100% [up to the maximum load for each athlete, editor's note], precisely to see how the hormonal process could affect maximum performance.

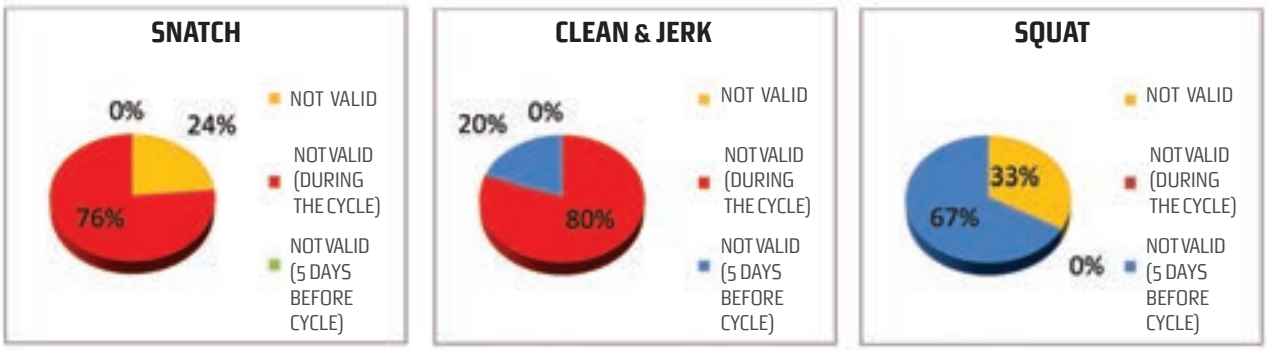
Daily body weight was recorded, to observe how changes in weight, caused by hormonal changes, could cause performance variations.

At the same time, the athletes were subjected to an analysis of their feelings during the performance, as well as during competitions, useful in helping us better understand their state both physically and mentally, especially during the period of the menstrual cycle. In addition to the considerations made on the athletes, directly on the field, we also wanted to analyse the coach's behaviour, in order to determine how training techniques and management differed from those described in literature, and if the coach in question adopted complementary methodologies.

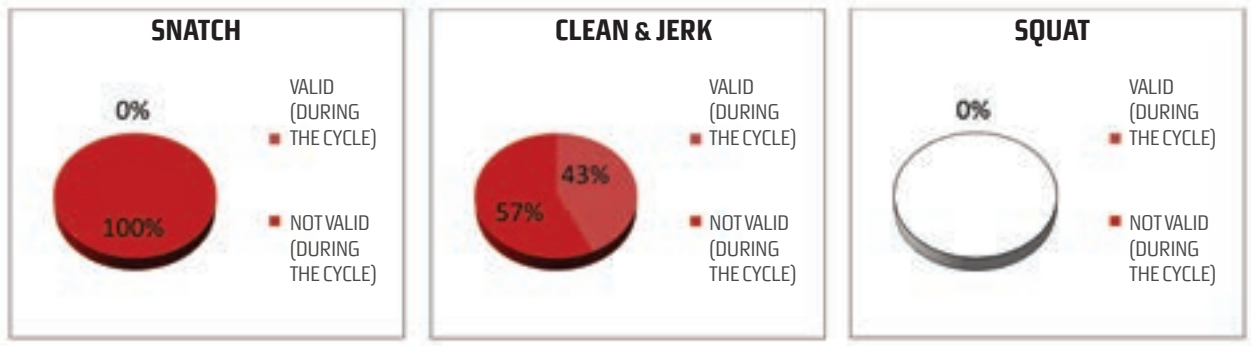
CASE 1 – LIFTS WITH LOADS IN THE RANGE OF 80% - 100%



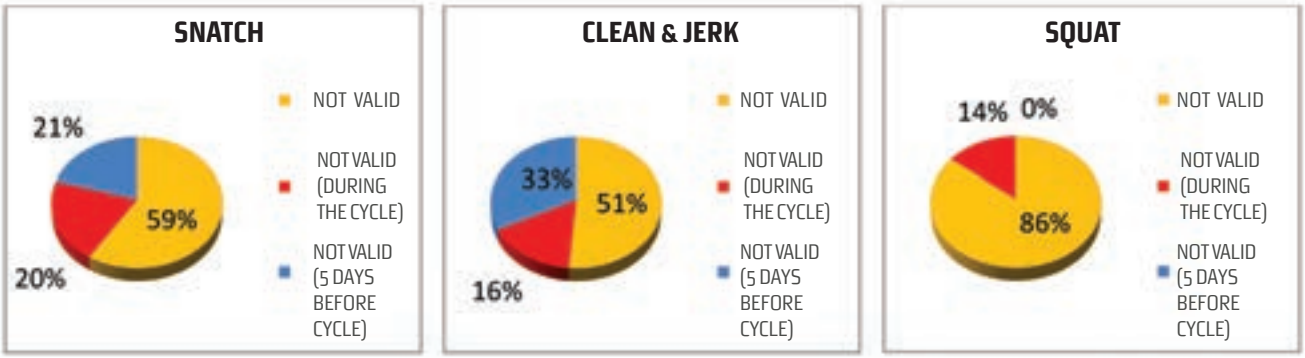
CASE 1 – LIFTS WITH LOADS IN THE RANGE OF 80% - 95%



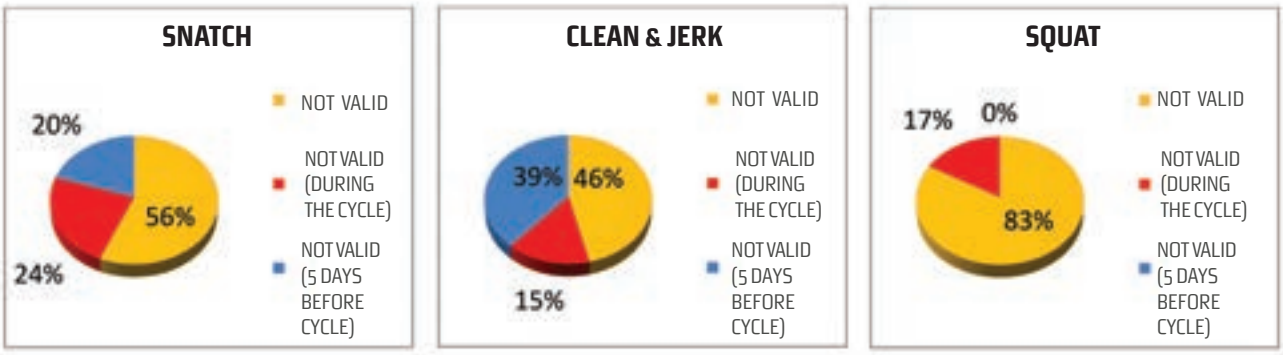
CASE 1 – LIFTS WITH EXCLUSIVE 100% LOADS



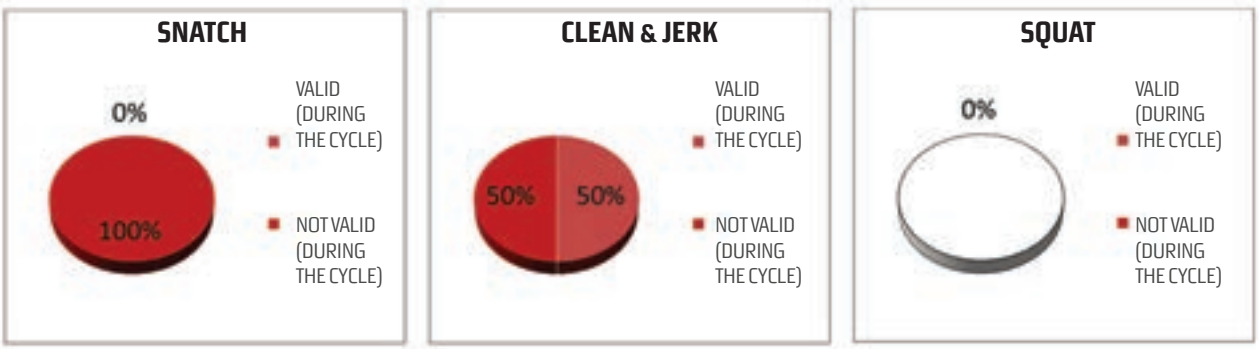
CASE 2– LIFTS WITH LOADS IN THE RANGE OF 80% - 100%



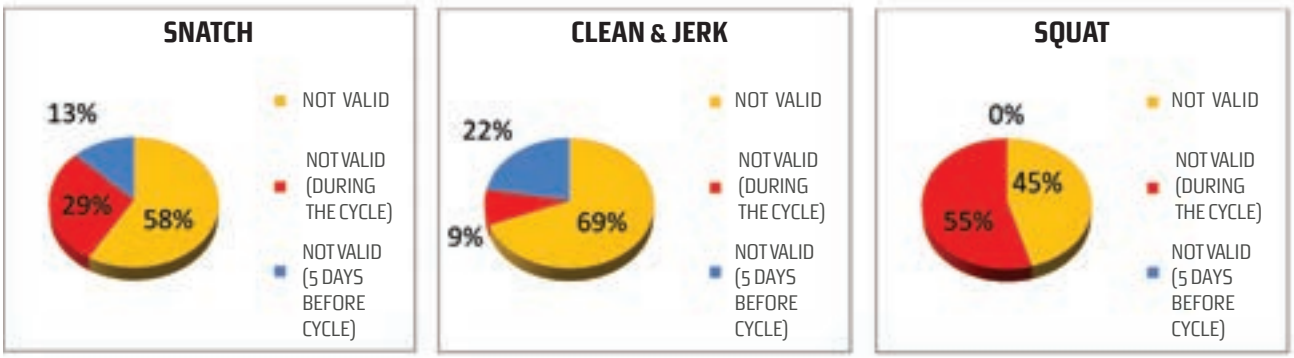
CASE 2 – LIFTS WITH LOADS IN THE RANGE OF 80% - 95%



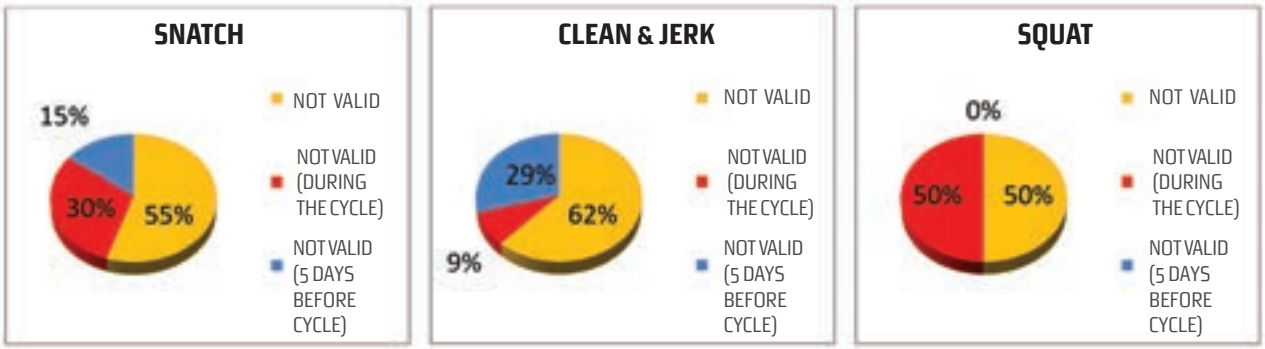
CASE 2 – LIFTS WITH EXCLUSIVE 100% LOADS



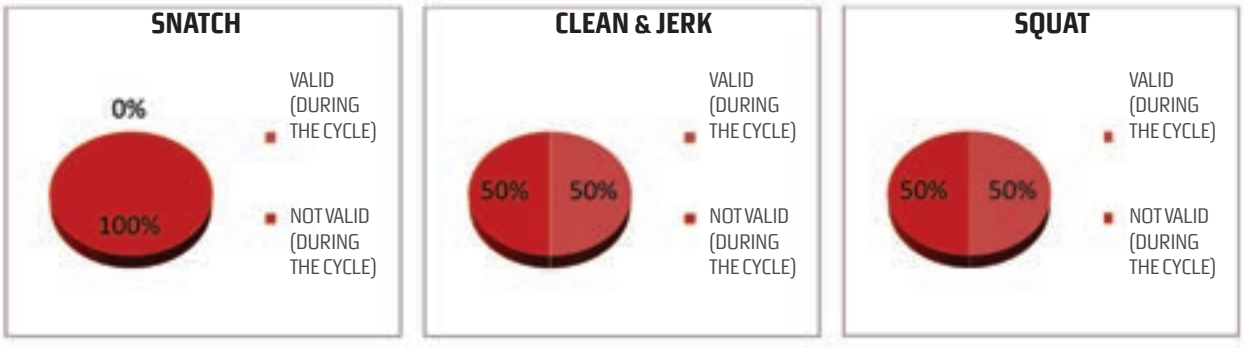
CASE 3 – LIFTS WITH LOADS IN THE RANGE OF 80% - 100%



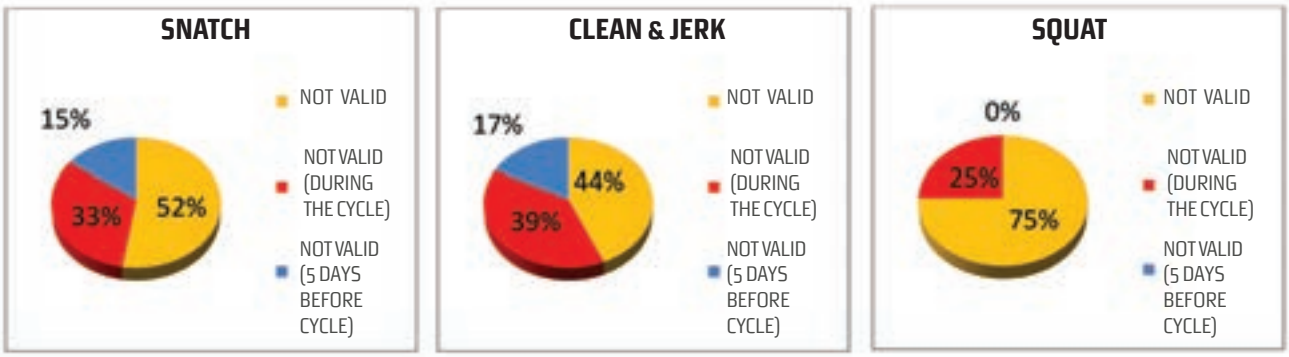
CASE 3 – LIFTS WITH LOADS IN THE RANGE OF 80% - 95%



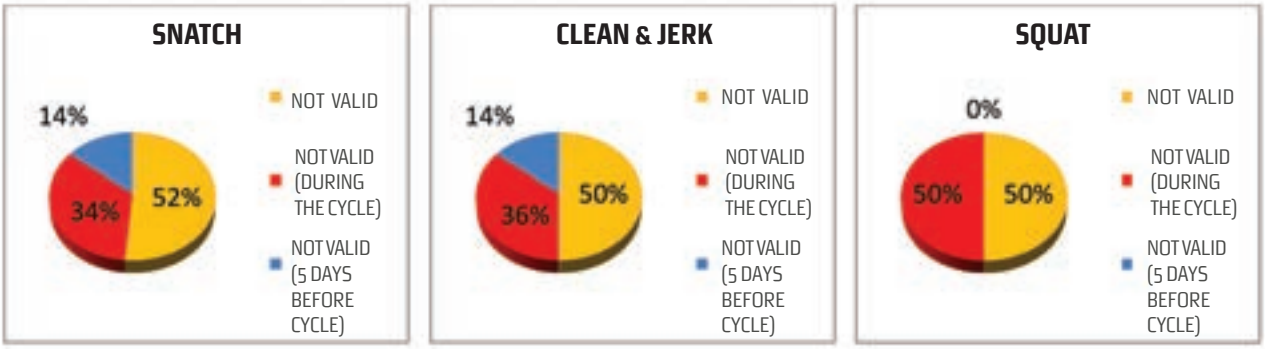
CASE 3– LIFTS WITH EXCLUSIVE 100% LOADS



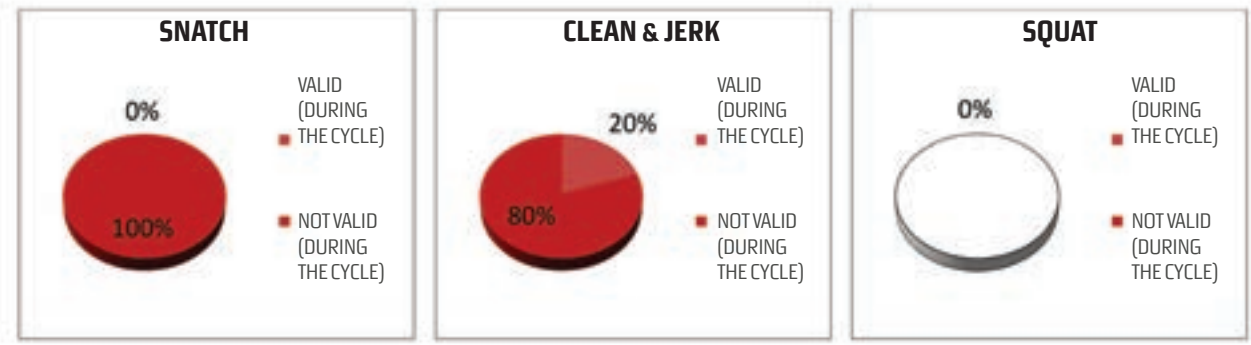
CASE 4– LIFTS WITH LOADS IN THE RANGE OF 80% - 100%



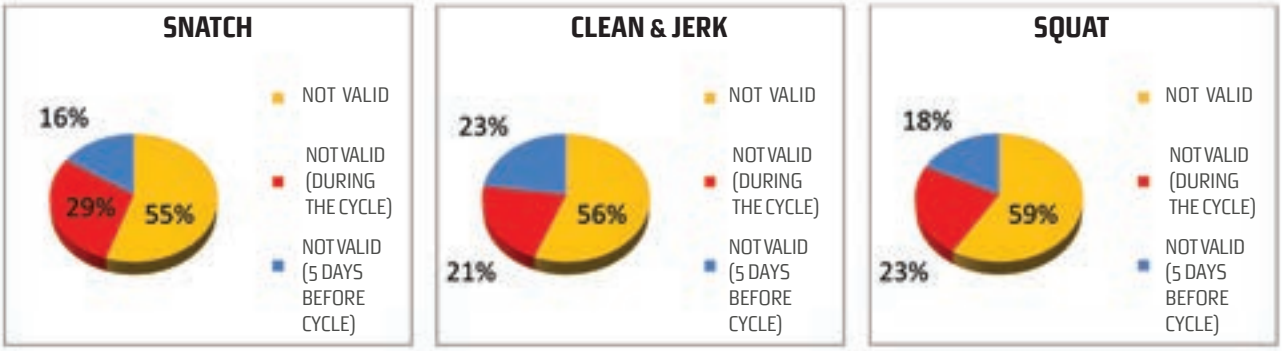
CASE 4 – LIFTS WITH LOADS IN THE RANGE OF 80% - 95%



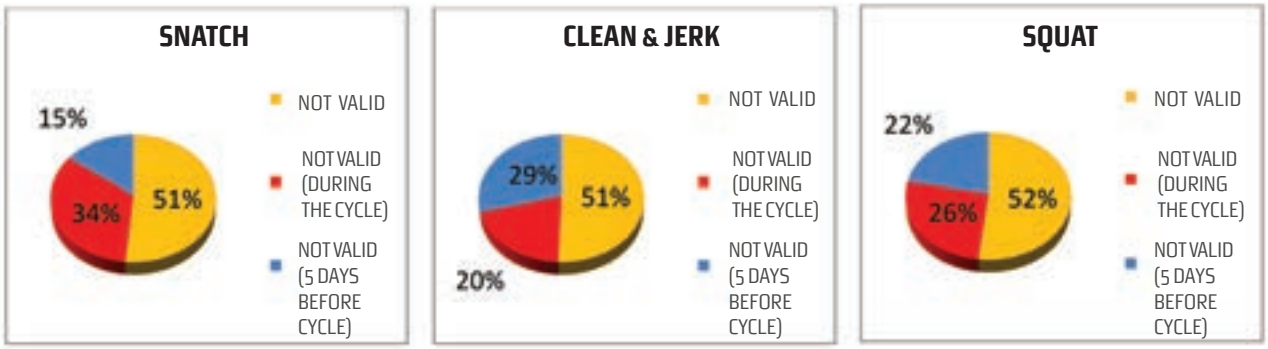
CASE 4 – LIFTS WITH EXCLUSIVE 100% LOADS



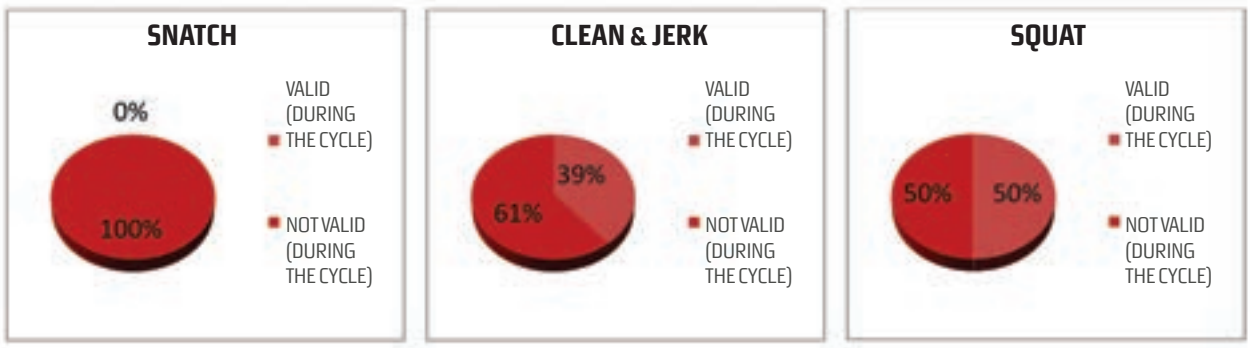
TOTALS - SUM OF THE RESULTS OBTAINED WITH LOADS BETWEEN 80% AND 100%



TOTALS - SUM OF THE RESULTS OBTAINED WITH LOADS BETWEEN 80% AND 95%



TOTALS - SUM OF THE RESULTS OBTAINED WITH AN EXCLUSIVE 100% LOAD



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8. CONCLUSIONS

The data relating to the performance of female lifters showed a high percentage of null lifts in the pre-menstrual and menstrual phase, regardless of the various quantitative differences relating to the individual athletes. However, several aspects are still to be analysed, as we also detected the presence of important variables which may influence the performance ability of female athletes, such as:

- the influence of changes in body temperature on performance, secondary to the menstrual cycle;
- changes in respiratory rate and pulmonary ventilation in the different phases of the cycle, affecting performance and response during training;
- the trend of hematological parameters and iron metabolism, also in function of the type of nutrition;
- the ability of expression and the power of the vegetative nervous system as a modulator of the responses to workloads and recovery index;
- the central regulation of effort and its psychological aspects, which we know to be very different between men and women, at least in practical expression.

All the above was confirmed in the answers to a questionnaire compiled by the athletes in question, but also by the trend of the training sessions appropriately assessed month by month, so as to discover any possible discrepancies between "cycle" period, the "pre-menstrual" period (circa 5 days before menstruation) and the "absence of cycle" period. Observing the "Total" graphs - the graphs which define the sum values obtained by the four athletes, in all three exercises (Snatch - Clean & Jerk - Front Squat) - the percentage of null lifts is just below 50% of the total lifts during the trial period. Whereas, evaluating the values obtained by observing only the lifts carried out with load percentages in the range of 80% - 95%, there is a net percentage of 50% of null lifts in relation to the total lifts of the entire period. Considering that the margin of "error" in maximum performance is statistically verified, regardless of gender and of the hormonal state of an athlete, we wanted to specifically isolate this type of test, as - by analysing only the period of a "cycle" - it shows, in fact, that the inherent difficulty in achieving maximum performance in this period is completely confirmed by 100% null lifts in the Snatch, since this exercise requires a high level of coordination and consequently, for its execution requires an optimal mental and physical state; whereas, in the Clean & Jerk and the Front Squat, the percentage of null lifts is not too far from the percentages obtained with loads between 80% and 95%, as these two exercises require less coordination than the Snatch, and in a progressive manner. Moving on from the examination of the entire group to that of an individual athlete, the general considerations remain the same, but naturally, a subjective evaluation shows, specifically, how the variations determined by the presence of the "cycle" can affect each athlete. This survey highlights how still today training protocols are used which, although technically valid, are limited as they are unstructured and/or inattentive to the consideration of a schedule based on phases of the menstrual cycle and the hormonal state that it produces in females. Therefore, in concluding this research into the female universe of professional athletes, it seems essential to stress the importance of an in-depth analysis of the different issues presented, and an increase in the awareness when evaluating workloads and scheduling training programmes for female athletes. Work should not be planned rigidly, but be as flexible as possible, bearing in mind those "sensitive phases", so that the more intense workouts are carried out during the periods most suited to the individual, as the processing of the medical and biological principles of female training constitutes a very important task, necessary both for increasing the effectiveness of the athletes' preparation and safeguarding their health.

Although there are coaches and trainers willing to adopt training methodologies that will nourish the growth of their own abilities, it has been definitely established that we are still lacking (the same occurs in many similar situations) the equipment and instruments in sports facilities with adequate space and specialised teams, organised to do a complete job, from A-Z. These reasons often have economic roots, and usually only large, better equipped sports organisations prevail over small ones, even when it comes to teams at national level.

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SPORTS PERFOR-MANCE

MUS, STRESS AND CHRONIC, LOW-GRADE INFLAMMATION

BY DARIO BOSCHIERO

An athlete's **sport performance** is clearly influenced by his/her state of health, but although this is a principle that is easy to agree on, it is not so easy to set up a method capable of assessing overall well-being and psychophysical performance.

The need to increase or maintain performance in modern society is a compulsory step, not only in sports, but in all areas of our lives of varying complexity, with more and more demand for adaptability in conditions presenting **stressors** or persistent stimuli.

Psychophysical performance is a multidimensional concept, including a range of variables such as physiological, psychological, physical, cognitive, proprioceptive and autonomic.

This very complex phenomenon is regulated by the **Stress System**, by low-grade inflammatory processes, by circadian rhythms and by major components of the body such as muscle, IMAT, fat and bone.

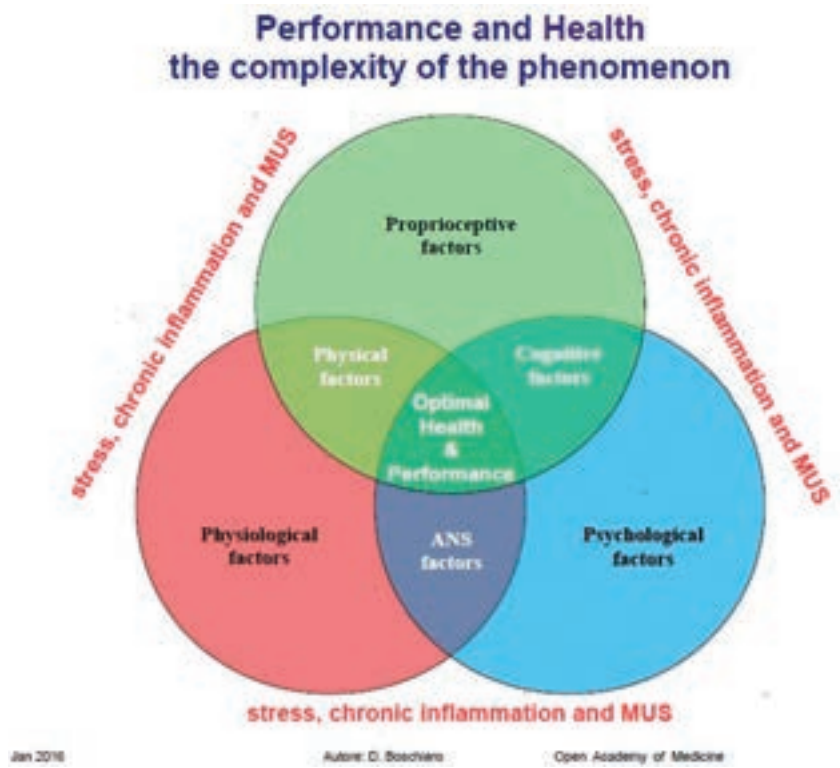
The athlete, while enjoying a state of health generally above the average, requires more specific assessments than the generic meaning of the term "well-being." To enhance performance, it is necessary to evaluate all types of imbalances that, without amounting to a defined clinical outcomes, reduce the well-being and physical and mental performance of the athlete.

The **subjective perception of well-being** is initially reflected in the onset of **vague and non-specific MUS** (Medically Unexplained Symptoms), in other words, a series of sub-clinical disorders of a functional nature, widely analysed in international literature:

- fatigue or persistent weariness not relieved by sleep;
- mood disorders;
- hands and feet being constantly cold;
- persistent insomnia or drowsiness;
- anxiety, apathy;
- changes in appetite (excessive hunger or lack of appetite);
- acidity and stomach pains, feeling of fullness, bloating after meals, nausea;
- periods of persistent constipation;
- irritable bowel syndrome;
- difficulties in sweating.

(Example of MUS – vague and non-specific symptoms)

The majority of the population (adults in particular) suffer, or have suffered on several occasions, from vague and non-specific MUS (Medically Unexplained Symptoms), according to the most accredited definition in international literature, the category entailing a large family of various kinds of disorders, which only rarely lead to a precise diagnosis, remaining quite frequently within the limits of altered clinical pictures, but not to the point of being pathological.



Literature on the topic has undergone considerable developments from the 1980s to the present day, mainly because of the increasing incidence of the phenomenon, considered nowadays as one of the most frequent, costly and complex problems in general medicine.

One of the initial obstacles with respect to the formulation of an approach to the phenomenon, was probably the confinement of such problems within an unspecified area of psycho-social disorders which general practitioners tended to refer to specialists.

The progress made in the analysis of interactions between the

nervous, endocrine and immune systems has created new horizons both in the field of medicine and sport; in particular, thanks to the integration of the abundant literature on the issue of Stress.

STRESS

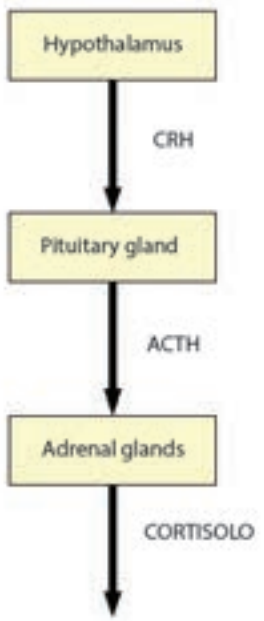
Literature describes "stress" as a form of adaptation of the organism (namely, the "adaptation syndrome") to stimuli called "stressors".

A stressor can be generically defined as an element capable of altering the homeostatic state (nowadays literature on the subject tends to talk about allostasis, rather than homeostasis) of the organism; this element may take various forms, and belong to the most diverse categories: indeed, it can be psychosocial or strictly physical, the distinction, however, does not involve changes in the body's reaction mechanisms.

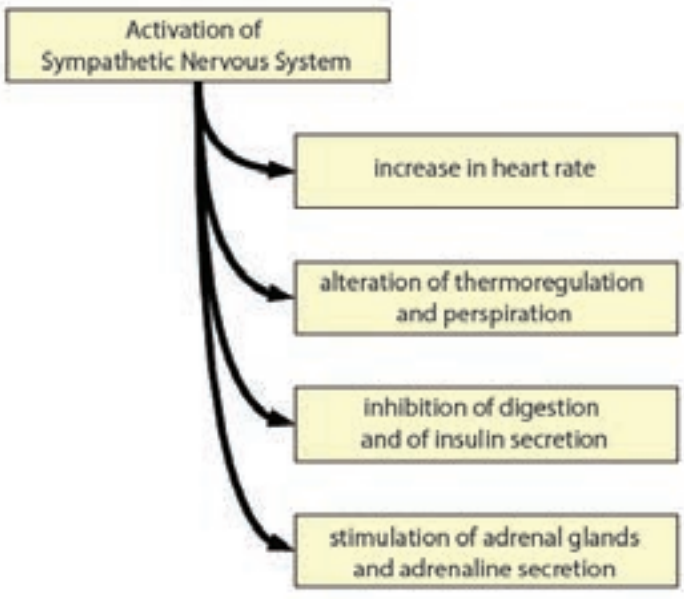
What is currently considered to be essentially a matter of fact, was previously one of the most unexpected features of stress: regardless of the type of stimulus, whether it be intense physical effort or concern for an exam, the activation mechanisms are remarkably similar.

The reactions to the stressors are determined by the activation of the nervous and endocrine systems; in both cases, the perception of stressors is located in the brain, which then sends out the stress mediators signals.

On the **endocrine level**, the **reaction to stress is expressed through the activation of the HPA (Hypothalamic-Pituitary-Adrenal) axis**, the ultimate consequence of which is the secretion of glucocorticoids by the adrenal cortex, whereas in the **nervous system**, the **stressors cause the activation of the Sympathetic Nervous System.**



On an endocrine level, the stress response causes the activation of the HPA axis, with the consequent release of glucocorticoids as the final product of the chain of interactions.



On a nervous level, the stress response causes the activation of the Sympathetic Nervous System

That being the case, it is no wonder that literature has documented, and continues to document, the relapses determined by the prolonged activation of reactions to stress on health in general.

The increase of circulating glucocorticoids, the loss of their circadian rhythm and the excessive activation of the sympathetic nervous system, are themselves direct or indirect risk factors for the high incidence of disorders such as obesity, high blood pressure and mood disorders (anxiety, depression). **Before evident signs begin to show, the persistent activation of the response to the stressors is associated with the onset of MUS, and the loss of mental and physical performance,** and when these phenomena are controlled and treated, the risk of full-blown disease (usually leading to damage of the system most at risk for the specific subject) will consequently increase.

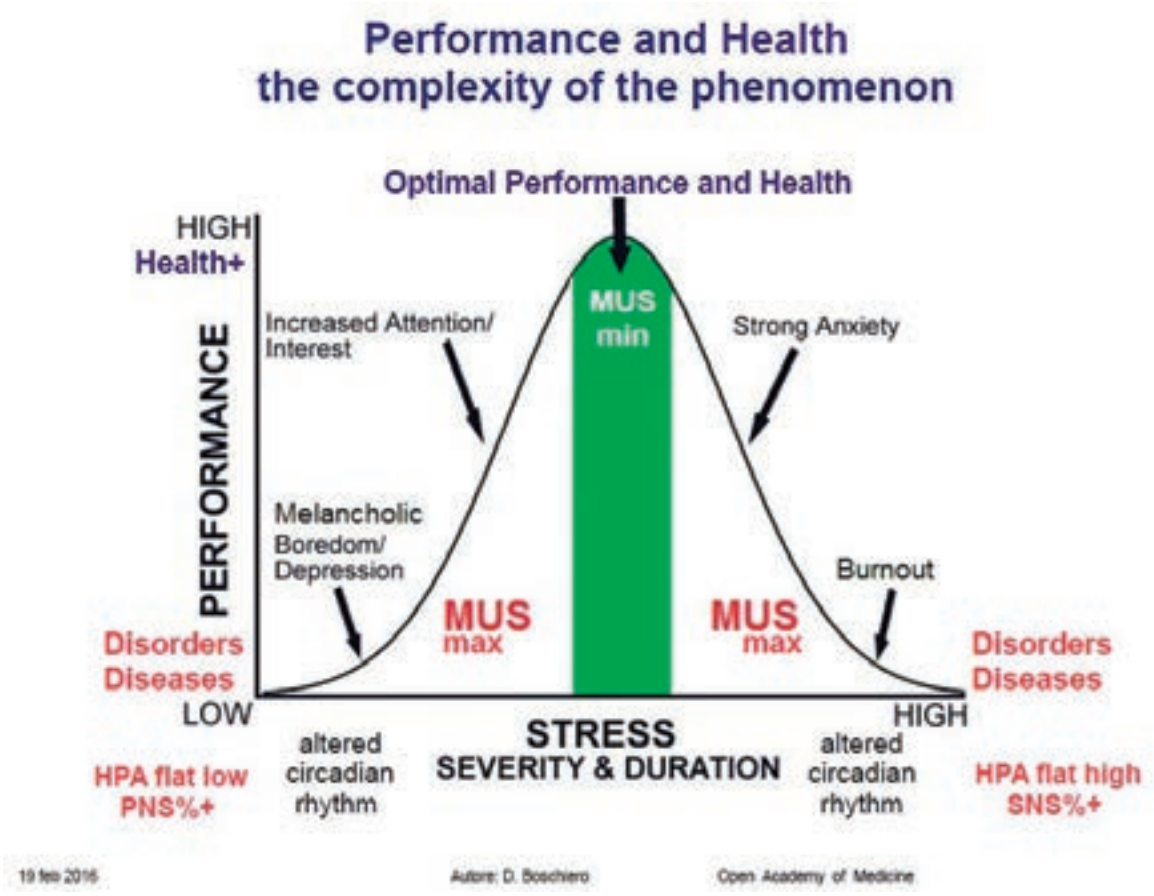
Based the requests of the scientific community, therefore, individuals with MUS should be carefully examined in order to clarify the genesis of the symptoms and to implement the most appropriate strategies.

The literature on stress has been rather quick to classify the **reaction stages to stress** according to their chronological dynamics, that respects the stages of the so-called GAS (*General Adaptation Syndrome):*

· **alarm reaction** is the stage in which the stressor is "recognised" and the organism prepares to deal with the threat, triggering the mechanisms described above;

· **resistance stage** is the actual reaction to the stressor where homeostasis begins restoring balance; based on the organism's responsiveness, on the intensity or the extent of stressors, or the concurrence of other previous stressors, this stage may run its normal course or may persist over time, without homeostasis recovery, bordering on the next stage, which is exhaustion;

· **exhaustion**: this stage represents the chronic or persistent activation of the stress response; once this stage is reached, the stress response is simply inadequate to restore the homeostasis of the organism; this is the most damaging phase, as prolonged exposure may increase the risk of developing physical and mental illnesses.



Stress is also generally differentiated based on its last consequences, according to the principle that one stressor may be considered both "positive" or "negative", based on the body's ability to react to it or not and to re-establish the physiological homeostasis; in this case we refer to:

· **Eustress**: indicates the stress that leads to an adjustment reaction by the organism, which then can re-establish a state of physiological homeostasis; from this point of view, the initial stressor takes the form of a positive stimulation of the body, be it a constructive or pleasant psychosocial stimulation, or a functional immune-endocrine modulation;

· **Distress** is the type of stress that results in the loss of homeostasis in the organism, usually associated with an excessive or persistent activation of the reaction to the stressors, ultimately **associated with emotional or physical disorders**.

One of the main problems in relation to the functional or diagnostic assessment of stress, is the wide variety of elements to be considered as potential stressors, ranging from psychosocial stimuli to organic diseases and from nutritional imbalances to physical activity.

Improving sports performance makes it necessary to fill the gap, that is often overlooked, between the state of health and the pathological state, without taking for granted the fact that the absence of specific diseases means perfect health.

The onset of MUS is a significant index that is related with the areas of metabolic or neuro-immune-endocrine disorders; investigation into the causes of the symptoms and the adoption of specific recovery strategies, as well as allowing the containment and regression of the symptoms, prevents the factors involved in their genesis from deteriorating, creating new and more serious systemic interactions that could lead to specific diseases.

The same non-specificity of the MUS, however, renders their classification or clear treatment difficult, as the same symptom can result various problems, when not from the concomitant interaction of pathogenic processes of different natures.

Focusing on the specific case therefore, requires an exchange and correlation of a greater number of data, in addition to those on vague and non-specific symptoms.

In addition, **the time variable associated with different types of stressors or stimuli** (endogenous and/or exogenous), and the capacity for adaptation lead to important changes with different psychophysical pathways that over time can maintain the negative loops, with **a strong presence of vague symptoms and non-specific MUS, chronic low-grade inflammation, body composition changes and significant loss of mental and physical performance.**

This type of symptoms, although not representing specific pathological conditions, is indicative of an impairment of the physiological balance of the organism, **often related to the chronicity of inflammatory processes, chronic stress, unhealthy eating habits, alterations of the physiological hormone balances or of their physiological circadian rhythms.**

Indices of paramount importance are obtainable by means of differential analyses of body composition such as muscle, bone, total fat, visceral fat, IMAT, HPA axis, etc., and of heart rate variability (HRV) and the Autonomic Nervous System, such as SDNN, RMSSD, scatter, etc.

There is no doubt that, for the athlete, monitoring hydration levels, the distribution of intra and extracellular fluids, muscle content, fat types, the quantity and quality of minerals and the regulation capacity of the autonomic nervous system (Heart Rate Variability) play a crucial role.

In this context, any state of systemic or intracellular dehydration is particularly significant, which is linked both to the shortage of phosphate buffer systems and bicarbonate, and to the increased cell mortality and consequent migration of the cell fluid into the extracellular environment.

One of the main issues related to a low level of hydration is the difficulty in transporting and absorbing nutrients (minerals, for example), a key aspect for the athlete.

The differential analysis of the body composition allows for the monitoring of key parameters related to muscle mass, the primary factor for the maintenance of tone and sports performance:

the tendency of muscle mass loss is not a rare phenomenon, whether it be related to endocrine, metabolic or chronic inflammatory issues, the periodic instrumental detection of the ratio of muscle mass (Skeletal Muscle), fat mass (FM) and fat types (IMAT intramuscular fat, AAT visceral fat) it cannot therefore be neglected before implementing any nutritional corrections or preparing specific training strategies.
In order to improve the athlete's nutritional habits, the value of the basal metabolic rate and the daily rate (BMR, 24EE) cannot be neglected, as they are metabolic parameters directly related to the positioning of the individual and the relationship between muscle mass and fat.

The preservation of muscle mass, however, is not the only aspect that influences the body's metabolic rate, which may undergo more or less substantial alterations also due to chronic inflammatory processes, and of the relative degree of systemic inflammation; in fact, persistent inflammation, stimulating neuro-immune-endocrine alterations results in changes in metabolism, generally decreasing the metabolic capacity of the individual. The differential analysis of the body composition (e.g. BIA-ACC) has been proven useful in this case where it can express the value of the **HPA axis index** (trend of the **cortisol rhythm**), indicating the integrity of cell membranes correlated with the degree of systemic inflammation and the loss of intracellular fluids and muscle mass.
Complementing the systemic parameters, the overall picture of health can be further clarified by the survey of the athlete's **ability to adjust and adapt, based on the analysis of the autonomic nervous system** (e.g. PPG) **and heart rate variability (HRV**). Parameters such as SDNN **(general health index and adaptive capacity)** and RMSSD (ration of **vagal/parasympathetic activation and anti-inflammatory capacity**) also allow us to assess the degree of endogenous anti-inflammatory regulation, highlighting the factors that generated the symptoms and the loss of psychophysical performance.

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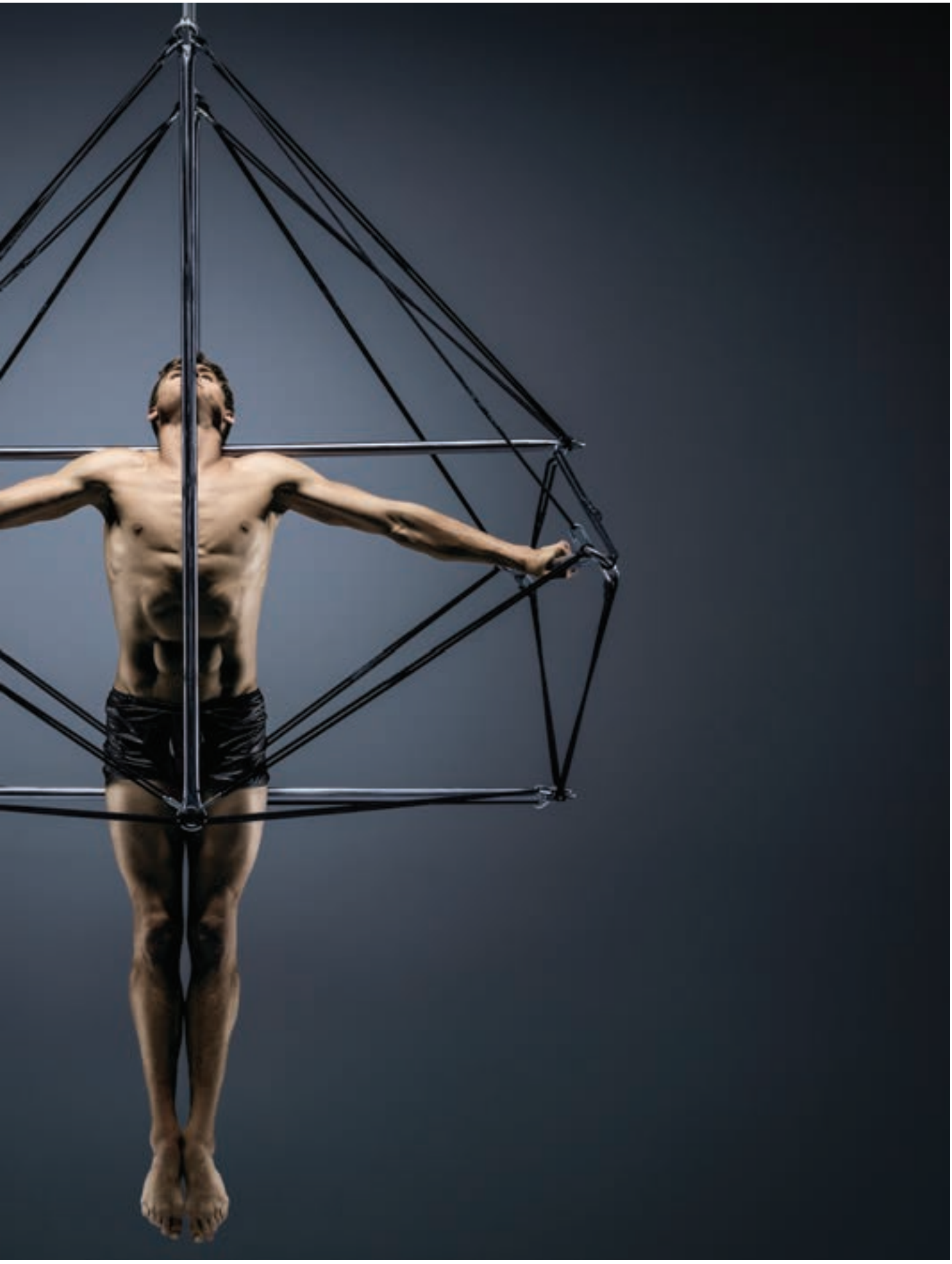
The official journal of the European Weightlifting Federation

ANTICIPATING THE TIMES. FROM THE THEORY OF IDEAS TO EXERCISING MOVEMENTS (PART TWO)

BY ALBERTO ANDORLINI



5. VIRTUES AND VICES.

Nevertheless, sometimes we forget. And despite continuous warnings that training is a process that must be filtered by particular attention, we tend to ... let it go. We often return to shaping forms and moving away from function. We focus on one piece of the puzzle, without considering what sense that single piece has in the big picture.

We should reflect on the lost opportunity, or on the possibilities that remain unexpressed. Reflections which are undoubtedly *sui generis*, but rather than apply them to a model, that of "Functional Theory", which has already been widely debated and discussed, it would be more appropriate to reflect on how much of that theory has become part and parcel of so-called "conventional" training, changing the contours and, sometimes also the content.

Point One. Functional Theory did not express a method, it did, however, set out the principles. As it did not define a shared and systematic operational line, it has been subject to multiple interpretations.

Point Two. The Theory of Functional Training came one step away from having re-discovered the **unity** of Movement; but it failed to escape the trap of selective motor intervention.

Point Three. The Theory of Functional Training has grouped exercises into new **categories**, bringing the same categories back, however, to bodily segmentations and not to *purposeful contextualised expressions*.

Point Four. The Theory of Functional Training drew attention to a Body that **f**unctions as a Kinetic Chain, but it failed to link the exercises in a finalised concatenation.

Point Five. The Theory of Functional Training invited us to observe common movements, but, in its various branches and extensions, it gradually forgot all those elements, which are ... common to all movements.

Point Six. The Theory of Functional Training coined new terms, it did not create new exercises. The proliferation of disciplines and sub-disciplines (Calisthenics, raw training, crossfit, suspension training, MovNat, paleo fitness, bodyweight training, integrated training, free running, move primal, animal flow, etc.) has fragmented training in an attempt not to claim "supremacy" over specific equipment, but the authorship of a system: precisely that of Movement.

Point seven. Today, the word "function" lacks a commonly accepted and shared meaning. In essence, it represents a limit rather than an opportunity. It divides as opposed to uniting. Contrary to its initial intention, it constitutes a dividing line between the various professions geared towards improving performance: whether it be sports training, physical education, gymnastics, or rehabilitation. And

why? Because without a collective interpretation, anyone working in the field of physical activity tends to attribute a different meaning to the term "function", depending on the specific nature of their own role and skills. So it happens that we forget to think about the general principles, which are transversal to all professional areas. Unfortunately, an all too specific and specialised approach has done little or nothing to produce a universal denominator. The solution would be simple: to promote theoretical and general application principles capable of developing knowledge and soft skills.

Point Eight. The Theory of Functional Training drew attention to ... the other side of the coin: intrinsic **being** muscles rather than extrinsic **doing** muscles; inhibition as a facilitating mechanism for excitement; "What not to do" as opposed to "what to do" or better yet, the "not having to do" as opposed to "having to do"; "doing well" rather than "doing a lot"; "useful" strength as an alternative to "aesthetic" strength; the ease and fluidity of movement as a remedy to a jerky and forced movement.

Point Nine. The Theory of Functional Training does not exclude, it "includes" and "encompasses" (comprehensive training approach); it is general, not specific training; it is not training aimed at the specialisation of extraordinary movements, but rather at the improvement of ordinary movements; it is not the imitation of the sports movement, but the reconstruction of "normal" movement.

Point Ten. Details. The success of Functional Training is often associated with the use of unusual tools (functional tools). Even in this case, nothing new. Simply, the demand for new stimuli has led to geometric shapes, sized and tangible, being associated with aggravating and destabilising materials and elements. Nothing else.

Point Eleven. Functional Theory came across the simple motor snapshots, each representing a "piece" of the complex relational dynamics, ranging from ordinary movement to extraordinary movement. Functional training rediscovered key positions, belonging to the gymnastics glossary of the 1900s, and made them contemporary and "functional." Essentially, every exercise mimics, integrates or breaks down a fundamental movement. Each exercise is a modular piece, replicable in various situations, which can be integrated with many different actions, and separated from, or associated with countless exercises. We have by now realised that BEFORE JUMPING, we must lift off the ground, first rolling and then gradually reducing our relationship with the support surfaces.
The following is the progression of terms that characterises the variety of movement: *1. Prone Position; 2. Rolling; 3. Raise up; 4. Sit up; 5. Horizontal Quadruped; 6. Hor. Tripod; 7. Hor. Bipod; 8. Hor. Crawl; 9. Kneeling; 10. Staggered Stance; 11. Stand Up; 12. Vertical Stance; 13. One legged Stance supported/unsupported; 14. Turning/Rotating; 15. Chopping & Diagonal Lifting; 16. Walking; 17. Running; 18. Landing; 19. Jumping.*

They constitute a continuum, which shifts the focus from proprioception to mobility; from mobility to motor static stability; from motor static stability to dynamic motor stability; from dynamic motor stability to force.

Point Twelve. Travelling on a line, progressing or regressing, with the aim of mastering sequential and consequential motor elements, means proposing exercises in a consecutive order. A sequence, although linked to movement, can only be established and exercised if dictated by some simple "grammatical" references. Functional Theory has linked executive positions and methods, trying to

obtain a map of the body moving in space; a map able to define the progressive and/or regressive values of the exercise, and to fix the contents of the exercise in terms of difficulty, complexity, similarity and biomechanics transferability. Table 1 represents an example of this.

when teaching how to recover a correct standing position, from prone/supine decubitus positions, or from quaduped/tripod position. Various values were then attributed to the progressions; we moved from warm up routines, to activating concatenations, to combinations of 3D-overall lengthening,

4X4 MATRIX	
SUPINE / PRONE	ASSISTED / UNLOADED
QUADRUPED	UNLOADED
HALF / TALL KNEELING	ASSISTED / LOADED
STANDING	LOADED

Table. 1 The table (*presented by Charlie Weingroff PT*) intersects 4 variances relative to the body's posture and 4 variances relative to the executive mode.

Point Thirteen. A point which is an emergence of the previous two. Functional Theory picked up subjects that were as natural as they were forgotten, and forged didactics based on simple transitions (*in other words: I practice moving from one position to another*); transitions and passages that mimic and replicate the stages of motor learning. We notice how the key to certain associations between exercises is represented by the connection - which occurs through smooth and simplifying passages - between *transitionary positions*, each used as an intermediate station between departure and destination. The simplest example is represented by the transitive models used to neuromuscular awakening sequences. In this sense, we noted how the creation of smooth transitions that facilitate the transition from one exercise to another, has become one of the distinctive aspects, characterising the same patterns of functional training. Here is one of the most-used transitions:

1. *Crawling Pattern*
2. *Low Kneeling*
3. *Tall Kneeling*
4. *Transition to Half Kneeling*
5. *Lunge to Standing*
6. *Transition Back to Half Kneeling*
7. *Back to Tall Kneeling*
8. *Low Kneeling*
9. *Back to Crawl.*

Point Fourteen. There is a "functional" hierarchy in terms of objectives. Prehabilitation training; rehabilitation training; the preactivation of "forgotten" or "inhibited" muscles; pro-activating "unused" motor sequences; connecting areas of intervention (prevention, rehabilitation, training) that are considered distant, if not contradictory or irreconcilable (transitional training); improving performance. These are the objectives of Functional Training, in order of priority.

Point Fifteen. Theoretical studies and practical verification have directed operational sensitivity to exercises that may be well known in form, but are renewed in function; exercises that may be inserted indifferently either in postural alignment sequences, or in progressions of structural workouts.

Point Sixteen. Functional Theory has shifted the direction from training to trainability; from the vertical quest of "peak form", to the horizontal discovery of the possibilities provided by a Body in Movement.

Point Seventeen. The debate on Functional Training thrives on dichotomies and contrasts, analogies and comparisons, hypotheses and axioms. An example of a dichotomy? Stability and mobility.[1] An opposition? Insulation versus inte-

1. The term mobility means the ability to produce a desired movement. Stability refers to the ability to resist an unwanted movement (Bill Hartman, Intelligent Human Performance). By joining the two terms, Gary Gray, PT, coined the term Mostability and described it as "the ability to functionally take advantage of just the right amount of motion, at just the right joint, in just the right plane, in just the right direction, at just the right time".

gration, Analysis versus Synthesis. A couple of analogies? "Training is rehabilitation and rehabilitation is training."[2] "Every exercise is a test, and every test is an exercise."[3] A hypothesis? "Improving proximal stability to make distal mobility more efficient"[4]. But not everything is ... only just black or just white. We should bear in mind that the functional approach is based on pragmatic considerations, not on incontrovertible dogmas, and that, in nature, everything is complementary.

Point Eighteen. The debate on Functional Training has lost the original themes, forgetting the teachings of those who, made significant marks in time and made a real effort to combine **the form of the exercise with the function of the body.**

Point Nineteen. Updating training passes through a process of unification and understanding. The many guidelines (different in concept, origin and extraction), and the many functional ramifications, may be comparable, compatible and above all, usable, if included in an action plan whose primary focus is the **relationship with the environment.**

Point Twenty. Functional Theory has changed the operational standard by redirecting the focus on primary elements - Body, Movement, Environment - and their possible, mutual interrelationships. Functional Exercise is the transverse element that makes us aware of the Environment through the action of the Body in Movement; knowing the body through the changes that Movement makes on the Environment; knowing Movement through the relationship that develops between the Body and the Environment.

Point Twenty One. The Functional approach may be positioned on programmatic lines which are indeed, "useful", however, they are destined for paralysis; or.... we can raise the bar of understanding, and overcome the limits of technical configurations and conceptual interpretations. Going beyond the thought barriers imposed by "believing" in a system (whatever system it may be) can mean questioning the significance we attach, in general, to training and, in particular, to training stimuli.

Point Twenty Two and Conclusion. The improvement of Skills which favour Environmental Adaptation is the only key capable of renewing the functional drive.
Having said that, there could be an even more personal analysis (*as if the previous thoughts were enough*). It sounds a bit strange speaking in the first person, even more so, trying to convey an experience. I can guarantee, however, that these are the most direct and "informal" ways I have of conveying my impressions and, above all, of stimulating an exchange of opinions.
Here's what I think. To train, I try to pose and analyse all the possible questions. For this reason, I often linger over conceptual contortions that allow me to ... open more paths. I do not think of training in a functional manner (*a trend that we made obsolete even before managing to assimilate it completely*). Instead, I focus on the how and why of movement, including in this reflection every cultural connection that can elaborate, modify and customise movement itself. The information comes from the four cardinal points, from any pole capable of generating news and information; stimuli that are separated, classified and promoted as disciplines, techniques, arts, and methods. Throughout my process, I always refer to two terms: Form and Function; terms which are more associated with the world of design, rather than the Science of Training. Two terms with which I align every Position, every Movement, every Action that I manage to try and internalize. Therefore, "Form" and "Function" - nothing more than two simple terms - become cardinal elements in the workout process. Applying the two terms to basic structures such as Body, Movement, Exercise and Tools for the Exercise; and -

2. Training=Rehab, Rehab=Training. (Charlie Weingroff, PT)
3. Vern Gambetta, Gary Gray: Following a Functional Path (Excerpt from: The Gambetta Method: Common Sense Training for Athletic Performance, 1998)
4. B.Kibler MD: The role of core stability in athletic function.

most importantly - defining what we mean by Form and Function of each of these structures, leads me to follow the working paths in line with the goal that I set myself.
The discussion shifts from terminological to practical, when we begin to glimpse the possibility of enabling the Function of the Body system by means of various Forms of Movement, Exercise and Tool and, similarly, when, through the actual Functions of Movement, Exercise and Tool, we come to a point where we induce changes in the Forms of the Body.
Now: one wonders: why Form and why Function?
In order to be as clear as possible, I will reduce it to only two elements. It is my belief that, only by acknowledging the Forms and Functions of the Body and of Movement, can we begin to identify the distinctive matrix of our path, to diversify the approach, to organise a consecutive and consequential progression. In other words, I can choose to train: 1) the form of the body through the form of movements; 2) the function of the body through the function of movement; 3) the form of the body through the function of movement; and, 4) the function of the body through the form of movement. Obviously, the limit of this approach is dictated by what is meant by the Form and Function of the Body, and the Form and Function of Movement.
The hypothesis that I follow envisages: 1) the Form of the Body is that of a bio-tensile structure; 2) the Function of the Body is the relationship with its environment; 3) the Forms of Movement are the 8 basic movements; and 4) the Functions of Movement are balance, the relationship with people and things, the mechanical and energetic purpose of the movement, and expanding one's comfort zone. By choosing such an approach, in my workout I can channel any form of exercise (Position, Movement, Action), whatever its origin, and from whatever motor platform it derives from (martial arts, yoga, tai - chi, pilates, sports, dance. ..); inserting such motor expressions in the sequences we defined as models of Transitional, Concatenation and Flow.

That's all.

6. THE EXERCISES.

Positions that become Movements that become Actions, which, if associated with Transitions, can generate Concatenations, which produce Flows[5].

LET'S TALK ABOUT POSITIONS, MOVEMENTS AND ACTIONS THAT BECOME EXERCISES.

The start of the paragraph is not meant to be a tongue-twister.

I myself have understood, and I have tried to make it clear, that Exercise is the simplification of complex and *extraordinary* movements, or the complication of simple and *ordinary* movements.

In this case, exercise is a rigid, conventional, codified, divergent act, whose repeated execution is aimed at training the body; movement is a purposeful-convergent action, that can be more or less organised, flexible and adaptable, but always targeted at engaging the mind and body in a vital expression.
In the names and ideas of dedicated scholars and experienced professionals, we have retraced the most significant stages in the genesis of the exercises that we call "functional", which are but forms of motion that develop a function.

We talked extensively about how Exercise, in its most comprehensive sense, can be considered the result of simple motor snapshots and how "exercising" can be traced to fundamental factors - Positions, Movements, Actions - capable of generating and developing Skills.

We also said that the training of such elements may involve the association in motor concatenations along lines of similarity (**Transitions**) or consistency and contiguity (**Concatenations**); and that both forms can generate a **Flow**.

As a reminder:

- we interpreted the **Transition** model (*Session, Lesson, Class, Practice, Routine depending on the discipline and on the technique used*) as a continuous sequence, with similar adjacent elements, and different extreme - start and end - elements;
- we then defined **Concatenation** (*Combo, Spot, Flow*) as a set of movements not neces-

5. Cf. previous articles in the EWF Scientific Magazine: "Towards an uncertain awareness"

sarily similar, but adequately compatible, linked to each other to form a complex exercise of variable duration;
- finally, in **Flow** we identified the final vessel into which Positions, Movements, Actions, Transitions and Concatenations run, all classified according to a common denominator.

All this in an effort to keep the training system as similar as possible, to the *real life model.*

LET'S COME BACK TO THE PRESENT. Let's realign using functional terminology, let's forget about methodologies assumptions and talk about Exercise that:
- sees the body as the protagonist (*Body Work*);
- exploits body weight (*Body Weight Training*);
- plots three-dimensional trajectories (*3D Training*);
- activates joint segments in a sequential and consequential kinetic sequence (*Kinetic Chain Training*);
- uses the determined instability of proprioceptively enriched environments (*Balance Training*);
- exploits the disturbances provided by the use of small tools (*Functional Tools*);
- conveys the overload expressed by a free weight (*Free Weight*);
- and controls the situational variability dictated by neuromuscular stimuli (*Neuromuscular Training*).

Following this approach, we will focus on exercises involving multiple joints and which produce wide arcs of movement. We will rarely dwell on isolation exercises. This does not mean that isolation exercises are not potentially useful, or at least used; it simply means that the key to training that we recommend, is the fruit of a different vision and offers a different perspective. The exercises proposed here do not isolate the activity of an individual muscle, but they can isolate individual movements. To distance ourselves from what the debate on functional training has generated, we will say that flexing the forearm is a completely plausible movement in everyday activities; but this is not the case if it is the object of a purposeless training workout. Training should research and propose the movement that can best adapt to the worst situation. Whether it be in the form of isolation or integration.

All movements are the instantaneous result of a modular biomechanical sequence: deceleration, stabilisation, acceleration. Each link in the kinetic chain[6,7,8,9,10,11,12,13]; it is decelerated, stabilised and accelerated in order to transmit the motor wave from the centre to the periphery. The kinetic expression of the sequence takes place in the three planes of motion. The sum of the movements allows one to place the distal segments (head, hands, feet) in the most suitable position and at the most appropriate time, so as to make the action purposeful (*PES online manual, Optimum performance training for the performance enhancement specialist, National Academy of Sports Medicine, 2001*).

Here's an immediate analogy: the body is a vehicle; some muscles work like brakes, others like accelerators; both systems (brake and accelerator), are supported by the clutch, which helps to modulate the transmission of motion. The *core* muscles have a function similar to that of the clutch. The clutch is a device which allows to

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gradually merge the motion of two shafts which rotate at different speeds. The shafts which rotate at different speeds are the scapular axis and the pelvic axis, where the effector terminals (arms, legs) are inserted.

The **kinetic chain** is the link between the parts; if one of the parts (links) is broken or does not work properly (e.g. the battery), the entire engine, and not the single part, is compromised. The steering wheel guides the movement on the **three planes.** We can drive forwards and backwards (sagittal plane), steer to the right and left (frontal plane) and go around a roundabout (transversal plane). If we wish to define our area of investigation more precisely, we can establish a "legend" that identifies the "places" of interest. We will not be concerned with movements that are isolated, rigid, limited, artificial, fake, link action, gravity confused, lab-like, mechanical, deceptive, 1-dimensional; instead we favour movements that are integrated, flexible, unlimited, physiological, real, chain reaction, gravity user, lifelike, biomechanical, proprioceptive and multidimensional.

Let's take a magnifying glass and study the area that we have delineated. One way of finding the movements we have shown as interesting, is to look for what *Paul Chek* calls *Primal Patterns*. The primordial movements include: *pushing, pulling, twisting, lunging, squatting, bending, gait*.

We have three destinations, five obligatory stops, which we cannot escape from: **function, kinetic chain, core, three-dimensionality**; and seven "monuments" to be photographed (I push, pull, turn around, take a step and kneel, I squat, bend and walk).

Let's analyse these (and other) terms, trying to establish a kind of vocabulary that facilitates orientation.

WHAT IS MEANT BY SYSTEM. It is the organism as a whole, to be defined as an Integrated System, when each part works and contributes to a common function. Although this definition may seem too broad, the fact remains that no "subsystem" (muscular, skeletal, nervous, cardiovascular, urinary, reproductive, gastrointestinal and lymphatic) functions by itself, when and if isolated from the others. A sub-system exists, only as part of a larger System; and only when something that interests/influences/affects one of microsystems interests/influences/affects the macro-system as a whole. The work of Bogduk, Hodges, Hides, Richardson, McGill, Meyers, Vleeming and Lee has contributed greatly to explaining how the Body and Movement integrate the activities of the subsystems; and how the integrated activities of the subsystems stabilise and mobilise the Body in Movement.

WHAT IS MEANT BY FUNCTION.

Optimal function =
effective load transfer
(Linda Joi Lee)

Optimal function requires the ability to effectively transfer loads through the System. An ineffective load transfer often leads to biome-

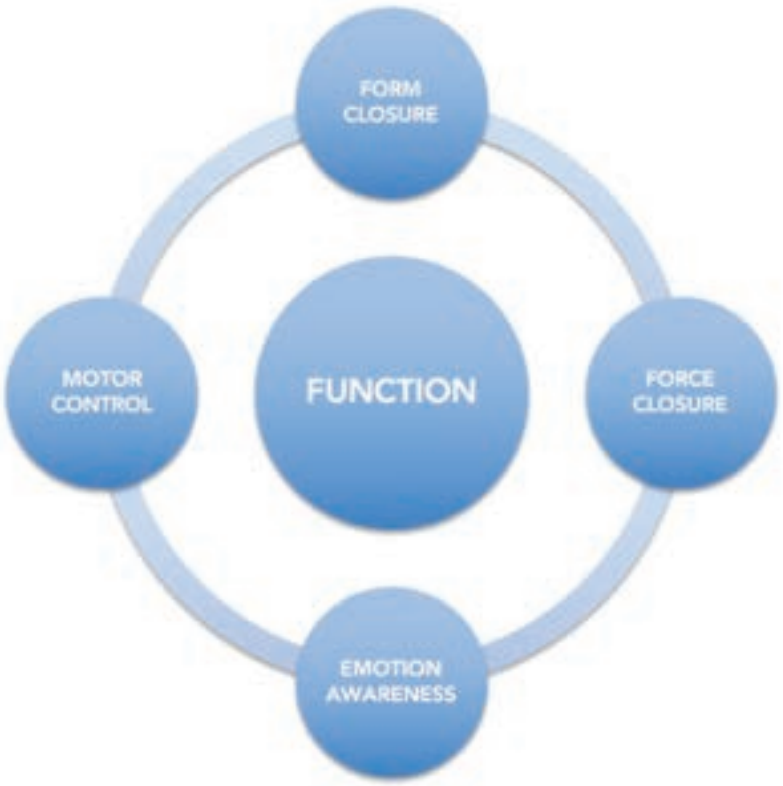

Diagram 1. The connection of the four components of load transfer: form closure, force closure, emotion awareness and motor control (Vleeming and Lee).

chanical dysfunctions that manifest themselves in the form of: increased compression loads on the skeletal structures (in particular, the spine); an increase of tensile loads on the soft tissue structure; a decrease in everyday, professional and/or athletic performance; aches.

The ability to perform "everyday activities", such as walking, holding a child, carrying the groceries and loading them into the car, or doing sports activities such as running, kicking a ball, or doing an "overhead press," depends on how efficient the neuromuscular system is in transferring the loads through the body. Complete accomplishment of the motor objective requires a strong structural base, a muscular force that adequately controls the structural base, the necessary neural input which regulates and addresses the system's activity, an appropriate joint participation of emotional and physiological components that support the development of the action.

The Integrated Model of Function designed by Vleeming and Lee, describes how these different systems can help to effectively transfer the load through the body. The connection between the four components of the load transfer - form closure, force closure, motor control and emotion awareness - is illustrated in diagram 1.

WHAT IS MEANT BY FUNDAMENTAL CHANGES. To return to a common image in functional language, we can say that the most direct way to describe primordial movements is to imagine our ancestors - primitive humans - and their motor skills, dictated and shaped by an ancestral imperative: survival. Primordial movements, also referred to as fundamental movements, are the result of a motor selection that primitive man had to make to adapt to an unpredictable environment. Bending over to lift a stone from the ground, stretching to get over an obstacle, pushing a log, dragging prey, turning around at a suspicious noise, crouching behind a rock to hide. The motor skills that were spontaneously honed can be divided into seven macro-types of movement: squatting, bending, lunging, pushing, pulling, twisting, gait.

Training of any background and origin, regardless of its different connotations and matrices, has always used these movements, varying how they are carried out (body weight/overload), the location and distribution of the load, the use of tools and the body position. There are endless variations, which give rise to new patterns and associations.
In the terminological description of the seven basic movements, I have included a list, partial and incomplete, of familiar exercises (taken from various websites, with extensive video documentation). I would like to specify that the exercises shown here in no way

exhaust the motor vocabulary of the basic patterns, which are cited as they are closer to a particular vision: western training. Oriental gymnastics (Yoga, Tai Chi) and techniques represented by the generic term *Body works* (*Alexander, Feldenkrais, Pilates*) are also an example of how from fundamental movement we are able to translate into composite and complex patterns, capable of "training" the flexibility, adaptability, fluidity of the "body in movement", without insisting on training-specific standards we are most familiar with.

The basic movements represent the **fragmentation** of the movement, be it an everyday or sports one. From a purely operational point of view, the "conversion" of the fundamental movements into training forms the basis of any progression, be it mechanical, energetic or coordinative. Any fundamental movement, introduced into the workout, must first be supported by a central pre-activation (core) and then be integrated into a complex kinetic sequence (**multi-joint kinetic chain**), involving the three planes of motion (**three-dimensionality**). Combining the fundamental movements, after they have been "stabilised" in an analytical way, means de-fragmenting the individual *files*, creating associations by contiguity and "likeness." In other words: we work on the *hardware*, enhancing the *software*.

Let's analyse the seven movements from a formal point of view.

Squatting (or *lower body pushing*), in other words, squatting with knees bent and the buttocks on or close to the heels. In "Western" training sessions we have: barbell or dumbbell squats, overhead squats, prisoner squats, air squats, front squats, sumo squats, squat to press, one legged squats, side squats, squat with rotational reach, squat with side reach, lumberjack squats, box squats, side squats, side squats with a barbell, zercher squat ...

Bending (*lower body pulling*), assuming a curved position by flexing the trunk over the hips. In "Western" training sessions we have: medicine ball overhead/ side throw, deadlifts, good mornings, single leg Romanian deadlift...

Lunging, taking a step forward, bending to a kneeling position. In "Western" training sessions we have walking lunge, side lunge, clock lunges, barbell or dumbbell weighted lunge, medicine ball lunge with twist, lunge with forward reach, lunge with side reach, crossing balance lunge, lunge with rotational reach, split squat, Bulgarian split squat, reverse lunges, step ups, 45 degree lunges...

Pushing, applying pressure against something with the aim to move it. In "Western" training sessions we have: pushup, fist push-up, modified push-up, t-push-up, staggered push-up, medicine ball switch push-ups, band push-up, chain push-up, triangle push-up, single leg push-up, stability ball push-up, spiderman push-up, judo push-up, clap push-up (plyometric), atomic push-up, push-up w/dumbbell row, dips, floor press, dumbbell floor press...

Pulling, applying a force so as to cause, or try to cause a movement in the direction of the origin of the force itself. In "Western" training sessions we have: standing high, mid, and low cable rows, chin ups, bent leg inverted row, straight leg inverted row, bent row, dumbbell bent row, one arm bent row, pull-up (neutral grip), pull-up (supinated grip), pull-up (pronated grip), pull-up (mixed grip), cable face pull, one arm dumbbell row, dumbbell, archer raises, javelin raises...

Twisting, applying a force on a body segment (the trunk, for example) so as to determine a rotation or twist. The pattern is frequently associated with most of the fundamental movements. In "Western" training sessions we have: medicine ball throws, medicine ball woodchoppers, lawnmower, bucket dump, Russian twist, scorpion, iron cross...

Gait, in other words, any form of human locomotion that determines a shift "over the ground". The different types of gaits are characterised by differences in limb movement patterns, body position (vertical: ambulation; horizontal: crawling), overall speed (walking, running, sprinting), in the type of contact with the surface, the type of surface (ground, grass, sand, asphalt), in the variety of terrain inclinations.

On the other hand, if we expand the 7 Fundamental Movements, combining the basic elements of the same movements (I bend, push, pull, etc.) with elements dictated by the adaptability of the pattern to variable situations, we will have a clearly functional classification, grouping movements in 4 Basic Movement Patterns. Juan Carlos Santana describes them as

the "Four Pillars of Human Movement"; Paul Chek labels them as the "Primal Pattern System"; and Stuart McGill, identifies them as the "Fundamental Movement Patterns". Whatever the terminological sense, the movements included in the classification, include: 1) shifts of the centre of gravity (standing, squatting, lunging, climbing); 2) walking (crawling, walking, running, sprinting, stepping, galloping, skipping, hopping, leaping, bouncing, jumping); 3) manipulation (pushing, pulling, throwing); 4) changes in direction (rotating, twisting, turning, spinning).

WHAT IS MEANT BY KINETIC CHAIN.

"*Everything changes once the foot hits the ground*".
Gary Gray, PT.

The **7 Fundamental Movements** and actions resulting from the association of these simple "basic ingredients" - the 4 Basic Patterns - are the result of sequential activation connected with the operation of a chain, in which each link is bound to the one before it and the one after it.

Let's go back to what we said about the "System." Stedman's Medical Dictionary defines a system as "*the entire organism, seen as a complex organization of parts, in which each partial structure is anatomically and functionally related to the other*." Apparently a very simple and simplistic definition, but in reality it perfectly describes the complexity required in the performance of human activities.

The kinetic chains accelerate, decelerate and stabilise the body.

The single action of every single muscle changes when the body comes in contact with the ground, opposing gravity, it changes position, searching for vertical balance.

The term "kinetic chain" (or kinematic) has clear affinities with the language of engineering. This word, referring to a mechanical system, identifies the elements that make up the system itself, joined to each other, by a series of links. In the '70s, when the term was first applied to the human body, the concept of a kinetic chain was defined as a system of links in which the joints connect a series of overlapping rigid segments (bones). In a KC system, each body segment receives one or more forces, transferring them to an adjacent segment in such a way as to influence the movement or, in turn, to be influenced. In the context of the human body, therefore, the term **kinetic chain** refers to a combination of motor segments connected in a sequential manner. Precisely because the segments are connected and interdependent, the movements, all of them, are never the expression of an isolation or a muscular selection, they produce complex and mutually associated movement patterns, in other segments of the system, according to a consequential trend. The movements that are the expression of an open kinetic chain (the effector terminal is free to move in space) do not necessarily produce a chain reaction in other segments of the system; vice versa, the movements produced by a closed kinetic chain (one terminal is fixed and the position of the body requires the neutralisation or overcoming the force of gravity) determine muscle activation that runs along a kinetic line.

The anterior oblique chain, the deep longitudinal chain, the rear oblique chain and the lateral chain are tracks that cross the Core, connecting intermediate stations. Running along a track, transferring the load from one track to another, means engaging stability, mobility and force in reaching a motor objective, taking an economic and effective path.

WHAT IS MEANT BY CORE. During the activation of the **kinetic chain**, the neuromuscular control system must maintain balance, support posture, create and adapt the movement, oppose sudden and unexpected forces, assist breathing. All this while ensuring sufficient stability. It is evident that there are no chosen prime movers, stabilisers or neutralisers. Virtually all the muscles have a primary role in maintaining proximodistal stability, but the importance of each of these is determined by the unique and unrepeatable combination contained in the programming and finalisation of the action (McGill).

The central link in the chain, the sorting pivot through which all the kinetic paths pass, is the functional unit called the **core,** or **powerhouse**.

The core is located at the navel, more or less where the centre of gravity is found. It consists of 29 pairs of muscles, which make up the so-called **lumbar-pelvic-hip** complex (*Fredericson & Moore*). Its structural "boundaries" consist of the diaphragm muscle at the top; the pelvic floor muscles at the bottom; the multifidus muscle and lumbar portions of the spine and the iliocostalis at the back; the transverse muscle and posterior fibres of the internal oblique abdominal muscle, anteriorly and laterally. The muscles making up the central box create a physiological powerhouse in which the floor (pelvic muscles) and the ceiling (diaphragm) are the longitudinal transmission elements; this transmission has the ability to:

- absorb and dissipate compressive forces in centripetal direction;
- transfer and project the forces with a peripheral destination.

The core has a triple function: a **stabilising** action, thanks to the co-activation of deep muscles, called the inner unit; a **driving** action, as a result of the direct action of the large superficial muscles, called the outer unit; a **protective** action, which engages proactive (feedback) and reactive (feedforward) neuromuscular mechanisms.

The protective activity of the core is a pre-programmed neuromuscular event, which guides the synergetic action of the single-joint **inner unit**, and multi-joint **outer unit**, with the aim of ensuring stability and producing movement.

Core stability "optimises" the generation of force and "minimises" muscle and joint overloading in every kind of activity, from everyday, to working or sports activities (*Kibler & Sciascia*). Good core functionality allows you to modulate the "traffic" of the kinetic chains, coordinating the sequential activation of the individual links, until the distal segments (hands and feet) are placed in the optimum position, at the optimum speed with the best timing to produce the required motor task.

In the field of experimental research, it has also been proven that the central area of the lumbar-pelvic-hip complex is the node through which the weight of the head, trunk and upper limbs is transmitted to the lower limbs and at the same time, it also counterbalances the forces encountered during movement of the upper and lower limbs, and restores postural balance after external disturbance (*Panjabi*).

This same node, therefore, is a "closed form", which provides a stable reaction point for the rest of the body (system). When the core system works in a "synchronised" manner, the result determines an appropriate deployment of strength; an optimal control of movement, adequate absorption of the strength resulting from the impact with the ground, and a reduction of the strength acting on the distal joints.

In this sense, the core is the most important functional joint in our body. All lines of movement converge at the core, and from the core all strength is modulated and distributed (figure 6).

WHAT IS MEANT BY THREE-DIMENSIONALITY. Movement does not only occur in one direction. Human movement is quite a complex event involving agonistic and antagonistic structures, cooperating in order to stabilise and move the body on three planes and in ten directions.

Human function is three-dimensional. We operate and we relate

Figure 6. The Core is where strength is generated: the greater the distance from the Core, the less the ability to develop strength; the greater the distance from the Core, the greater the angular speed with which the part of the body can move.

simultaneously in three dimensions. The planes of motion are used as spatial reference. The sagittal plane identifies forward and backward movement.

The frontal plane, movement to the right or to the left. The transverse plane, involves rotational or spiral movement.

All activities are based on the activation of a kinetic chain and core dependant. Each involves the neuromuscular system, it reacts to stimuli and searches for balance, occupying all three planes simultaneously. Walking forward engages the body on the sagittal plane, but it requires movements associated with the transverse and frontal planes. The shape of the joints, the insertion of muscles and nerve connections enable and demand the inclusion of kinematic components on the three planes simultaneously.

The traditional approach leads to selective improvement, often unbalanced, since it is targeted at the use of only one plane of motion, ignoring integration with rotational movements and diagonal patterns.

To improve resistance to injuries and achieve optimal performance, it is necessary to use multi-planar patterns, and solicit the entire body as a connected system; a system in which all the parts contribute simultaneously to achieve a goal.

Multi-planar soliciation requires multi-joint commitment. Although many activities can emphasise specific planes of motion and specific joints, establishing a a predominant spatial and joint one, it is still important tend towards an activity that integrates the greatest number of fundamental movements, engaging three dimensions and using all the joints.

Multi-planarity and multi-joint activity require the activation of kinetic chains and involve the use of gravity as a first and essential form of intrinsic resistance. The neutralisation, overcoming and control of gravity increase the proprioceptive and kinesthetic impulses. Once the body has adapted to the management of gravity, it can be beneficial to add extrinsic loads as a disturbing factor, with the goal of improving reaction times and methods to external disturbing forces. A practical example of this concept consists in the centrifugal orientation of training (from the core to the extremities), from the rationale that defines the continuity of the training program (from Body weight training to Resistance Training), and from progressive learning to the contraction mode (from eccentric to concentric contraction) in opposition to first the intrinsic load, and then to the extrinsic load.

To activate a kinetic chain, with a three-dimensional and core-centred development, Mobility, Stability and Force must co-exist.

WHAT IS MEANT BY STRENGTH (IN THE WESTERN WORLD). Muscle strength is the motor skill that allows the individual to overcome resistance, or oppose it through the development of muscular tension.

The main determinants of muscle strength are:

1. the transverse diameter of the muscles (2-3 kg per cm^2 of transverse area)
2. the number of fast fibres
3. the recruitment capacity of the motor units
4. muscle coordination, understood as the ability to work the agonist and the antagonist muscles in synergy to produce the movement
5. the initial length of the muscle
6. the number of recruited motor units (the smallest motor units are the first to activate, see figure).

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There are three basic forms of strength:

1. **Maximum strength**: the greatest force that the neuromuscular system is capable of developing with a voluntary contraction
2. **Endurance strength** (resistance to force): the body's ability to resist fatigue during performances requiring strength and durability.
3. **Explosive Strength**: the neuromuscular system's ability to overcome resistance with a high speed of contraction.

This is, in the most simple and direct form, what we mean by muscle strength in physical performance.

WHAT IS MEANT BY STRENGTH (IN THE ORIENT). Let's go beyond and for once - *for one time only and only for the time it takes to read the following lines* - try to appreciate a (di)vision, which aims to describe a different strategy for achieving Strength. To do this, let's sit down, and look towards the east.

A brief preamble. The transmission of Eastern thought has always been in accordance with canons that do not belong to our culture. It so happens that valuable lessons are easily misunderstood or misinterpreted, losing much of their value. It is typical of eastern teaching methods to mainly rely on the imitative process of the movement and resort to an evocative language of fantastic images and suggestive metaphors, difficult for us to translate into practice because they are so different from our logic.

Hence the need for a translation of principles and shared concepts, which act as intermediaries between the two worlds, the western and the eastern, and between two logics, the rational-linear and the intuitive-analogical. Perhaps this is precisely the difference: the overturning of a paradigm, of a vision that in the East focuses on the individual who practices the movement and with that movement expresses and achieves; whereas in the West, the vision focuses on techniques, methods and strategies that select and highlight, in turn, only one part of the movement. In brief: the West produces outward strength; whereas in the East strength is drawn from inside.

Drawing out strength. The Chinese term **qi**, **ki** in Japanese, or the term **ci** in Korean (the oldest form) is the name given to the "internal" energy of the human body. It is a recurring term in all the areas subject to the influence of Chinese culture (Japan, Korea), arising from purely philosophical reflections, and then translated to the world of martial arts and traditional medicine. In English it is pronounced "chee". In particular, the term Ki is the constitutive central element of the Japanese word "Aikido" (ai-ki- d , in other words: "discipline that leads to union and harmony with life energy and the spirit of the Universe") .

By extension of meaning and according to a scientific dissertation corresponding to the Western mind, the Ki can be associated with what the eighteenth and nineteenth century physicists called *vis viva* (living force), in other words a

kind of fluid through which energy has the possibility of moving from one material object to another.

In Aikido, taiji chuan, judo and ju jitsu, every gesture is a movement of energy; and each movement is determined not so much by muscle strength, as by the ability to manage and direct the Ki.

In "Nei Gong" (or *internal energetic work*) training systems, movement is an expression of **Elastic Strength**, **Spiral strength** and **Explosive strength**.

According to this view, **elastic strength** is the strength of a muscular structure that acts without effort and in the right elastic tension. This occurs when the deep muscles interact harmoniously with the superficial one and osteo-articular system is aligned.

It is based on the idea of a development of strength, which, acting on opposing vectors, widens and len-

gthens the muscles, opening them like a sail in the wind.

Spiral strength is the body's second strength, which is obtained from the transformation of elastic strength. It is characterised by the three-dimensional component that develops the twisting capacity of the muscle bundles.

Explosive strength implies the ability to externalise strength in a sudden and eruptive manner, presupposing the realisation of elastic strength that moves in spirals, good relaxation and the ability to concentrate in the abdominal *Dantian*, which functions like the combustion chamber of a combustion engine, the energy of the body.

When the *Dantian* "explodes", it causes shock waves within the organism that travel outward along certain paths (the strength pathways) of the body. The mind guides and controls the flow of these shock waves, by opening or closing the joints, adjusting the breathing and muscle tone so that strength can pour out powerfully and precisely according to their intentions.

Such a division, of course, is only virtual, not real, because in practice is the development of only one type of strength: internal strength, which must be elastic, spiral and explosive.

The logical organisation of *internal work* sequences proceeds in a specific order on the basis of practical and evolutionary reasons:

- **Elastic strength** is the easiest to experiment, because it is based on the principle of two linear forces that move in opposition, by means of opposite vectors;
- **Spiral strength** moves according to the same principle, but adds a three-dimensional rotational component: the strength winds along a spiral around the strength pathways. Thus, it is the logical evolution of the previous, for the complexity of the composition of strength;
- **Explosive strength** is distinguished from the other two not only by its composition, but also by its use: while the first is the primary act of generating strength, and the second transfers it, the latter refers to its distribution and its emission in particular ways, by an undulating-sussultatory motion. Therefore, the generation and conduction phases, which are entrusted with the other two sequences, precede it.

The exercises dedicated to the development of **elastic strength** are intended to maximise the strength of each single structural part. The exercises designed for the development of spiral strength, to dynamically connect the different parts, so that the body can effortlessly move as one unit, with grace, harmony and power. Lastly, the purpose of exercises for the development of explosive strength is to allow the body to externalise strength without becoming stiff and/or damaging itself.

All this results in three key words:

- **ACCUMULATION** (Principle of the five body arches; one dorsal arch, and the four arches formed by the two arms and two legs);
- **CIRCULATION** (the strength directed towards the ground, the strength rising towards the sky and the strength that unites the centre; the strength connects the *nine pearls* and moves through the five arches with spiral motion);
- **EMISSION OF STRENGTH** (Principle of the six directions; strength in the six spatial directions (up/down, forward/backward, left/right).

WHAT IS MEANT BY MOBILITY. Mobility is the ability that allows the body in its entirety, or a part of the body, to move in a controlled manner, within the portion of space defined by the muscle-articular limits. In other words, it indicates the range of movement within which the body is able to produce and control in an efficient and effective way, a specific motor expression. It depends on the function of the outer unit. Mobility, therefore, involves muscles and joints; it relates to the freedom of movement; and proves to be more inclusive than the word "flexibility." Flexibility simply indicates the range of motion allowed by the muscles and joints, but excludes functional implications related to control of the movement.

WHAT IS MEANT BY STABILITY. Stability is the ability that allows you to control: the strength required by the movement; or, vice versa, the movement generated by the application, the production and the transmission of strength. It is a precursor of Strength and Neuromuscular Control. It depends on the function of the inner unit. Stability is a local joint condition. It creates anchor points which trigger muscle actions. The proximal anchor point is made up of the Core. The Core alone cannot ensu-

re stability along an entire kinetic chain (from the toes to the tips of the fingers), it needs structural references that accompany the transmission of the movement along the kinetic lines. Other kinematic anchor points are represented by the pelvic complex and the shoulder girdle. Muscular balance, activation timing, and synergistic actions are just some of the elements that combine to ensure stability. A muscle can fail to respect the proper activation timing, may be inhibited or hyper-excited, resulting in an alteration of the balances that govern the maintenance of an optimal rotation axis in all the joints involved in the movement. Once the stability of an anchor point is compromised, the dysfunction can produce a local mechanical alteration, or be passed along all the links in the kinetic chain until it finds a "weaker" or less "attentive" one. A deficit in terms of Stability is presented as a segmental dysfunction (joint) and multi-segmental (myofascial). These dysfunctions generate the limitations in movement and consequent compensation, associated with the need to maintain the function. If Balance is the ability to control the body by neutralising gravity, in the absence of movement, Stability is the ability to control the body during movement. One element is static, the other is dynamic. Instability, conversely, indicates the degree of mobility that cannot be controlled.

Oddly, the two terms, Stability and Mobility, have been put together to generate a new term: MOSTABILITY. Mostability is an ad hoc coined term indicating the synthesis of mobility and stability (by G. Gray). According to the original definition, it is the ability to functionally take advantage of just the right amount of motion, at just the right joint, in just the right plane, in just the right direction, at just the right time. It depends on the integrated function of the global and local muscles.

WHAT IS MEANT BY LOCAL AND GLOBAL SYSTEMS. The Core muscles were categorised by Bergmark, Comeford, Richardson et al, on the basis of the function expressed: local or global. The primary function of the Local System is to ensure the intersegmental, deep and "end" stability of the spine and of the joint structures that make up the pelvic complex, in order to reduce rotational and/or translational stress. The functions of the Global System are: to participate in the "superficial" stability of the spine and pelvis, and provide for the "coarse" and overall movement of the body. The **Local System** is made up of small, deep muscles; it exercises control over 1-2 joint segments; it adjusts rotational and translational intersegmental movement, and reduces shear stress; it performs an anticipatory activity (feedforward mechanism); it is non direction-specific; it has greater endurance; it undergoes a secondary inhibition process, following trauma/stress/ overload (delayed activation). The **Global System** is composed of large, superficial muscles; it encompasses more joint segments; it produces a global movement; it generates movement; it induces non-specific stability; it has a specific direction; it tires easily; it undergoes an increase (hypertonicity or spasm), following trauma/ stress/overload.

WHAT IS MEANT BY CLASSIFICATION OF THE EXERCISES. Each movement is an "ingredient", which, if suitably dosed, is able to "bind" with

the other, in order to produce a pattern adaptable to every situation.

Below, we will examine a type of classification, among the most recent, which divides the exercises not on the basis of a motor purpose (I move in order to ...), but along the lines of a "dominant" expression (*knee dominant, hip dominant, hybrid focus leg exercises, upper body push, upper body pull, core conditioning, shoulder stability exercises, hip stability exercises*). We realise that the "dominance" is brief and relative, and that the authentic structure of the subdivision is given by the distribution and the placement of the fundamental movements under different titles; that the transition from one position (postures, poses, etc.) to the other determines a movement; that the sum of several movements determines an action aimed at achieving a goal; and that variety and variability of the elementary patterns are dictated by the association of the building blocks on which we have focused (*fundamental movements, kinetic chain, core, three-dimensionality*) and some "ancillary" elements, such as:

- staticity (position) or dynamic (movement);
- nature of the support surface;
- position of the support surface (horizontal, vertical, inclined)
- relationship with the support surface (touch, sliding, partial/total load, jumping/landing area;
- body position (horizontal, vertical);
- number of supports or, more generally, the number of support points;
- rotation or no rotation;
- stationary or walking;
- use or non-use of tools.

Remember that the combination of these elements (basic and ancillary) has allowed us to put forward a hypothetical classification of non-conventional exercises, but broadly in line with the "historical" principles of Functional Theory.
The classification below summarises patterns similar to each other, or at least comparable, reported in several papers and texts. We will share this, to expand reflection and to convince ourselves that the exercise in itself is a factor of little significance if not connected with the study of the elements that compose it.

From the vast, infinite panorama of exercises, let's take "only" the ones that combine basic elements (squat, lunge, push, pull) with complementary elements (twisting, bending, gait). Including also the exercises dedicated to raising awareness of abdominal muscles (core conditioning), we will make an exception; an exception based on two conditions: their affinity and transferability to all the exercises according to a core-centric approach; and their specificity in respect of a function (stabilisation) that is common to all movements.

EXERCISES COME AND GO. All latest proposals provide a subdivision of the exercises according to the groups designated by a specific dominant. They are systematic proposals, useful from an operational point of view, but still textbook. It is a categorisation based on the similarity of movements, as well as on the prominent use of certain muscle groups. It is not perfectly aligned with the subdivision I have outlined in this article. Far from it. However, it can be helpful to understand the complexity of a system that is difficult to fit into a "box", that continues to rely heavily on anatomical or physiological references (it makes little difference if they refer to muscles or joints) and not enough on spatial or purposive references. I will however, sum it up according to an ideal index, reminding the reader that *exercises come and go, whereas the understanding behind the exercise - that and only that - remains.*
The index and the notes that accompany it are the result of a "collection" of exercises and notes, among the most common in literature. I will present it in the most immediate and simple way possible, without delving too deep, essential of course, but inadequate to this discussion.
Table 1 provides a synoptic overview of the exercises related to the vast area of training based on the ergonomic exploitation of internal and external resistance. The vision, albeit concise, is extremely detailed and complex.

The exercises are divided into ten categories: *Knee Dominant, Hip Dominant, Hybrid Focus Leg Exercise, Upper Body Press, Upper Body Pull, Shoulder Stability Exercises, Hip Stability Exercises, Olym-*

pic Lifts, Chop & Lifts (o Rotational Exercises), Core Conditioning.

Subdividing into categories has by now become part of conventional language. Nevertheless, the same division can be appreciated through a different filter of interpretation (cf. the proposed methodology in previous articles).
Each category holds infinite connections to the other and therefore can be neither isolated, nor technically limited in its scope.

Each category, and each exercise included in the individual categories, is an integral part of a bigger picture.
Each category contains fundamental exercises and derived exercises.
Each category develops a fundamental movement or a movement arising from the association of the most basic movements 1. squatting, 2. pulling, 3. pushing, 4. lunging, 5. bending, 6. twisting, 7. gait: walking, running, crawling.

Each category contains basic performance forms (basic exercises and derived performance forms (variations), closely connected to the basic exercise they derive from.
The derivations are elaborated versions of the elementary form; they develop the function from the basic form.
Each exercise (basic or derived) expresses a Transitive (I move an object) or Intransitive (I move) function.

KNEE DOMINANT	HIP DOMINANT	HYBRID FOCUS LEG	UPPER BODY PRESS	UPPER BODY PULL	STABILITY GIRDLES *	OLYMPIC LIFTS	CHOP & LIFT**	CORE CENTERED
Two leg knee dominant exercises	Hip Hinge Dominant (Deadlift)	One Leg Squats, Lateral Squats, Split Squats, Step Ups, Lunges	Horizontal Push up	Vertical pull up	Shoulder stability exercises	Clean progression	Half kneeling chop/lift	Plank/Hover, Heel shoulder Bridge, Side Plank
One leg knee dominant ex. Supported / Unsupported	Hip Raise Dominant (Bridge)	+ reach/ chop/ diagonal lift	Vertical Push up (HandStand press, Overhead pressing)	Horizontal pull up	Hip stability exercises	Snatch progression	Standing chop/ lift	Knee tuck & Pike progression
Lunge /Split Dominant	Hip Extension Dominant (Leg Raise)	+ press/ pull			Core stability exercises	Jerk		Rollouts
								Rotational core
								Crawling+ Climbing + Marching

Table 1. Exercise classification. Synoptic table with examples. *The Stability Girdles Exercises may include "Core Centered Exercises" where the stability prevails over the dynamism.
** The "Chop & Lift", characterised by diagonal evolution, can be placed in a sub-category of "Core Centered Exercises".

In each category there are exercises that trace back to the 5 levels we saw earlier: 1) the level of selective muscle awareness; 2) the level of activation in the horizontal position of the myofascial chains; 3) the level of bi/monopodalic placement when standing; 4) the level of the closed/open-chain; 5) the level of locomotion.

In each category, there are items related to the three macro structures to which we have referred: Kinetic Chain, Core, 3-dimensionality. When varying the instruments used (body, terrain, slope variations, changes in placement and support), each exercise changes shape and alters both orientation (Kinetic Chain, Core, 3-dimensionality) and purpose (Mobility, Stability and Strength in Isolation or Integration).

Each Exercise is a test. And as each exercises challenges mobility, stability and strength, it is necessary to observe, evaluate and correct mobility deficiencies, difficulties in stabilisation, disturbance in the timing of muscle activation, deficits in the absorption stage and production of strength.

ALBERTO ANDORLINI

After extensive experience as a Physical Education Teacher, today he is a Sports Trainer and Rehabilitator. His activity has long been connected to his interest in the evolution of movement and the development of performance.

He has worked for Fiorentina F.C., Siena F.C., Al Arabi Sports Club, Chelsea F.C., he was the Physical Therapist and Sports Trainer for the Italian Women's Football Team. He is currently the Rehabilitator at Palermo Sports Club. He collaborates with the Florence Training Lab and lectures in Sports Science and Techniques and Preventative and Adaptive Motor Sciences at the University of Florence.

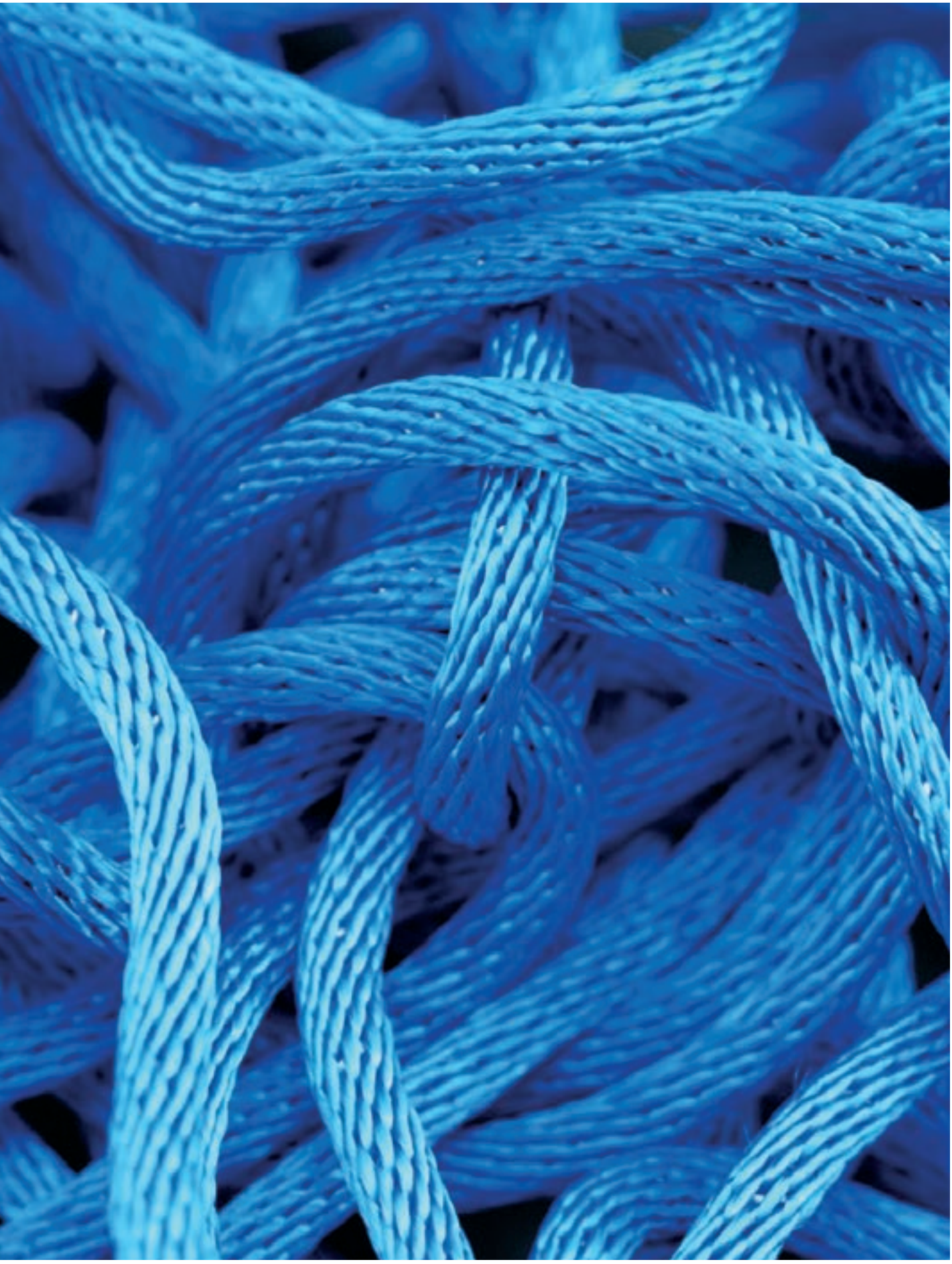
COM PLEXITY.

HOW TO STUDY IT AND OBTAIN USEFUL INFORMATION

The position and innovative approach of a renowned physicist, to comprehend complexity and study it in various phenomena typical of modern society. And also of sport.

(Part two)

BY LUCIANO PIETRONERO



The editorial staff of S&C put a series of questions to Professor Pietronero, who took due note and proceeded to answer them precisely, the first part was published in the EWF Scientific Magazine Year 2, n.5, 2016, pp. 72-79). In this issue, you will find the second part, with minimum adjustments made, of the encounter between Professor Pietronero and various members of the Physics Department. As the reader will see, we have chosen to conserve the spontaneous and lively nature that characterised the interview and the encounter.

5. ELABORATING ON COMPLEXITY AND APPLYING IT TO SPORT

5.1 When we see that complexity is before our eyes. We cannot elaborate much on the concepts of complexity, as it a relatively new science. Some complex things have always been right in front of us: for example, everyone knows that the structure of a tree is a typical complex structure, no simple geometric figure is remotely similar to a tree; whereas a typically complex fractal structure is very similar. Why have we not considered the scientific nature of the trees we have always had before our very eyes? Because we lacked the mathematical concepts to define them scientifically. Nature always creates complex structures;, in physiology, for example, it created the structure of our lungs, where oxygen enters, sustaining a volume of about 5 litres/min, spread over the huge surface area pulmonary alveoli, therefore the surface of the lungs, where blood-oxygen exchange occurs, is significantly large: as big as two tennis courts. If we had just a balloon, the available surface would be maybe half a square metre and not much exchange would occur. Instead, the air enters our lungs, reaching all the crevices of the alveoli, whose actual surface area is great, and the consequence is an extensive area for the necessary exchange. We can therefore say that physiology has created a geometry with a small volume of 5 litres, distributed over an enormous surface area, equivalent in size to two tennis courts. Returning to the example of the tree, which was and has always been before our eyes, we can say that until the concept of fractal dimension was developed by several authors (a concept that allowed us to really open our eyes), we did not understand that a tree is a very complex structure, which can be described in a scientific way. The same applies to clouds - these are simple examples of complex structures that we now understand better thanks to the vast research on complex fractal structures carried out in the 1980s and 1990s, which I myself participated in, in various **ways, and submitting a number of papers.**

5.2 When we speak about fractals. Fractals [the term *fractus*, interrupted or broken, was coined by Mandelbrot in 1975 – they can be simply defined as come geometric objects that are repeated in their structure in the same way on different scales, in the sense that they never change appearance, even if examined with a magnifying glass (self-similarity), and the characteristic fractal images are, mathematically speaking, fractional dimension objects - Ed.] represented a very important fact, because they were the first truly "popular" complex structure - so to speak - to which it was possible to apply a scientific methodology; and today they are considered a problem solved, even though I have good reason to believe that the very structure of the universe is fractal rather than homogeneous: these are open issues, which will require very long experiments. From the problem of fractals, which were basically simple, as they were characterised by a fractional dimension and were very similar to other problems of physics, today we have moved on to the *big data* phenomenon, venturing into the most unexplored areas, where there are also fractal, hierarchical aspects or others of varying types, but mixed with many other properties.

5.3 When we speak about earthquakes. Naturally, complexity does not solve everything. Here I can mention a classic example of the failure of complexity: earthquakes. You see, earthquakes are a magnificent complex system, the map of earthquakes has a fractal structure, both in space and in time and also in space-time: thus a careful observer would say that as an element of complexity, earthquake prediction is excellent. From a certain point it is, because the most scientific element of complexity of earthquakes is the so-called Gutenberg-Richter law, discovered in the 1930s-40s,

which tells us that the probability of an earthquake of a certain magnitude (energy logarithm of the earthquake) diminishes with the power law of a given exponent. The power law implies scale invariance, it somehow implies fractal and complex properties. This means that since there is only one straight line in the logarithmic space, the physics of small earthquakes is analogous to that of large earthquakes: a very important and significant conclusion. This led to a series of studies from which, given the characteristics of the many small earthquakes, one tries to deduce the properties and the probability of a large earthquake. This perspective study has substantially failed because, whereas the scientific solution of the problem, from a theoretical point of view, means deriving the G-R law from a model (and this is successful when accomplished); from a practical point of view, it means that we make a prediction that earthquakes will occur in this way in an infinite time and infinite space: and this too is feasible. But the interesting problem of earthquakes is the opposite, in other words: will an earthquake will take place in this small space, and in this brief lapse of time? This question goes beyond the standard concepts of complexity that are asymptotic concepts; therefore, for example, the crucial question about earthquakes is not part and parcel of what an academic can realistically do when studying these phenomena. For this reason, I wanted to provide you with an example, because it is important to understand the potential for success of complexity, as it is important to understand its limitations, in order to try to overcome them. In the case of earthquakes, unfortunately, the situation is so diverse that you have a lot of random precursory effects changing from case to case and from moment to moment. In earthquakes, it appears that noise prevails over signal.

5.4 When sport comes into the picture. Now let's take a look at the case history of sport; I'm not yet able to tell of success or failures, I can only say how we intend to proceed from here on in. I must acknowledge that a strong stimulus, an authentic encouragement, was the story of baseball analyst and forecaster, Nate Silver (statistician and author of the famous book: "The Signal and the Noise: The Art and Science of Prediction". Undoubtedly a highly original thinker who sought to address a crucial issue in the lives of all, that of being able to base one's decisions on predictions that over time, prove to be more or less reliable).

We can relate to Silver's idea, although we believe we can have greater (which is not necessarily sufficient) mathematical algorithmic technique than this brilliant analyst. What do these observations (our own, those of Nate Silver, his data collection method, etc. etc.) mean in a football game? We have a statistic of several characteristics of the players, we know everything about both their athletic performances and their performances on the football field: I will attempt to look for synthetic variables, such as the marks journalists give players, in relation to their physical features, in other words, how they move on the field: this is the individual element. Then, there may be a particular element (here's where we hope to provide an original contribution), represented by the player's chemistry with the team: for example, it may occur that a player in a certain context has a low performance, but much higher in another. The explanation is the interaction between him and the others: and this is the field in which we are more experienced. For example, it would be very useful if we could understand why a player with characteristics *xy* does well in team *z*, but, despite having with the same characteristics,

plays badly in team *f*, or vice versa: perhaps we can reach this level of knowledge. Yet another level of knowledge, I suppose, is related to how the team is positioned on the actual field, and how it changes its positioning with respect to a given opponent.

We will begin our investigation in this way: searching for a correlation between the marks that journalists give the individual players, and the highly detailed characteristics that we already have of several players, in order to have a synthetic variable; goal statistics are not enough, they are few and the information is inadequate; the journalists' marks are plentiful and represent a synthetic variable that sums up both athletic performance and play ability. So, if we succeed in this, we can move on to the integrated element of the player within the team and then, in the third phase, the other speculated aspect - how a team measures up strategically against each other, with a distinctive layout. Naturally, we will evaluate how this entire theory works, hoping that, other ideas will come to mind along the way, which will lead to modifications and improvements of the overall idea. From what I can speculate at this stage of thought and in this preliminary approach, the information obtained would be helpful both during *scouting*, when deciding which players to buy ("I'll buy a player that best fits my team"), and also in the definition and application of a precise game strategy, in other words: the best way for me to arrange my team and how appropriate it is to have my team play against an opponent who plays in a certain way: the latter, I believe, is the maximum level a coach should aim for. Perhaps we will never get there, but think of the usefulness of even taking some steps in that direction.

6. COMPLICATED SYSTEMS, COMPLEX SYSTEMS.

6.1 Where we summarize, at least a little. Let's recap on what is a complex system and what is a complicated system. A complicated system is, for example, an airplane: it has a million pieces, however, if we cut a wire, there is undoubtedly someone who knows exactly the effect that cut causes. The Internet is a complex system. Firstly, because nobody actually designed, it grows by itself and evolves almost like a biological element: so, this is both complex and complicated. Complex systems have properties that are defined as emerging, just like life emerges from inanimate matter; too complicated for us today, but in the simplest cases, we can understand a little more.

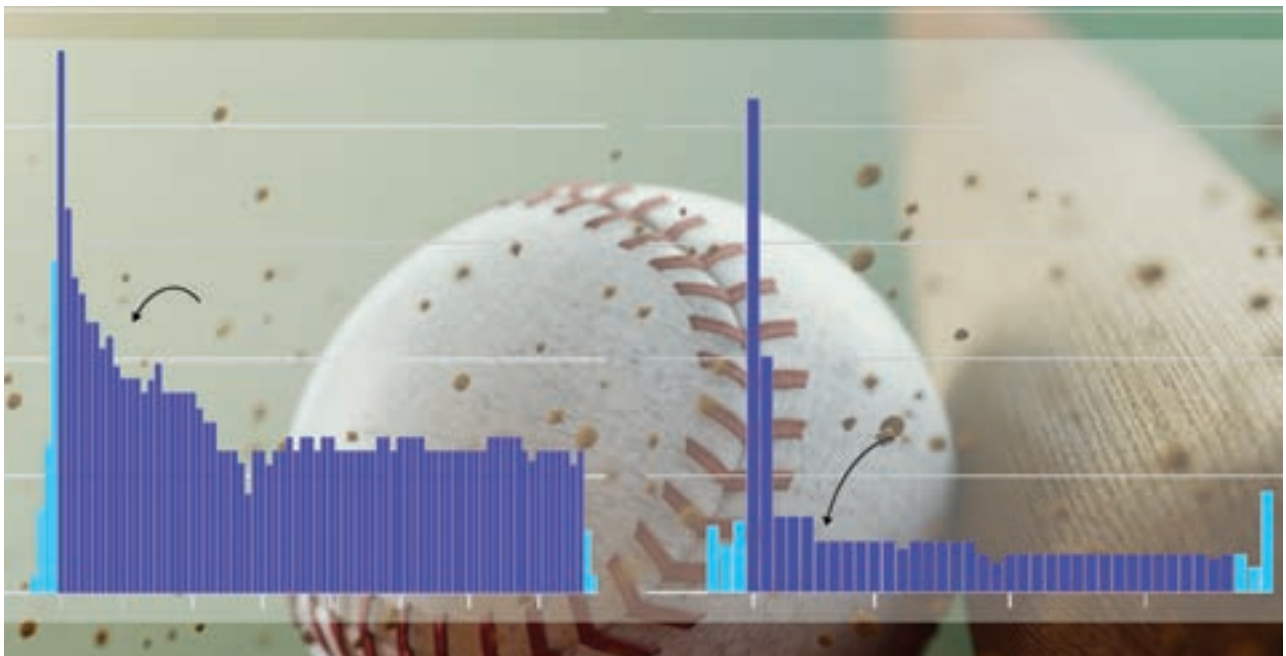
Even in relatively simple individual performance, such as athletics or weight lifting (how fast one runs or how much weight one lifts), we can imagine that it (the performance) is in fact the emergent product of a complex system, our bodies: what we eat, how we train and everything that can contribute positively or negatively to the increase in performance. Therefore, this can be considered the simplest vision of the element of complexity in individual sports, and how performance connects to all the characteristics of the individual that we can study. Of course, also in this case it is a rather complex phenomenon, and one that must be studied as such. Then there are individual games such as tennis (one on one), team sports where there is cooperation but no contact, sports with interaction such as volleyball, and then team sports with physical contact such as football, which are probably more complicated. What can we hope to achieve? I think that - just as in the development of the *economic complexity*, where we were relatively successful, so we can take it as a positive example, it was very difficult to plan it, it just happened by chance - at the time I said, I think that in all this original analysis of *big data*, so as not to produce an obvious and banal analysis, we need new ideas: success will come to those who have a greater understanding of the causal relationship between a type of training and the type of diet and performance, or in teams, between how a group harmonises and co-operates, or how it measures itself by the other team. We are dealing with elements that are like a largely unexplored jungle; therefore, my opinion is that there is a great opportunity, however, it will not come without a price, it will require hard work, ideas and originality in each single case.

6.2 Where working hypotheses are once again presented. What, for example, do we think we can do: we have just talked about football, which is definitely the most complicated case. And precisely for the most complex case, being experts in the field of complexity, we can

provide a more original contribution. Let's see what happened in the past, when these ideas were extremely successful: there is a famous movie, "Moneyball", about a man who, through statistics, had managed to establish the potential of champions, in other words, which players with certain characteristics from a young age, had high chances of becoming good, or excellent players.

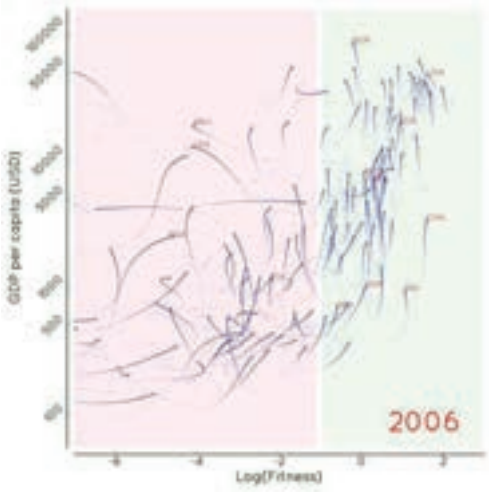
6.3 The United States, baseball and Nate Silver. I recently read the book, "The Signal and the Noise", in which - as we know - there is an important example of relatively simple sports data. Nate Silver is a young statistician who for several years has been on the list of the top one hundred most influential people in the world. He began his career as a financial analyst, but was not very successful, mainly because it was a fairly repetitive job and he got bored easily. In his free time, however, he studied baseball statistics. Despite being a team sport, baseball is almost equivalent to an individual game, because it mostly consists of one person throwing the ball with his hand and another hitting the ball with a bat: the rest of the game looks like an appendix of this crucial event, then - in practice - 1 on 1 is the heart of baseball. In US baseball, you play in college up to 18-19 years old, and are considered semi-professional; when the players finish college, they are selected by professional teams using a fairly random mechanism, to prevent one team from taking the cream of the crop. They then stay on the same team for 5 years: at the age of 24, a professional is on the market and can be sold for any price: and here's where Nate Silver's analysis comes into play.

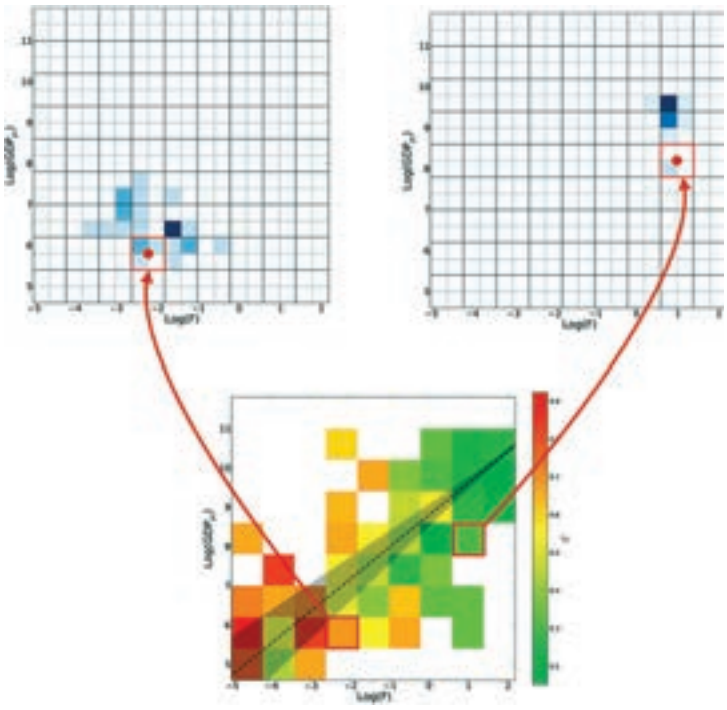
The crucial question is: if you buy player X, how long will he last at a high level? If he is 23-24 years old, the average duration is up to about 36-37 years (sport life expectancy of 12 years). However, the average can vary greatly. Some either get injured or their talent deteriorates, some stop playing at 30, others play up to 40 years old. So, you buy a player with a life expectancy of 12 years, you pay a lot of money, but then this player can last 5, 6 or even 15 years (that's a big difference). A key point in buying players when they are hot on the market is to estimate whether they will last many years, or just a few. The average does not help much here because the fluctuations are represented by the number of years more or less than this average. So, experts started to draw up two/three profiles and in the end they created as many as 26, which sought to pinpoint the characteristics of different players, to see whether they fell into one of these profiles or not. This is not a particularly clever vision, because the attribution is completely random. Nate Silver said: let's take the player who we plan to buy at 23/24 years old, we look at his characteristics of the previous five years - so we have a series of quantifiable mathematical information - as the rules of baseball have been the same for the past 80 years, we can go back in time and look for those players who have very similar characteristics to our candidate. Maybe we will find one from three years ago, or one from forty years ago

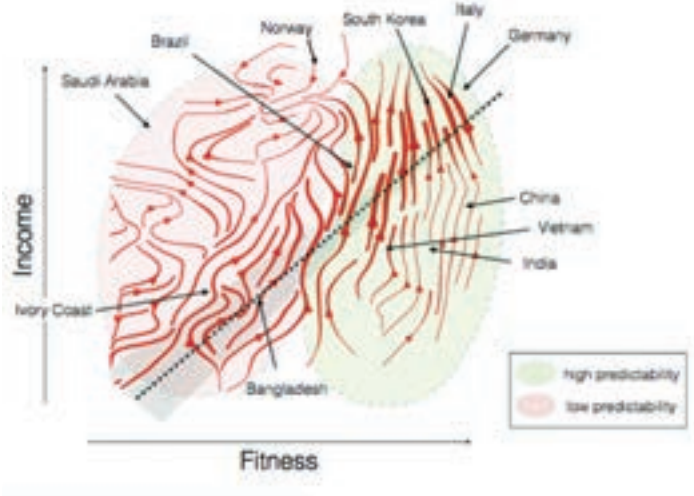


... so we project our player's information onto the players of the past. Here we create a system that, at this point, starts with the selection of our player and is then optimized, but is integrated with all the periods in the history of this sport and this selection of players from different eras: let's take a look at the duration of their high-level performance. This "game" - changing the perspective from 26 pre-assigned profiles to just one pre-assigned profile, based on the characteristics and integrated with the entire history of this sport - has improved the performance of this choice. We did exactly the same, independently of Silver, in the analysis of the various countries of the world, with an historical study of all the other countries that are in the same area macroeconomic area, etc.

Silver then became very famous for election forecasts. It is true that in America the predictions are fairly simple, because there are only two parties. But it is also true that Silver nailed the forecasts of 50 out of the 51 states. What does Nate Silver do? Although he is not a mathematician, he has studied the subject a great deal, for example, the Bayesian probability concepts. Silver is a very clever person: clearly defining the choice of data was his winning move. I cannot say that we will be able to do the same, he was extremely smart; however, the ace up our sleeve is technology, for example, we can use network technology and algorithm technology, so if Silver, without much mathematical technological means, has managed to get such interesting results, this encourages those, who have a little more than just mathematical technique, to think that the *big data* phenomenon, if treated in the right way, can provide a lot of important information in various fields.







6.4 So .... So, we are not faced with a codified discipline, but a kind of confused jungle: for this reason, it is important to understand that *big data* is also *big noise*, or in other words, great confusion, in which we need to turn on a light in the dark if we are to understand anything. Obviously we will not be successful in everything we try, but that's part of the game. We are, however, willing to invest time in activities that will lead us perhaps not to great results, but, we enjoy trying to see if something works maybe, just like what we happened in the case of *economic complexity*. In this regard, I'd like to repeat a metaphor that intrigues me: what you need in *big data* is to turn a light on in the darkness, to actually begin to see a light. When you read Nate Silver, this fact is crystal clear, it is the fundamental characteristic: he was able to turn a light on in the darkness of the jumble of data. I believe that, rather than a coded field where you need to apply sophisticated math, at this point in time we only need to begin understanding something.

LUCIANO PIETRONERO, PHYSICIST.

EXTENSIVE INTERNATIONAL EXPERIENCE IN SCIENTIFIC AND INDUSTRIAL LABORATORIES (XEROX USA AND BROWN BOVERI CH FOR A TOTAL OF 10 YEARS) AND IN THE ACADEMIC FIELD (FULL PROFESSOR IN GRONINGEN NL FOR 5 YEARS).

SINCE 1987, PROFESSOR OF CONDENSED MATTER PHYSICS AT THE UNIVERSITY OF ROME, "LA SAPIENZA".

FIELDS OF INTEREST: THEORY OF THE STRUCTURE OF MATTER, SUPERCONDUCTIVITY, STATISTICAL PHYSICS,

PHYSICS OF COMPLEX SYSTEMS, ECONOMIC COMPLEXITY.

IN 2004, PROFESSOR PIETRONERO FOUNDED THE INSTITUTE OF COMPLEX SYSTEMS OF THE NATIONAL RESEARCH COUNCIL IN ROME (200 PEOPLE), WHICH HE DIRECTED UNTIL 2014. THE GOAL WAS TO STUDY ISSUES THAT GO BEYOND THE INDIVIDUAL DISCIPLINES SUCH AS THE INTERNET, BIOINFORMATICS, COMPLEX SYSTEMS IN GENERAL, SMART CITIES AND MORE RECENTLY, ECONOMIC COMPLEXITY.

HE HAS CREATED A GENERATION OF YOUNG SCIENTISTS (MORE THAN 100) DETERMINED TO OVERCOME DISCIPLINARY BARRIERS TO DEVOTE THEMSELVES TO THE MORE CURRENT AND IMPORTANT ISSUES OF SCIENCE AND SOCIETY. MANY OF THESE YOUNG PEOPLE HOLD LEADING POSITIONS BOTH IN ITALY AND ABROAD. IN 2008, HE RECEIVED THE FERMI AWARD, THE HIGHEST AWARD CONFERRED BY THE ITALIAN PHYSICAL SOCIETY. RECENTLY HE DEVELOPED THE THEME OF ECONOMIC COMPLEXITY, CONSISTING OF A RADICALLY NEW SCIENTIFIC APPROACH TO THE ECONOMY, CONSISTING OF A SCIENTIFIC AND VERIFIABLE WAY TO UNDERSTAND WHAT FACTORS LEAD TO THE DEVELOPMENT AND SUCCESS OF A COUNTRY, OR HOW A POOR COUNTRY CAN GET OUT OF THE POVERTY TRAP. THESE WORKS HAVE HAD GREAT RESONANCE IN BOTH THE ACADEMIC WORLD AND IN THE POLICY MAKING AND BUSINESS SECTORS, AND HAVE BEEN SUBJECTS OF A "NATURE" EDITORIAL: HTTP://WWW.NATURE.COM/NEWS/PHYSICISTS-MAKE-WEATHER-FORECASTS-FOR-ECONOMIES-1.16963

RECENTLY THE WORLD BANK, WHOSE MISSION STATEMENT IS TO ERADICATE POVERTY FROM THE WORLD BY 2030, HAS DECIDED TO ADOPT THESE NEW METHODS FOR ITS STUDIES ON STRATEGIES FOR THE INDUSTRIAL AND ECONOMIC SUCCESS OF DEVELOPING COUNTRIES.

Spanish resumenes

LA COMPLEJIDAD DE DETERMINAR LAS CARGAS PARA LOGRAR LA POTENCIA MÁXIMA
Anna Swisher
SM (ing), n.º 6, año III, enero-abril de 2016, págs. 4-9
Durante las fases de entrenamiento en las que el desarrollo de la potencia es prioritario, los entrenadores deberían elegir una carga de aproximadamente el 70-80 % del valor de 1RM de los movimientos de levantamiento de pesas. Un entrenador debería tener en cuenta lo cansado que está un deportista, así como la calidad y velocidad de las rondas de calentamiento, antes de establecer una carga para utilizar en el entrenamiento. Desde un punto de vista más general, el entrenamiento para desarrollar la potencia debería realizarse con una gama más amplia de carga y potencia que combine ejercicios de alta velocidad y baja carga (como los ejercicios pliométricos o las sentadillas con salto) con ejercicios de fuerza elevada y velocidad moderada (como las cargadas de potencia o las sentadillas), con objeto de facilitar una adaptación más completa a lo largo de la curva fuerza-velocidad2,4,33. Para seguir optimizando el desarrollo de la potencia y el rendimiento deportivo, este método mixto aplicado al entrenamiento para desarrollar la potencia debería realizarse en el contexto de un programa de entrenamiento periodizado.

EL TOBILLO Y EL TIRÓN SEGÚN EL ESTILO ASIÁTICO
Andrew Charniga, Jr.
SM (ing), n.º 6, año III, enero-abril de 2016, págs. 10-19.
El autor afirma que la función combinada del pie, la articulación del tobillo y la conexión de las estructuras musculares, tendinosas y ligamentosas es uno de los aspectos (o quizás el aspecto) menos comprendidos de la halterofilia, a pesar de ser decisivo para la ejecución, en especial la de alto nivel. Por ende, aborda los temas de la contribución inicial de los músculos tibiales, de la transmisión de potencia por los músculos biarticulares, del pie utilizado como un muelle (es decir, el mecanismo de cabrestante) y de la postura del levantador de pesas (que puede causar variaciones del potencial de fuerza expresado, de lo que se extrae una serie de conclusiones interesantes).

EL MOMENTO DE LA INGESTIÓN DE PROTEÍNAS PARA EL DEPORTISTA DE FUERZA Y POTENCIA
Jay R. Hoffman
SM (ing), n.º 6, año III, enero-abril de 2016, págs. 20-28
Uno de los beneficios asociados con el consumo de proteínas tras una sesión intensa de entrenamiento contra resistencia es la capacidad de mejorar la recuperación y los procesos de remodelación del tejido óseo. En varios estudios de investigación se ha observado que la ingestión de proteínas tras un ejercicio de resistencia produce una atenuación del grado de daño muscular, una reducción de la fuerza y una mejor recuperación. Además, si las proteínas se consumen antes de una tanda de ejercicios contra resistencia e inmediatamente después de la misma, se observa un aumento de la expresión del ARN mensajero (ARNm). Se cree que ello acelera la adaptación muscular y mejora la recuperación de los músculos tras cada sesión de entrenamiento. En consecuencia, el momento de ingerir las proteínas parece tener una gran importancia en la estimulación de las adaptaciones musculares que se producen durante los programas de entrenamiento contra resistencia. Esta reseña se centrará en los efectos agudos del momento en que se ingieren las proteínas y luego dirigirá la atención a los posibles beneficios derivados de los efectos crónicos de la ingestión de proteínas en torno a la sesión de entrenamiento.

INFLUENCIA DEL CICLO MENSTRUAL Y DE SUS FASES EN LA EJECUCIÓN DE LAS DEPORTISTAS ESPECIALIZADAS EN HALTEROFILIA OLÍMPICA
Antonio Caporale
SM (ing), n.º 6, año III, enero-abril de 2016, págs. 30-43
El autor expone algunas consideraciones relativas a las características del deporte femenino y de las especialidades de la halterofilia olímpica femenina, y se detiene a examinar las características del ciclo menstrual en sus diversas fases, la posible relación con el entrenamiento y, sobre todo, los resultados del estudio preliminar realizado con un grupo de levantadoras de pesas cualificadas, durante la preparación para un importante evento agonístico: experiencia que se llevó a cabo para valorar la influencia del ciclo en el entrenamiento, en especial en la corrección o incorrección de los levantamientos realizados durante el entrenamiento. En la fase premenstrual y menstrual de las deportistas estudiadas, las últimas mostraron un aumento significativo de los levantamientos nulos. El autor expone algunas reflexiones relativas a las modalidades de programar el entrenamiento, incluso teniendo en cuenta el ciclo menstrual de cada deportista.

RENDIMIENTO DEPORTIVO: SIM, ESTRÉS E INFLAMACIÓN CRÓNICA LEVE
Dario Boschiero
SM (ing), n.º 6, año III, enero-abril de 2016, págs. 44-51
El autor expone el concepto de rendimiento deportivo y lo relaciona con el de rendimiento psicofísico, que considera un fenómeno multidimensional, esto es, que comprende variables diferentes: psicológicas, físicas, cognitivas, propioceptivas y autonómicas; todo ello regulado por el denominado sistema del estrés. En las publicaciones especializadas, el estrés generalmente se describe como una forma de adaptación del organismo (se habla del "síndrome de adaptación") a estímulos denominados "estresantes", que pueden definirse de forma genérica como elementos capaces de alterar el estado homeostático del organismo, que puede adoptar las formas más diversas y pertenecer a las categorías más dispares. De hecho, puede ser de índole psicosocial o estrictamente física, pero la distinción no conlleva diferencias sustanciales en cuanto a los mecanismos de reacción del organismo. El autor analiza, por consiguiente, los diversos aspectos del proceso que conduce al estrés distinguiendo, entre otras cosas, la fase de alarma de la de resistencia y de las de adaptación o de agotamiento. En el proceso de adquisición de las adaptaciones necesarias para la ejecución, hay que tener bajo control un aspecto fundamental, que es la aparición de una sintomatología vaga e inespecífica, denominada SIM (por síntomas inexplicables médicamente), esto es, una serie de molestias subclínicas de tipo funcional: cansancio o agotamiento persistentes que no se alivian con el sueño; trastornos del humor; manos y pies siempre fríos; insomnio o somnolencia persistentes; ansia, apatía o cambios en el apetito (hambre excesiva o falta de apetito); acidez y dolor de estómago, sensación de saciedad, hinchazón después de las comidas y náuseas; períodos de estreñimiento persistente; colon irritable; y dificultad en la sudoración.

"PRERRECORRER" LOS TIEMPOS: DE LA TEORÍA DE LAS IDEAS AL EJERCICIO DE LOS MOVIMIENTOS (SEGUNDA PARTE)
Alberto Andorlini
SM (ing), n.º 6, año III, enero-abril de 2016, págs. 52-71
Se trata de la segunda parte de un extenso estudio en el que el autor aborda una nueva serie de reflexiones con el título: "Prerrecorrer" los tiempos, sobre la posibilidad de entrenar el movimiento y mover el entrenamiento, un debate que ha suscitado el interés de numerosos pensadores y ejecutores del movimiento, a quienes se ha pedido su opinión para elaborar casi un compendio de consulta rápida, simple y comprimido, capaz de indicar, aunque sea parcialmente, hacia dónde se está dirigiendo el mundo del entrenamiento.
En esta parte se abordan los temas siguientes: la teoría funcional magistralmente presentada en doce puntos, ejercicios, movimientos fundamentales, cadenas cinéticas, la tridimensionalidad, la fuerza en el mundo occidental, la fuerza en el mundo oriental, la movilidad, la estabilidad, el sistema local y el sistema global y la clasificación de los ejercicios.

LA COMPLEJIDAD Y LA FORMA DE ESTUDIARLA Y DE EXTRAER INFORMACIÓN ÚTIL (SEGUNDA PARTE)
Luciano Pietronero
SM (ing), n.º 6, año III, enero-abril de 2016, págs. 72-79

Se trata de la segunda parte de una disertación sobre la complejidad en la que se presenta el punto de vista y el planteamiento innovador de un físico de renombre, para comprender la complejidad en cuestión y para estudiarla en diversos fenómenos característicos de la sociedad moderna, entre los cuales también se encuentra, y no en último lugar, el deporte.
El autor es el profesor Luciano Pietronero, catedrático de teoría de la estructura de la materia en la Universidad de Roma "La Sapienza", Departamento de Física.
La primera parte se publicó en SM (ing), n.º 5, año II, septiembre-diciembre de 2016, págs. 72-79.

Russian

СЛОЖНОСТЬ ПРЕДПИСЫВАНИЯ НАГРУЗОК ДЛЯ ДОСТИЖЕНИЯ ПИКОВОЙ МОЩНОСТИ

Anna Swisher

На этапах тренировки на которых развитие мощности является приоритетной целью тренеры должны выбирать нагрузку величиной приблизительно от 70 до 80% от 1RM (1 максимального повторения) в движениях тяжёлой атлетики. Для того чтобы определить нагрузку для использования в процессе тренировки тренер должен принять во внимание развитие поцессов утомления спортсмена а так же качество и скорость разминки. Рассматривая проблему с более широкой перспективы, тренировка направленная на развитие мощности должна включать более широкий спектр нагрузок предусматривающий сочетание упражнений с высокой скоростью исполнения и низкой нагрузкой (например плиометрия и приседания с прыжком (jump squats) и высокосиловых упражнений выполняемых с умеренной скоростью (например, приседания с отягощениями (squats) и взятие на грудь в стойку (power cleans)). Это позволяет достичь более полную адаптацию контролируя кривые сила-скорость. Для дальнейшей оптимизации развития мощности и спортивных результатов этот подход основанный на смешанном методе должен быть включён в контекст периодизации тренировки.

ЛОДЫЖКА И ТЯГА В АЗИАТСКОМ СТИЛЕ

Andrew Charniga, Jr.

Согласно утверждению автора статьи, совместная роль лодыжки, голеностопного сустава и взаимосвязи мышечных, сухожильных и связочных структур представляет собой один из аспектов (о возможно основной аспект) меньше всего изученных в тяжёлой атлетике, несмотря на то что эти аспекты играют решающую роль для достижения спортивных результатов особенно результатов высокого уровня. В этом смысле автор рассматривает следующие темы: начальная роль берцовых мышц, передача мощности со стороны двухсуставных мышц, нога используемая в качестве пружины (или механизма лебёдки), поза тяжёлоатлета (в состоянии вызвать изменение реализованного потенциала силы). На основе этого анализа автор делает целый ряд интересных выводов.

«ТАЙМИНГ» (TIMING – ВЫБОР ПОДХОДЯЩЕГО МОМЕНТА) БЕЛКА ДЛЯ СПОРТСМЕНОВ СИЛОВЫХ/ МОЩНОСТНЫХ ВИДОВ СПОРТА

Jay R. Hoffman

Один из пролезных результатов потребления белка после интенсивной тренировки с сопротивлениями (отягощениями) заключается в способности белка интенсифицировать восстановление и ремоделировать процессы происходящие внутри скелетной ткани. В результате ряда исследований было установлено что в результате потребления белка после упражнений с сопротивлениями наблюдается уменьшение степени повреждения мышц и понижения силы, улушается восстановление. Кроме того когда белок потребляется до и сразу же после тренировки с сопротивлениями наблюдается повышение проявления информационной о матричной РНК (m РНК). Предполагается что это ускоряет мышечную адаптацию и улучшает восстановление мышц после тренировочных занятий. Таким образом можно предположить что «тайминг» (timing) приёма белка приобретает всё большее значение в стимулировании мышечной адаптации вызванной использованием программ тренировки с сопротивлениями. В статье основное внимание уделяется острым эффектам «тайминга» протеинов и потенциальным выгодам вызванным хроническим воздействием приёма белка в моменты близкие к тренировочным занятиям.

ВЛИЯНИЕ МЕНСТРУАЛЬНОГО ЦИКЛА И ЕГО ФАЗ НА РЕЗУЛЬТАТЫ (ПРОИЗВОДИТЕЛЬНОСТЬ) СПОРТСМЕНОК СПЕЦИАЛИЗИРУЮЩИХСЯ В ОЛИМПИЙСКОЙ ТЯЖЁЛОЙ АТЛЕТИКЕ

Antonio Caporale

Автор представляет ряд размышлений о характеристиках женского спорта и в частности видов женской тяжёлой атлетики, потом переходит к анализу особенностей менструального цикла и его различных фаз, возможных связей этих пробламатик с тренировочным процессом и главным образом к анализу предварительного исследования реализованного с группой квалифицированных тяжёлоатлеток в течении длительного периода подготовки в важному соревнованию: исследование проведённое с целью оценки влияния менструального цикла на тренировку и в частности на правильное выполнение подъёмов во время тренировки. В течении предменструальной и менсруальной фазы у спортсменок набдюдалось значительное увеличение так называемых «нулевых» (недействительных) подъёмов. Таким образом автор предлагает ряд размышлений об организации тренировочного процесса принимая во внимание менструальной цикл каждой спортсменки.

СПОРТИВНАЯ ПРОИЗВОДИТЕЛЬНОСТЬ – «MUS», СТРЕССОВОЕ И ХРОНИЧЕСКОЕ ВОСПАЛЕНИЕ НИЗКОГО УРОВНЯ

Dario Boschiero

Автор анализирует понятие «спортивная производительность» связывая это понятие с понятием «психофизическая производительность», как многосторонний феномен вовлекающий переменные различной природы: психологические, физические, умственные, проприоцептивные и автономные, регулируемые так называемой системой стресса. И литературе «стресс» широко описывается как форма адаптации организма (говориться о «синдроме адаптации») к стимулам называемым «крессоры». «Стрессор» может означать, в общем смысле, элемент который в состоянии изменять гомеостатическое состояние организма, может принимать различные формы и быть частью самых различных категорий. Может иметь психосоциальную или же строго физическую природу. Эти различия однако не влекут значительную разницу в механизмах реакции организма. Автор анализирует так же различные аспекты процесса приводящего к стрессу, делая различие между сигнальной фазой, фазой адаптации и фазой истощения. Очень важный аспект который надо держать под контролем во время пробретения необходимой адаптации для достижения результатов заключается в появлении не очень ясной и неспецифичной симптоматике определяемой как MUS (Medically Unexplained Symptoms), речь идёт о целом ряде субклинических нарушений функциональной природы: стойкие усталость и утомление не проходящие после сна, нарушения настроения, постоянно холодные руки и ноги, постоянная бессонница или сонливость, тревога, апатия, изменения аппетита (чрезмерное чувство голода или отсутствие аппетита), кислотность и боли в желудке, чувство переполнения желудка, вздутие живота после еды, тошнота, периоды постоянных запоров, синдром раздражённого кишечника, проблемы потоотделения.

ПРЕДВОСХИЩАТЬ ВРЕМЯ. ОТ ТЕОРИИ ИДЕЙ К ВЫПОЛНЕНИЮ ДВИЖЕНИЙ (ВТОРАЯ ЧАСТЬ)

Alberto Andorlini

Речь идёт о второй части долгого исследования в которой автор представляет новую серию размышлений озаглавленную «Предвосхищать время, о возможности «тренировать движение» и «двигать тренировку», дискуссию вызвавшую большой интерес со стороны многочисленных исследователей и «исполнителей» движения, чьи идеи привлекаются в игру, в краткой, простой, сжатой и легко консультируемой форме, которые в состоянии указать, хотя бы частично, в каком направлении движется мир тренировки. В этой части анализируются следующие темы: функциональная теория мастерски представленная в форме двенадцати пунктов, упражнения, фундаментальные движения, кинетические цепи, трёхмерность, сила в западном мире, сила в восточном мире, гибкость, стабильность, локальная и глобальная системы, классификация упражнений.

СЛОЖНОСТЬ, СПОСОБЫ ИЗУЧЕНИЯ СЛОЖНОСТИ И ИЗВЛЕЧЕНИЯ ИЗ ЭТОГО ПОЛЕЗНОЙ ИНФОРМАЦИИ (ВТОРАЯ ЧАСТЬ)

Luciano Pietronero

Статья представляет собой вторую часть рассуждения о сложности в которой автор, известный физик, представляет свою точку зрения и инновационыый подход к изучению проблемы сложности и её различных проявлений типичных для современного общества в том числе, и не в последнюю очередь, в области спорта. Автор – Luciano Pietronero, профессор теории строения материи Физического факультета Римского университета «La Sapienza». Первая часть была опубликована в SM (ing), n.° 5, год II, сентябрь-декабрь 2016, стр. 72-79.

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