



# **SPORT SCIENCE LAB**

PROPRIETARY EQUIPMENT



[www.sportscielab.com](http://www.sportscielab.com)



## ABOUT SPORT SCIENCE LAB

SSL was established in 1999 by Founder Gavin MacMillan. To date there are multiple international franchises and affiliates. We focus on the conditioning and rehabilitation of various level athletes competing in a variety of sports. Our ultimate goal is to prepare athletes for all demands and adversity the sporting world might pose. SSL's evaluation and training systems are based on current scientific research related to improved performance and injury prevention, thereby striving for success and longevity in the athlete's chosen sport.

## EVOLUTION OF THE SSL PROPRIETARY EQUIPMENT

Conventional weightlifting systems consider strength to be the ability to lift a maximal load in an unlimited amount of time. Squats, deadlifts, cleans etc., which form part of these training systems rarely simulate the angles and velocity of most sporting activities. This type of training system therefore is not a true reflection of athlete's functional strength capacity. Functional strength is a product of muscle action initiated and orchestrated by the nervous system, under specific conditions.

For the majority of sports, it's the ability to produce and control force and power in a very small amount of time. All the different strengths as highlighted by Prof. Verkhoshansky has to be addressed to transfer to sport. In the quest to incorporate all the types of strength into a training system, existing equipment posed many limitations. As a result, SSL designed proprietary equipment which would allow training of athletes in a more functional manner and address all types of strength to a more or lessor extent, depending on the athletes' particular needs

# SPORT SCIENCE LAB STRENGTHWORK EQUIPMENT

## ACCELERATED ISOKINETIC MACHINE



An isokinetic muscle action is one in which the muscle contracts and shortens at a constant rate of speed. While current technology (Cybex/Biodex) allows for the production of forces associated with isokinetic actions, these forces are not produced or measured in functional movement patterns. Also, the majority of sports require athletes to produce forces which allow them to accelerate toward the end of joint range of motion in as little time as possible (i.e. at a great rate of force development). Current technology doesn't allow for this. The resistance/opposing force generated by the ISO's fan blade system constantly matches that of the athlete, but also allows for the athlete to accelerate the velocity at which the force is applied, thereby making this type of training more applicable to sporting activities.

Air (fan blade) as oppose to weight load is used to create resistance and clients can be inverted making training at less than body weight possible. Training on the ISO is therefore safe in the acute/subacute phases of rehab and under guidance of a skilled clinician highly unlikely to aggravate or worsen a client's injury.

For performance, training on the ISO will mainly be aimed at improving rate of force development (RFD), Force, Accelerating strength and/or velocity during the concentric phase of movement. Six intensity settings makes it possible to adjust the momentum/resistance offered by the fan blade.

## THE PLIO

Training on The Plio forms an essential part of the SSL strength and plyometric training regimes. The design allows for both constant and non-constant contact movements as well as upright and inverted (less than body weight) training. Upper and lower body movements that more so resemble cyclic activities (i.e. activities in which the concentric phase is preceded by the eccentric phase) such as running, jumping and throwing can be trained at body weight or a load less or more than body weight. Additionally, the downward motion of the arm accelerates at a 2:1 ratio, thereby eliciting a greater stretch-reflex upon contact during non-constant contact movements. For performance purposes the value and timing of Fmax in a cyclic movement can therefore be manipulated.

For rehabilitation purposes, post injury plyometric type actions can be re-educated at loads less than body weight until the athlete/injured structure is able to tolerate loads closer to body weight before upright (i.e. body weight) training commence.



# SPORT SCIENCE LAB STRENGTHWORK EQUIPMENT

## THE 4-WAY HIP

The muscles of the hips are essential for breaking, stabilizing and propelling athletes' linearly, laterally, vertically and horizontally. Weakness of these muscles have not only been associated with increased risk of knee and other lower limb injuries but also impedes athletic performance. The 4-way hip allows training of the hips in all directions through full range of motion.

While one hip is challenged dynamically, thereby improving force during concentric and eccentric phases of movements, the other is required to provide stability (isometric action) of the pelvis. The adjustable pad height (above or below knee) allows for change of lever length thereby isolating or engaging muscles within the myofascial line to a more or lessor extent.



## AB/OBLIQUE BENCH

During athletic movements, all forces are created or transferred by the proximal part (trunk) of the body. In addition to the Ballwork program, The Ab/Oblique bench is used to dynamically strengthen the muscles of the trunk in all planes of motion at various velocities. Depending on the nature of the athletes' sport and ability, the inclination angle of the bench can be adjusted to a more or lessor vertical angle.



# SPORT SCIENCE LAB STRENGTHWORK EQUIPMENT



## PLIO POWER PRESS

In contact sports such as American football (NFL), rugby or fighting, athletes are required to generate and transfer forces large enough to halt or drive opponents backward. The Plio Push Press is designed to strengthen the relevant muscle chains and reinforce movement patterns at which these optimal forces are transferred. A range of exercises isolating or engaging various muscles of the lower and upper limbs in these movement patterns are possible.

## TRANSVERSE PLIO

Various sports require rotational strength in the transverse plane. For both injury prevention and performance purposes, torque should be produced by proximal muscles of the trunk and transferred via the limbs to for e.g. propel the body forward (during running/walking), execute a forceful punch during boxing and efficient paddling during kayaking. Additionally, linear pull strength (e.g. pull during scrummaging/contact) of the upper limbs and change of direction technique can be trained/enforced.



## GLUT/HAM MACHINE

During the most basic athletic movements (running and jumping) it is essential that the hamstrings, gluts and lower back muscles (i.e. the posterior chain) work in a sequential, coordinated manner. Exercises done on the Glut/Ham focus on training the posterior muscle chain, while ballistic upper body exercises are often also incorporated.

# SPORT SCIENCE LAB STRENGTHWORK EQUIPMENT

## PILATES REFORMER



The Pilates reformer is mostly used to train strength and flexibility of the muscles of the hip, but not in the conventional "pilates" manner. Constant and non-constant contact, upright linear and lateral movements are incorporated in training programs as well as rotational strength of the internal and external rotators of the hip. In the acute and sub-acute phases of rehabilitation, athletes can also be inverted to train force and power plyometrically at less than body weight.

# SPORT SCIENCE LAB FLEXIBILITY EQUIPMENT

## LIGHT STRETCH BAND



Contrary to many conventional training and rehabilitation regimes, SSL doesn't use elastic bands for strengthening but merely to improve flexibility by means of resisted stretching. Considering the force- and velocity-time curves of concentric athletic movements, concentric movements done with an elastic band, yields curves with the exact opposite shape and values over time. Where velocity/acceleration increases toward the end range of movement (ROM) when for example throwing a ball, the velocity/acceleration of concentric movements done against elastic band resistance decreases at the end ROM where resistance is highest.

## HEAVY STRETCH BAND



Considering extensive research regarding stretching, static stretching has been found to have little to no long term effects on joint ROM. SSL therefore only use dynamic (as with the ballistic ball program), resistive and neurodynamic methods to improve athletes' flexibility. Resistive stretching works on the physiological principle of reciprocal inhibition i.e. maximal contraction of the agonist leads to maximal relaxation of the antagonist, thereby increasing ROM limited by increase tension of myofascial structures.

# SPORT SCIENCE LAB PLYOMETRIC EQUIPMENT

## JUMP ROPE

In addition to emphasizing plyometric movement from the forefoot in various directions, jump rope drills trains hand-and foot-eye coordination as well as timing and rhythm. Depending on the speed at which the drills are executed, all aspects of cardiovascular conditioning can be addressed.



## HEAVY ROPE

Training with the heavy rope is a progression of jump rope training and not only used to train plyometrics of the lower limb but also to challenge the aerobic and anaerobic cardiovascular systems. Additionally, athletes' upper body strength endurance, rhythm, timing and coordination can be developed.



## STEEL PLYOMETRIC BOX SET

Jumps from different heights develop athletes' power and plyometric ability and challenge components of the the neuromuscular system to different extents. While depth jumps from heights lower than 1 meter improves explosive ability by shock method, depth jumps from 1m or higher improves force. Different types of jumps to challenge concentric power is done from floor to box. These jumps includes bleacher-, rebound- and step-up jumps and can be done in a cyclic or acyclic manner depending on the training goal. Box heights: 12", 18", 24" 30", 36", 42"



## FOAM HURDLES

Foam hurdle jumps challenges athletes' vertical but also horizontal displacement ability. The foam hurdle height is 30", with 2" and 4" pads which can be added to further increase hurdle to any desired height. Linear, lateral, side-to-side counter-movement and combination jumps are some of the jumps that can be included in athletes programs depending on the sports demands.

# SPORT SCIENCE LAB BALLWORK EQUIPMENT

## BALLISTIC TRAINING BELLS



The training bells are used for various upper body exercises and are an essential part of the SSL upper body ballistic ball program. They can be filled with sand or water to increase or decrease the weight. When moved, the design thereof results in constant shifting of the sand/water thereby challenging athletes' proprioception of the upper limb and trunk. Additionally, shifting of the water to the outer part of the training bell, results in additional acceleration (and in turn force) of movement at the end of range, thereby eliciting a greater stretch-reflex at eccentric-concentric switch over.



## ANTI-BURST SWISS BALL

The notion of promoting core stability by static isometric type movements such as planks or side-planks is contrary to the role of the proximal muscles of the trunk during fast functional athletic movements. Gracovetsky's "Spinal Engine" concept explains the dynamic role of the proximal muscles of the trunk and how forces generated by the spine is transferred via the limbs.

The Anti-burst ball is therefore used during the ballistic ball program to challenge proprioception of various joints but especially the trunk.



# SPORT SCIENCE LAB FOOTWORK EQUIPMENT



## SLANT BOARD

Strengthening the feet in all directions enables the athlete to push-off more forcefully during running, jumping, lateral movement and quick change of direction. Additionally, balance and proprioception is also challenged. Basic and advanced slant boards available for progression.



## DISCS

Wobble boards and bosu balls are often used in conventional training systems to improve athletes' balance and proprioception. However, the feet function independently during for e.g. running and it is therefore more appropriate to also train strength, flexibility, balance and proprioception individually. Training on the basic discs can be progressed to training on the advanced discs. Exercises on the discs also facilitated mobilization and strengthening of the hips.



## PIPES

Exercises on the pipes challenge the muscles and joints of the ankles and feet in all ranges and planes of motion. Additionally, mobility of the plantar fascia is promoted. Exercises included in the pipe program also aim to mobilize, stretch and strengthen the calf and hips.



## NECKER

The Necker is used for activation of the posterior myofascial chain as well as strengthening of the neck. Footwork exercises on the slant board can be advanced by adding the necker to the training regime. By activating the posterior muscles of the neck, the associated muscles of the posterior line are also engaged to maintain balance. Athletes who participate in sports such as boxing, rugby, NFL, triathlon (aero position in tri-bars during cycling) and wrestling etc. that requires isolated strengthening of the neck also greatly benefit from training with the necker.

# SPORT SCIENCE LAB FOOTWORK EQUIPMENT



## POLES

The poles are used to assist with athletes' balance when doing the disc and pipe exercises.



## FOOTWORK COMBO

The footwork combo includes a slant board, set of pipes, set of poles, a set of discs and footwork training manual.



## FOOTWORK/BALLWORK COMBO

The footwork/ballwork combo includes a slant board, set of pipes, set of poles, set of discs, 75cm anti-burst Gymnic ball, set of ballistic training bells as well as footwork and ballwork training manuals.



## FOOTWORK/BALLWORK/FLEXIBILITY COMBO

The footwork/ballwork combo includes, one light stretch band, one heavy stretch band, a slant board, set of pipes, set of poles, set of discs, 75cm anti-burst Gymnic ball, set of ballistic training bells as well as footwork and ballwork training manuals.

# LIMITATIONS OF CURRENT STRENGTH MEASURING EQUIPMENT

Throughout the rehabilitation and conditioning process, athletes have to be monitored periodically to ensure the prescribed program achieved the set goals for the specific rehab/conditioning phase. Limited evidence exists to support the use of currently available equipment to objectively assess athletes' readiness to participate in planned training sessions i.e. assess the extent to which athletes' have recovered prior to a new training session as well as ultimately returning to play post-injury. Isokinetic strength tests as measured by the Cybex/Biodex machines are the most commonly used test and the results of these tests often considered in conventional rehab settings when clearing athletes for return to play. Limitations of this type of testing include:

- Single joint actions are tested in non-functional movement patterns
- Isokinetic testing can only test torque up to 300 degrees/sec, while the majority of dynamic sports require torque far exceeding 300 degrees/sec.
- During isokinetic testing velocity is the limiting factor (i.e. the speed at which the movement is tested is set and remains constant, The majority of sports requires athletes to accelerate or decelerate. The speed at which the previously injured structure is tested is therefore not at the velocity at which the structure will be required to function upon return to sport.

## SSL PROPRIETARY STRENGTH MONITORING EQUIPMENT (COMING SOON)

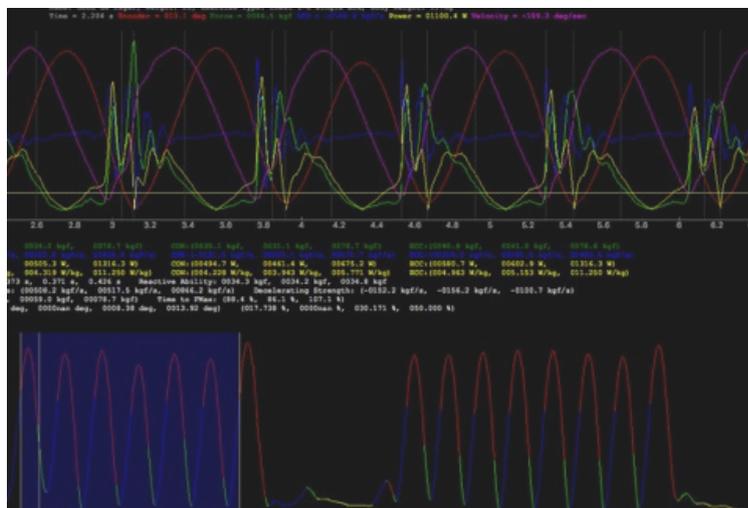
Considering the limitations of current "strength measuring equipment, SSL together with PVM Nutritional Sciences is in the process of developing equipment and software which enables us to measure and analyze the following parameters during the performance of cyclic movement which are ballistic in nature (thereby making the specific test more closely related to functional athletic movements):

- Force
- Power
- Explosiveness
- Rate of force development
- Reactive ability
- Velocity
- Accelerating and decelerating strength

All of these parameters are measured for the complete-, eccentric- and concentric phases of cyclic movements. The above variables relevant to isometric muscle actions are also possible. All data is stored in a "cloud, making periodic comparisons as well as comparisons to other athletes possible.

The advantages of assessing and training athletes on the SSL equipment include the following:

- Testing and training of multi-joint functional movements.
- Both cyclic and acyclic movements can be objectively and accurately tested and trained accordingly.
- Side-to-side comparisons of different strength parameters (for screening and return-to-play purposes).
- User friendly, day-to-day comparisons (for the assessment of the extent of recovery prior to training).



# CONTACT US

## Sport Science Lab

80 Technology Drive, Irvine, California



@sportsciencelab



@Sportsciencelab

[www.sportsciencelab.com](http://www.sportsciencelab.com)

**Gavin MacMillan**

Founder and CEO

+1 949 842 0685/ssltraining@gmail.com

**IF YOU WANT TO BE GREAT, THERE IS ONE RULE  
DON'T DO WHAT EVERYONE ELSE DOES!**

