**Complementary or Supplementary Forms of Training.**

Steve Cram is on record as saying “In order to become a great runner, all you need to do is lots of running”. Now, it would be a brave man (or a foolish one?) who would attempt to argue with The Jarrow Arrow when you consider that he ran three World records in the space of 19 days in 1985. First man under 3:30 (3:29.67) for 1500m., he went on to break the world record for the mile (3:46.32 ) and 2000m. ( 4:51.39 ). He also ran 800m.in 1:42.88, 1000m.in 2:12.88 and 5000 in 13:28.58. We would have to agree that this guy was good and should know what he was talking about!

Cram, however, was blessed with great natural strength: standing 6’ 1” tall (1.854 m.) and weighing 10 stone 12 lbs. (69 Kg.) he was a big man, blessed with innate athletic ability. Perhaps he was one of the lucky ones: a man so naturally strong that he didn’t need weight training, circuits, plyometrics or core work. Arthur Lydiard,too, had no time for weight training. “I never saw an athlete run on his arms” was his curt response to a person who suggested that runners should lift weights. *(But as I said before : while an athlete does not run ON his arms , he certainly does run WITH his arms. )* I remember once asking Seamus Power if he did any circuits or weight training. He just grinned and said “I’m a farmer: I get enough strength training simply by doing my farm work”. Seamus was strong enough to win 10 national senior cross-country titles, so I think he had a point. And perhaps this goes to the core (pun intended) of why strength and conditioning work has become so necessary for today’s generation of Irish athletes. Most young athletes nowadays do not have to do much, if any, hard physical work in their youth. Unlike Irish athletes of previous generations, they do not have to walk or cycle to school, they do not have to do hard physical work on farms or building sites, they do not have to chop trees for firewood or cut and save turf (peat) for Winter warmth. In short, mechanisation and technology have, thankfully, eliminated drudgery from our lives but, in so doing, may have produced a generation which is less physically strong than previous ones. We often hear that the Kenyan lifestyle, particularly the lifestyle of Kenyan children, is one of the main contributory factors to the development of their great distance runners. Many Irish athletes who have travelled to Kenya have said that the lifestyle there is similar to the Irish way of life in the 1950s which they have heard about from their grandparents.

Most coaches now agree that strength and conditioning are a necessary part of every athlete’s training programme. And indeed as far back as the 1960s, coaches like Percy Cerutty firmly believed in weight training for his runners while one of the all-time greats, Ron Clarke, said “You can never be too strong around the middle”. But I worry when I see middle and long distance runners apparently putting core work, sprint drills, hurdle hops, depth jumps, etc. ahead of actually running as the basis of their training. As Killian Lonergan said recently “Many runners have become preoccupied with the ‘one percenters’ while not paying enough attention to the ninety-nine percenters”. And very well put too! So, if you are a typical amateur athlete, working full time with a limited time for training, you would be well advised to put the emphasis on actual running itself and only incorporate other forms of training into your programme if you have the time and energy to do so. Joe Doonan was a great believer in plyometrics and incorporated it into Catherina McKiernan’s training programme, but Catherina also regularly logged up 100+ miles per week. Alberto Salazar is adamant that strength training is necessary “to make it to the next level”. Mo Farah lifts weights and does other forms of strength and conditioning work 3-4 times per week - but he also runs up to 145 miles per week. And remember: he IS **a full time athlete.**

Personally, I believe that plyometrics, weights, drills, circuits, etc. do have an integral place in the training schedules of distance runners but I also contend that they are **complementary or supplementary forms of training** and are NEVER an alternative to the basic diet of pretty high mileage. Even Peter Coe, who was a very strong advocate of weight training (especially for 800m. runners) also believed in lots of actual running. After outlining a very comprehensive conditioning programme of weights, plyos., circuits, etc., he re-affirms: “Remember that these are **merely an aid** **to running; they are not a substitute for it and must not be overdone**. Thus during any week of training, running will always occupy the majority of the total training effort.”*( cf. Better Training for Distance Runners )* .In an earlier article I referred to what Seb Coe called the “ Sunday slog”: this was a unique form of fartlek which he and some team mates did regularly during the conditioning phase ( involving leap frog , partner-carrying on his shoulders , doing “chinnies” from tree branches ,etc.) which lasted up to **three**  hours. So, having established that the basic running training must never be neglected, let us now look at the various forms of supplementary training:

**Weight training :** Free weights and the use of one’s own body are particularly effective at improving strength andpower while at the same time integrating balance and coordination of many major muscle groups in a manner that closely matches the neuromuscular patterns utilised in various skills, especially the ability to accelerate. It is generally agreed that young athletes up to the age of 15 (at least), who engage in strength and conditioning programmes, should not use anything other than their own bodies in exercises such as press ups, sit-ups, “chinnies”, pull-ups, dips, etc. At this stage they should also learn good lifting and breathing technique using nothing more than the bar or a broom handle. Both eccentric and concentric tension should be developed rather than developing either one alone. They should also remember that the purpose of weight training is NOT about increasing muscle tissue and bulk and it most certainly NOT about how big your chest or arms are. It is not about hypertrophy. It is not about looking “toned” or “ripped”; it is simply about developing increased strength and muscular power in order to enable you to run and accelerate faster. Strength training should be incorporated ( gradually ) into your training regime but no more than three times per week . So, when should you lift? Even Salazar, with his group of elite, full-time athletes, admits that “this is a hard one “.His runners usually lift on medium hard days or the day before a really hard day .They will not lift if their last previous running session was very hard or if it was a really long run . What equipment do you need? With free weights, only a very sophisticated lifter (who is not a runner ) will need any more than a bench and a rack on which to position the weights . These can be purchased (or built\*) for fairly little expense and permits training in the privacy of one’s garage - or basement if you have one. This also avoids the very expensive gym fees being currently charged. *\* Remember the home made weights used by the Kenyans as evidenced by Adharanand Finn in his* *book* ***“ Running with the Kenyans”*** *referred to in an earlier article .* Of course, an athlete should only commence a weights training programme under the supervision of an experienced coach as lifting incorrectly can cause more harm than good and can, indeed, lead to serious injury. Even when the athlete becomes quite experienced, he should still lift only when he has a helper (or “spotter”) present to ensure that he has assistance in case of getting into difficulty. In this regard, machines with stacks of weights are probably safer than free weights because the weights slide up and down on metal bars supported indirectly by the lifter, via cables or chains. But these machines are very expensive to buy and, as stated earlier, gym fees are not cheap. Most machines are designed so that developing each major muscle group requires a separate machine. Therefore,one must ensure that for any agonist muscle group being trained, the appropriate machine is available for training the antagonist group. Furthermore, as many of these machines dampen acceleration to ensure a slower speed for optimal strength development, the movement patterns have little direct transfer to sport skills. These machines are tools to develop comprehensive fitness rather than tools for specific skill development. Identification of progress comes objectively by such measurements as the maximum manageable weight for one rep., the number of reps. and sets that can be managed and subjective assessment of the effort required. Caution is necessary to ensure that for any agonist muscle being trained, the antagonistic group must also be trained (muscles often occur in pairs, called antagonistic pairs . As one muscle contracts the other relaxes. e.g. biceps and triceps). Before lifting, a thorough warm up is essential . Static stretching and self-myofascial release (rolling) therapy using a foam roller to ease out any knots deep within the muscle tissue improve flexibility and reduces the risk of injury . Stretching also increases blood supply to the joints and helps to keep muscles strong and pliable. When lifting , athletes should know which muscle group is being developed and why .A basic knowledge of human anatomy is very useful if not essential. Schedule no more than 5 to 8 exercises if you are a beginner ( this can be increased gradually from 8 to 12) and ensure through variety that all major muscle groups are exercised. Each exercise should take only about 30 seconds and the circuit of reps. should be completed in about 15 minutes. Good technique should be emphasised; one should not rush through each exercise.

Here are some basic rules to apply to weight training : 1. Train regularly . 2. Train the muscle groups most in need of conditioning and that are of greatest benefit to running. *( Be specific ! ).* 3.Ensure balance by training antagonists as well as agonists e.g. hamstrings as well as quadriceps, biceps as well as triceps. 4. Provide a **progressive** overload stimulus. 5. Work the muscles through their full range of movement. 6. Allow adequate time between training sessions for recovery and physiological adaptation to occur.

Traditionally, it has always been believed that distance runners should use light weights and high reps. Some doubt is now being cast on this. Salazar, for instance, believes that light weights and high reps. provide little or no stimulus for further growth. Coe also believed in relatively heavy weights, especially for 800m. runners. Each individual athlete should, of course, be guided by his coach and by how he is responding to the stimulus of various types of lifts instead of trying to copy the programme of world class runners. We should remember, however, that whereas **strength is increased by emphasising higher-intensity work with fewer reps.**  and **endurance is best improved by emphasising many reps. of a submaximal stimulus, *stamina bridges the gap between the two.*** Stamina represents a high level of strength sustainable for a considerable number of reps. An experienced coach will know how ( which exercises )and when( during the training year ) the athlete’s focus needs directing toward strength, or stamina or endurance. Although strength and stamina are usually stimulated in separate sessions, it is possible to incorporate both into single training sessions. This is done by decreasing the number of reps. per set while increasing the amount of weight lifted per rep. For example, Seb. Coe often did six sets of half-squats; the number of reps. per set was 15,15,15,10,10,5 with the weight increasing by 10 lb. (4.54 Kg.) per set. On a day when he did an intense weights session, he only did an easy run and an easy run the next day also. This developed enormous muscle stamina and greater resistance to injury.

Generally, when lifting, one should proceed from upper body to lower body . A typical example would be as follows: 1. Barbell curls. 2. Bent-arm pullovers. 3. Barbell bench press. 4. Barbell half-squats. 5. Vertical rowing . 6. Barbell step-ups. It is necessary to state some basic safety rules for weight lifting : First , sturdy shoes that give lift and support to the heels and arches are essential. Trainers are fine but racing flats should never be used. Second, when the vertebral column is stressed, as with squat exercises, a well-fitting waist belt is recommended. Third, and possibly most important, a proper breathing pattern is an essential part of effective weight training. The athlete should exhale on the way out, down or up (i.e. during the action phase) and inhale on return i.e. the recovery phase. Improper breathing patterns can reduce venous return to the heart thereby decreasing cardiac output. This could lead to the athlete fainting. There are many other exercises an athlete can perform with weights. As this is **a** general outline of weight training ,I do not propose to give specific advice as to which exercises should be done : that is a matter for each individual athlete and his coach. **The type and number should be event specific**; therefore a weights programme for a marathon runner will be significantly different to a programme for an 800m.specialist. I will simply give a list of the different types of lift which may be included. (in addition to those above ) . 1. Barbell squats: Targets : thighs, glutes ,core. *Benefits : increases power in the thighs.* 2. Barbell squat snatch. Targets : deltoids, thighs, glutes, upper back, core, triceps, hamstrings. *Benefits : increases power ( and mass ) in the shoulders and thighs.* 3. Barbell deadlift : Targets : erector spinae; quads, glutes, hamstrings, core, forearms, biceps. *Benefits :Increases power in the torso.* 4. Bench press: Targets : pectorals, anterior deltoids, triceps, abdominals, upper back. *Benefits: increases power and mass in the chest :* 5 . Barbell power clean . Targets : Deltoids, upper back, thighs, glutes, hamstrings, core. *Benefits :increases power in the shoulders and upper back.* 6 . Barbell power clean and jerk: Targets: deltoids, upper back, triceps, thighs, glutes, hamstrings, core. *Benefits: increases power and mass in the shoulders and upper back.* 7.Standing barbell press : Targets : deltoids , triceps, upper back, core. *Benefits : Increased power in the shoulders and upper arms.* 8. Barbell shoulder shrug : Targets : trapezius , neck, upper back, forearms, core. *Benefits : increases power and mass in the trapezius muscles.* 9.Barbell upright rows : Targets : front deltoids, trapezius, upper back, forearms, biceps, core. *Benefits: increased power and mass in the trapezius muscles.* 10. Dumbell pullover. Targets : serratus ,latissimus dorsi, pectorals, triceps, core. *Benefits : increases both mass and range of motion in the latissimus dorsi.* 11. Wide-grip high pull: Targets : legs, upper back, forearms, core. *Benefits : increases both strength and mass in the upper body and thigh.* 12. Alternating kettlebell row. Targets : middle back, biceps, latissimus dorsi. *Benefits : builds strength in the lower back.*

If you are completely new to lifting , here are a few more pointers to help you get started : \* Stay hydrated ; remember again that muscles are 75% water so drink lots of water before and after your workout. \* If you’re lifting in a gym, bring two towels: one for your shower and one for sweat soaked equipment. You should wipe your sweat off the bench between sets. \* Be prepared to spot for others. But make sure to ask the person who is lifting what exactly he wants you to do. \* As a beginner, never use a weight so heavy that you need momentum to lift it. A simple gauge: you should be able to pause for at least one second before lifting a weight. \* Stand up straight. Check your posture. The correct starting position for most exercises is shoulders back, chest out, standing (or sitting) tall with your abs. tight. Good posture generally ensures good form. \*Finally, put the weights back on the rack or stand; don’t leave them lying on the gym floor. It betrays a lack of courtesy to other users to leave the weights lying around.

It is obvious that during running much more is occurring than simply the activation of the primemovers. Many other muscles are utilised with different attachment points on several involved joints. All of these must be strengthened if they are to do their job of permitting distance runners to meet their competitive needs. These needs can vary from great strength or enormous quickness in short, fast races to prolonged performance at submaximal workloads in long distance races. Though running itself provides the most specific development stimulus to the prime movers, conditioning programmes should include exercises that effectively improve the performance abilities of these accessory muscles in assisting the prime movers. Weight training can (and will, if done properly) develop balance and coordination of many major muscle groups thereby providing a total conditioning effect.

**Plyometrics .**

Plyometrics, or “jump training” are exercises in which muscles exert maximum force in short intervals of time with the goal of increasing power or speed-strength. Some people simply call them “plyos” or bounding exercises. Sport scientists define a plyometric exercise as a quick, powerful movement that starts with an eccentric (muscle lengthening) action and is immediately followed by a concentric ( muscle -shortening ) exercise. They are intended to provide runners with an explosive component in their leg and hip extensors that can be beneficial for specific aspects of racing.

It was Fred Wilt ,the former US Olympic long distance runner, who coined the term plyometrics. He came up with this name after watching Russian athletes performing jumps in their warm up prior to a competition. The American were using only static stretching exercises but Wilt came to the conclusion that the “plyometrics” were just one of the reasons why the Russians were so successful at that time. (This has led to what we now call “dynamic stretching”). Wilt learned of the work being done by Michael Yessis in this area of Russian training methods and teamed up with him to learn and disseminate information on plyometrics. The man who is credited with inventing this form of training is another Russian , Yuri Verkhoshansky, who called it “the shock method”. Depth jumps were the key exercise in this shock method but nowadays any form of jump training is referred to as plyometrics. *( Wilt is the author of such classic training manuals as “How They Train” and “Run ,Run, Run”. He* *represented the USA in the 10,000m. in both the 1948 and 1952 Olympics )*

\*Because of their intensity and ballistic nature, plyometrics should always be preceded by a thorough warm-up and stretching exercises. \* Plyometrics should not be done after serious weight training or fast running sessions, but rather should be scheduled as a first item on a training agenda, when muscles and joints are fresh. \* Because these exercises have a large anaerobic component and require good technique and considerable concentration, nearly complete recovery should occur between sets.

\* Use of a weighted vest should only be considered after considerable proficiency has been developed using normal body weight. \* Anaerobic running sessions should NOT be scheduled for the day following a quality plyometric session; one day of easy running is needed to ensure recovery. **\* Athletes should always use soft, resilient surfaces such as firm grass or suitable gym mats, along** **with shoes that provide plenty of support.** (*It is best not to use a track -especially a hard Mondo one ! ).* \* Plyometrics should be introduced only after a substantial base of strengthening and conditioning. Not all distance runners should attempt this form of training e.g. runners with a history of injuries should give them a wide berth. Distance runners should not consider that plyometrics are crucial or essential. Many fine runners, including Olympic champions and World record holders have never used plyometrics ! For sprinters and jumpers ,however, plyos., in their many varied forms, are an integral part of their training. ( basketballers ,footballers, tennis, squash, and volleyball players all use plyos. )

**The Theory behind Plyometric Training :** Bounding and jumping exercises involve isotonic tension generation but do so in a unique manner. As a jumper strikes the ground after having been in midair, an initial brief period of eccentric tension occurs as the landing leg absorbs the impact effects of body weight and gravity by momentarily flexing at the knee. Forward momentum as well as body weight contribute to this eccentric tension. A split second later this is followed by concentric tension generation. During concentric tension, forward and upward motion then occurs. Every impact of feet striking the ground is accompanied by this eccentric-concentric tension-generation; bounding and jumping simply exaggerate it. Yuri Verkhoshankiy referred to this type of training as “shockloading” or “bounce-loading” exercises. According to Verkhoshankiy and Matveyev ( in 1981 ) these exercises augment or increase concentric power output . In other words, they activate the quick response and elastic properties of the major muscles in the body.

**Some of the exercises used are :** \* Squat jumps: squat down, then jump up as high as possible with extended, vertical legs. \* Lateral jumps: from a standing position, jump from side to side. \* Alternate leg bounding: run with long stride, **placing emphasis on hang time.** \* Box jumps: jump onto and off a sturdy box 18’’( 46 cm.) or higher. \*Vertical depth jumps: starting from the top of a box, jump down and back up as fast as possible. Quickest ground reaction time is the key. \*Power skipping or Skipping for height: on each skip, lift the upper leg as high and as aggressively as possible. Make the arm action very aggressive as well. This will increase hip extension and flexion strength. It can improve leg power and stride length. This can help to develop a kick. \* Skipping for distance: Skip, driving the knee upward and forward as aggressively as possible. Make the arm action aggressive also. This increases hip power and stride length. \* Split-Squat Jumps: Start in a lunge position. Jump straight up into the air and return to the original position. Repeat without pausing. The knee closest to the ground should never touch the ground. Repeat for the other leg. Again, this increases hip power and stride length. \* Bounding: Run, but drive the free knee so that the thigh reaches a parallel position with the ground and jump a little on each step. This should look like a bouncy run with longer than normal strides. This will increase hip extension and flexion strength as well as ankle muscle stiffness. It will improve leg power and enhance stride length. \* Single leg bounds: Get a slow running start and start hopping on a single leg. ( You can measure improvement by checking the distance covered in a given number of hops.) Again, the positive effects are to increase hip extension and enhance stride length.

Both weight training and plyometrics can improve running economy **by making the mechanics of the athlete’s body stronger and more efficient.** The muscles and tendons dictate the anatomical position of the body during running. *(The other factors which affect running economy are (a) metabolic and (b) neural : (a) metabolic, i.e. using the aerobic system to metabolise glycogen and fats efficiently and (b) neural ,i.e. the ability to recruit muscle fibres which are necessary to maintain pace )* **Running with good mechanics transfers most of your effort into forward motion.**  A strong chassis is the key to a Formula 1 car’s performance ( as well, obviously, as a powerful engine ). If the chassis was not strong , the body of the car would flex on its frame and wobble on its misaligned wheels. Running with a “wobbly axle” i.e. weak hips and a sagging frame ( weak core ) wastes forward motion and energy is lost in excess body movement. Weight training develops strong and efficient form and helps to prevent injury. It makes the entire “support system” ( ligaments ,tendons, cartilage ) more durable. Improved biomechanics can eliminate such problems as misaligned gait and excessive lower limb rotation. Incidentally, Peter Coe indirectly responded to Steve Cram’s comment that “all you need to do in order to be a great runner is lots of running ”. In his book**, Better Training for Distance Runners**, Coe published a photo of the finish of the 1986 European 800m. Championships . The photo clearly illustrates excessive lower-limb rotation in Cram. Coe analyses this with all the expertise of his meticulous engineer’s eye : *“ The left foot of Cram is markedly everted ( turned out ), as well as his left knee ,giving that leg a reduced forward force vector as it generates propulsive thrust. An excessive amount of his propulsive energy is being absorbed by his knee and ankle joints in resisting the torsional stresses generated by his everted foot plant. This style of foot plant not only increases the risk of lower-limb injuries, but also reduces his stride length by more than 1 cm. At his race pace and stride length, Cram was losing a little more than 50 cm .for every 100m. of distance covered. At this level of competition, this is an enormous disadvantage to overcome .This is an excellent example in which an athlete’s potential performance might be enhanced by professional orthopaedic/podiatric evaluation with a view toward* ***developing an ongoing programme of corrective exercises to either improve foot plant or******strengthen the musculature that is being unduly stressed****. It may also be of interest that Cram was bothered by lower-limb running injuries, particularly to his calf muscles.”* For the record, Cram was 3rd.in that race behind Tom McKean (2nd.) and , wouldn’t you know , Seb Coe (1st.) . In the photo the latter exhibits **optimal foot orientation parallel to the path of movement.**

**Circuit Training :**

In 1957, at the University of Leeds, two sport scientists, Morgan and Adamson, developed a programme for building a reasonably high level of fitness for the general populace who wished to be basically fit without pursuing a high level of competitive type training involved in weight lifting, body building and other formally organised sports. It involved a series of exercises designed and sequenced in such a manner that, if performed one after the other, a combination of strength, power, stamina, agility, flexibility and cardio-vascular conditioning could be stimulated. Some circuits consist solely of calisthenic exercises done against body weight that require no special equipment. George Gandy, of Loughborough University, devised a plan in the mid-1970s, that involved such varied exercises as a rope climb, depth jumps onto and off a box, dips, burpees (also called squat-jumps), leg raises, inclined push-ups (press-ups ), and step-ups onto a bench . This circuit merged plyometrics, strength training, flexibility, and cardiovascular development into a single programme. ( Gandy 1983 ).

The following is a programme which a number of athletes found useful; they are structured in such a way as to alternately develop arms, abdominals, and legs : \* Press-ups. \* Bent-knee sit-ups. \* Step-ups on bench. \* Pull-ups ( “chinnies” ). \* Balancing on tummy. \*Half-squats. \* Medicine ball throw. ( soccer throw ) \*Medicine ball-throw ( sit up and throw ). \*Hurdle hopping. \*Press-ups with feet on a bench. \* Turkish Get-Up ( using a kettlebell ) \* Star Jumps ( or Burpees ) ( *Incidentally, pull-ups were the only form of “core” work that Steve Prefontaine ever did ! And for those who don’t know what a Turkish Get-Up is well, here it is: you lie flat on your back ,holding a kettlebell above your head .Then keeping that arm perfectly outstretched , you stand up. Return to starting position and do it again.)*

Here is a programme which can be done at home as it requires no specialised equipment. It is ideal for athletes who don’t have a lot of time at their disposal. It was developed by a renowned Strength and Conditioning coach and kindly passed on to me by Michael Mac Diarmada :

**1.Upper Body : \*** Wide grip pull-ups and ,with feet raised, Wide-Grip Push-ups. \*Chin-ups & Diamond Push-ups. \*Pull-ups and Reverse Triceps push-ups on stairs (diamond hand pose). \* Close grip pull-ups and Triceps push-ups. 2.**Legs :** \* Sissy squats ( Use book edge or a 30 degree wedge ,forward on toes ,don’t let knees touch the ground ) & Split Squats ( back leg raised ). \* Squats ( arms out 90 degree angle for balance ) and Calf Raises ( fast ! ).

**3.Core :** \* Sit-ups: arms crossed on shoulders, grab knees, release, arch back so that lumbar is straightened and fall back. \* Leg raises: palms face down beneath sacrum, chin into chest to prevent hernia and raise legs.

**Sprint Drills :**

While sprint drills could not be strictly considered as “training” for distance runners, nevertheless these drills can improve a runner’s form and should be incorporated into the programme if time permits. Many of them can also be incorporated into a dynamic warm-up. (Some of them may be too tiring before a running session, so consult your coach before attempting them. Many of them are also plyometric in nature so can be incorporated into a plyo workout.) :

1.Schoolyard skipping. Simply skip like a young school child. 2. Bunny hops : With feet shoulder width apart, squat down and bring arms back .Drive your arms forward and jump ahead as far as you can .Land and repeat the jump . 3. Butt Kicks: these can warm up the hamstrings. They are also good for flexibility and range of motion in the quads. 4.High Knee Lift/Skip: these are good for flexibility and range of motion in the hamstrings . 5.Quick Feet Ladder Drill. ( There are several different ladder drills that can be done ). 6.”The Majorette” : this is just an elongated skip. 7.Straight Leg Running 8.Ankle bounce 9. Long Skipping N.B. Spring twice off the same foot 10.Flat-footed marching 11. Flat foot Shuffle 12. Carioca . Moving laterally while swivelling your hips and swinging your arms across your body. 13.Skip Kicks ( “Kick the Door Down” ) i.e. Skip and kick, skip and kick …… 14.Bounding over hurdles. 15. Lie flat and, on a whistle command, spring up and sprint flat out for 30-50m. *N.B. Athletes need to have those drills and plyometric exercises demonstrated to them by an experienced practitioner. First attempts will probably be awkward (and at times hilarious to behold!). They need lots of practice to get them right and it’s only by doing them right that the benefits can accrue.*

**Core Exercises :** Core work has become very popular in recent years . Many of the weight lifts described above will strengthen the core. Here are a number of further exercises, some of which may require a medicine ball or a Swiss ball. \* Spiderman Crawl (also known as “Spiderman Plank” or ”Spiderman Mountain Climber”) : This is a great exercise for developing stability and core strength. It also strengthens your back. It enhances hip mobility and stretches your entire leg from quads to hamstrings to hips. You get into a push-up start position; then bring your right knee up to your right elbow by bending your knee. Extend your left arm forward and keep your left leg straight. “Crawl” forward, bringing your left knee up to your right elbow , moving your right arm forward and extending your right knee. Repeat 8-10 times. \* Plank : position yourself on all fours .Plant your forearms on the floor parallel to each other,then raise your knees off the floor and lengthen your legs until they are in line with your arms. Hold this position for 30 seconds. This strengthens your rectus abdominis and erector spinae. \* Side Plank : Lie on your right side with your legs extended , one on top of the other. Your right arm should be bent at a 90-degree angle, with your fingers facing forward. Rest your left arm along your left hip. Pushing through your right forearm, raise your hips off the ground until your body is one straight line. Hold for 30 seconds, then switch to your left side and repeat. Great for transversus abs. \*Medicine Ball Pike-Up: Begin in a standard push-up position with your hands shoulder-width apart and your toes planted on a medicine ball. Raise your hips to the ceiling, rolling the medicine ball towards your hand as you do so. Reverse the movement, lowering yourself back down to the starting position. Complete 15 reps. Develops the rectus and transversus abdominis. \*T-Stabilisation: Start in the finished push-up position with your arms extended to full lockout and your palms facing forwards, supporting yourself on your toes. While keeping your body in one straight line, turn your left hip skywards, allowing your left foot to rest on your right. Raise your left arm laterally across your body until it pints to the ceiling. Hold for 30 seconds, return to the starting position and repeat with the other side. Strengthens the rectus abdominis, the transversus abdominis, the iliopsoas and the iliacus. \* Swiss Ball Jack-knife: Start on all fours, with your hands shoulder width apart . Raise your left leg and place it on top of the Swiss ball; then do the same with the right leg so that you are in a push-up position with your shins resting on the Swiss ball. Bend your knees ,rolling the ball in towards your chest as far as you are able, then extend your legs back out to the starting position . Repeat 20 times. This is great for the sartorius, the iliopsoas the rectus abdominis and the erector spinae.

\* Bent-Knee Sit-Up (“Crunches”): Lie on your back with your legs bent so that your feet are tucked as close to your buttocks as possible. Either put your hands on your head or cross your arms over your chest. Flex your trunk towards your thighs until your back is off the floor, then lower yourself back down. Repeat 25 times. Strengthens the Sartorius, the iliopsoas, the erector spinae and rectus abdominis. \* Stability Ball Exchange: Lie on your back with a Swiss ball on the floor just above your head. Reach back with your arms to take hold of the ball. With the ball in your hands, raise both your upper body and your thighs, moving them towards each other. Place the Swiss ball between your legs, then lower all your limbs back to the floor, bringing your arms beside your head. Repeat the movement, this time passing the Swiss ball from your legs to our hands. Repeat 15 times. \* Seated Russian Twist : sit on the floor with your legs bent, knees slightly apart, holding a Swiss ball in front of you at arms’ length. Lean back slightly to activate the core, keeping a flat back. Rotate your torso to the left as far as you can comfortably go; smoothly return to the centre, then rotate to the right as far as possible before returning to the centre. This is ONE rotation. Repeat 20 times. Great for the obliquus externus ,the obliquus internus and the rectus abdominis. \* Pullover Pass: Lying on your back, with your knees bent and your feet on the floor, hold a medicine ball behind your head at arms length. Quickly sit up and pass the ball to a partner while contracting your abdominals. Receive the ball back and gently return to the starting position. Repeat 25 times. Strengthens all the abdominal muscles as well as the serratus anterior.

There are many more exercises and drills which can be done to strengthen the core and improve running form. But, again I would stress, all this is fine if you are a full-time athlete who can train 3 times a day incorporating a morning run and an evening run (or session) every day, a weights session three times a week, a plyometrics workout twice a week and drills two or three times a week. As a full time runner, you would be able to get lots of rest and sleep in between the various workouts, thereby enabling you to recover fully. But if you’re a person who is trying to hold down a 9-5 job, then it is simply not possible to train this often or this intensely. And in that case, I still believe that actual running is the best training for a runner and one should not substitute any of the above complementary or supplementary types of training for a running session. *\* The next article will deal with Testing and Monitoring the Athlete.*