









The official technical publication of USA Track & Field

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FROM THE EDITOR **RUSS EBBETS**

PRE-HAB AND INJURY PREVENTION



It seems for many coaches sport-related injuries are just something that happens, an inevitable consequence of athletic participation, akin to living on earth and getting hit with a piece of space junk. But are sports injuries really inevitable? Who designs the practice and dictates volume and intensity? Who teaches correct technique and movement patterns? It's not somebody sitting up in the stands. It's the coach, of course.

Injuries happen. I get that, but if one has control of the elements, the moving parts before the breakdown occurs, shouldn't one take some of the responsibility for the consequences? I know, I know—another job for the track coach to do. Just throw it on the pile of sport psychologist, career development specialist, bus manager and bruised ego unbruiser. And that list doesn't even begin to address the sport's techniques and disciplines and the nuances thereof. And you still have to figure out who's running the relays, what order and how to keep the stick off the ground.

But if coaching is a proactive activity, and I'm defining "proactive" as referring to plans or strategies that are done before, with forethought, why cannot some of that forethought be directed towards actions that prevent injuries?

"Pre-hab" is the word I'm thinking about here. Pre-hab has come into the vernacular over the last decade and can be defined as efforts to prepare (you can read that as strengthen or stabilize) the body's weak links. You may have learned about pre-hab as general prep, specific prep, anatomical adaptation or multi-lateral development but the common denominator here is that all these efforts involve forethought, thinking ahead to achieve a goal.

In truth the pursuit of excellence in our sport walks a fine line between health and injury. The body responds to the stresses placed upon it. It needs to be pushed to exceed one's current state to accomplish exceptional things. Sometimes personal motivation or goal-directed behaviors can exceed one's capacity to recover from the effort. It can become difficult to separate what one should do from what one feels compelled to do. It is a fine line and sometimes that line is almost invisible.

Knowing this and accepting this can allow one to prepare, something every coach learns early on—which is another "proactive effort," by the way. The pre-hab efforts mentioned above are part of everyone's practice plan anyway. What I'm suggesting here is a tweak of that plan. The addition of an exercise here, an action there or the

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ORGANIZING LONG DISTANCE TRAINING RUNS FOR LARGE GROUPS OF ATHLETES

How to design and implement distance workouts that meet the needs of all members of a diverse team or training group.

BY MONTY STEADMAN



For more than 30 years Monty Steadman was a head and assistant track coach at the high school, community college and collegiate levels. He is also a certified USATF official and is the author of *Coaches' Guide to Cross Country and Track and Field: Training Cycles* (2015), available from amazon.com

OBSERVATIONS

As I was driving down a rural street one day, I came across a group of high school distance runners going on a long run. I was driving in the opposite direction so I passed the top runners first. They were more or less running in several loose knit groups. Then I passed some slower runners and a runner who appeared to be their coach running together at a slower pace than the top groups. Finally at the other end of the line of runners, I observed a rather strung-out group of runners. Some were running. Some were running and walking, and at the back end of the group, some were just plain walking. The entire situation demonstrated the challenge of coaching large and diverse high school cross country teams and/ or groups of middle distance and distance runners while they train on long runs.

INSTEAD OF DESIGNING WORKOUTS THAT HAVE RUNNERS COVER SPECIFIC DISTANCES, A COACH CAN DESIGN WORKOUTS THAT HAVE RUNNERS RUN STEADILY FOR SPECIFIC LENGTHS OF TIME.

THE PROBLEMS

Most high school cross country teams and track & field distance groups consist of male and female athletes, sometimes in large numbers, with a wide range of talent, ability, and motivation. Not everyone can handle the same workloads during a workout session. Wasted time and runners standing around are two enemies of effective team workouts. For a workout to be effective and efficient, all individuals or groups should be running during the entire workout and finish running at more or less the same time.

The problem for a coach is how to design and implement long run and hill workouts that meet the training needs of all members of a diverse team or training group while fostering team unity. Sometimes coaches never really get to view all of their runners during these workouts. If a coach stays in one place, the runners pass by and are not observed again until they reach their destination. If a coach runs with athletes, then a choice has to be made as to where in the large group a coach can or will run. If a coach has the ability to run with top athletes, then athletes with lesser abilities are unobserved while running behind that coach. If a coach runs with or behind the slower athletes, then top athletes are neglected.

Two coaches can help with this problem, as one can run in front and one can run at the back. However, what happens to the runner who becomes sick or injured during the workout? Who sees that runner when she or he needs help, and where does that runner go to get help? In my opinion, this problem can be solved through training sessions designed around *Timed Running* and *Loop Courses*.

TIMED RUNNING

When large or small groups of athletes set out for a run of a specific distance, two things can happen. One is that no matter the distance run, some athletes will finish the distance before the remainder of the group finishes. Generally these athletes then either warm down and go home earlier then the rest of the group, or they wait around until everybody finishes the run. A creative coach can give these athletes some extra work to do while they are waiting for the rest of the group to finish, but then the workout tends to become fragmented.

The second thing that happens is that the slower athletes at the back end of the group always finish after everyone else in the group has already finished and maybe has even gone home. This situation can cause these slower athletes to feel disconnected from the rest of the group. They may also become discouraged by always being in the rear. From my observation, some runners at the tail end of groups don't always challenge themselves in long run workouts. Some few even have a tendency to walk when nobody is looking.

A solution to these two situations can be Timed Running. Instead of designing workouts that have runners cover specific distances, 2 miles, 5 miles, 10 miles, 15 miles, or what have you, a coach can design workouts that have runners run steadily for specific lengths of time. 10 min., 25 min., 40 min., 60 min., or longer. These workout duration times should be based on the fitness and performance levels of the athletes as well as on the desired outcome of the various workouts. With timed runs everyone starts together and then finishes at the same time. By everyone running for the same duration of time as everyone else during the same workout, runners will cover different distances based on each individual's or subgroup's fitness and ability levels but all finish the workout together. As runners improve and raise their fitness levels. they will cover more distance during specific time periods. Timed running can effectively work for short tempo and threshold runs and also for very long, high mileage training runs. As was stated, the time of the runs depends on the goal of the specific workout.

WORKOUT COURSE DESIGN

If athletes are going to run for time rather than distance, workout course design becomes critical.

Timed running on an "in and out" course is fairly simple to set up and implement. The coach determines the duration of the timed run. The course is set up, and the runners are told to run for half of the allotted time from point "A" toward point "B", say 15 min. for 30 min., 30 min. for 45 min. or whatever is desired and then to turn around and run back toward point "A." By having all the runners turn around at half time no matter where they are on the course, everyone, no matter their talent or ability, will arrive at the starting point at more or less the same time. When the workout concludes, it will conclude for everyone in the group at almost the same time.

The major problem with time running on "in and out" courses is a coach's ability to monitor and supervise all the runners in the group during the entire workout. A coach can't be everywhere at the same time. Running these workouts on loop courses offers a solution to this problem.

THE LOOP COURSE CONCEPT FOR TIMED RUNS

No matter what the location, hill and long run workouts can be performed on loop courses of any distance depending on the location. Loops can vary from 1 mile to 3 or 4 miles depending on the type of workout. Running on 2.0 to 2.25 or 2.5 mile loops seem to work the best from a supervision standpoint. There are several reasons for working a team on loop courses.

Loop courses provide a good means for supervising all runners during the entire workout. Having all runners run on a loop course, allows them to all continually pass by a coach or coaches. (If two coaches have two separated check points on any loop course then runners will never be too far from a coach at any time.) These loop courses can be set up in parks, recreation areas, on actual cross country courses, and even on some large school campuses.

LOOP COURSE WORKOUTS ALLOW COACHES TO MAKE INSTANTANEOUS CHANGES IN WORKOUT PATTERNS THUS CREATING VARIETY AND INDIVIDUALIZATION IN THOSE WORKOUTS.

Close supervision of runners on a loop course allows a coach or coaches to keep in close communication with all team members throughout the entire workout. The pace and intensity of runners' work can be monitored continually as each runner or group keeps passing by a coach or coaches. The physical health of all runners can be assessed throughout the run. If a runner becomes injured, sick, or unduly fatigued, that runner can receive help or first aid much quicker than a runner would on an extended "in and out" or single-direction course. Also water stations can be set up on loop courses. Coaches can carry small walkie-talkies or cell phones, so that they are able to communicate with each other concerning their runners.

This direct supervision and communication eliminates many monitoring and supervision problems as well as keeps the workouts going at the pace and intensity that a coach desires. By moving runners continuously around a large loop, coaches are able to set runners at different paces, intensities, and distances while keeping them all in the same immediate area. Coaches are able to supervise and regulate the work done by all runners in these loop course settings.

By running athletes for set times on a predetermined loop, it is very easy for coaches to establish how much work is performed by individuals or groups from workout to workout. For example, if at a given site a runner or group runs three complete loops in a given time, and then at the following week's workout, the same athlete or group runs three and a quarter loops in the same time as in the previous week, obviously more work at a faster pace has been performed the second week. Also, if less work is performed during the second week's workout, then coaches can look into this difference. Fatigue, illness, injury, adverse weather conditions, or maybe lack of effort can all be causes of the workout differences. Changes can be made in the workout structure to remedy such problems. Shorter workouts, longer workouts, pace changes, rest days, or even pep talks can all address these problems. Timed running on loop courses enables coaches to locate and solve training problems as they come up, thus helping runners to grow and improve.

Loop course workouts allow coaches to make instantaneous changes in workout patterns thus creating variety and individualization in those workouts. When runners work according to strictly repeated patterns there can be a tendency for some individuals over time to lose interest and become bored with workouts. Loop course running allows a coach to make sudden changes in a workout at any time during that workout. These changes can be communicated to all the runners performing the workout, or to some groups, or to individuals. Groups and individuals can be given tasks, which are different from those of others running on the same loop. Unexpected changes can add variety and zest to otherwise monotonous workouts.

An example of a very simple change in a loop course workout is that as the runners pass a checkpoint a coach sends them back in the opposite direction. (This change of direction is always a crowd pleaser.) A variation of this change of direction tactic is to send the lead runner who reaches a checkpoint back in the opposite direction. This lead individual is instructed to turn the other runners around as the designated runner meets the runners coming up the course. So what starts out as a single runner running in the opposite direction ends up with the entire team or group running together around the course in that opposite direction. This is always a good way to finish up a workout.

Some athletes, especially those who are new to the sport of distance running and/or cross country or those with limited fitness or motivation have a tendency when unobserved to walk during portions of long runs. This walking problem needs to be corrected as soon as it is observed by a coach. Timed loop course running provides a coach with many opportunities to observe and then stop individuals from walking.

THE NO WALKING RULE

One concept that must be established with all runners on the very first day of practice and must be continually re-enforced thereafter is, *"THERE IS NO WALKING DURING ANY OF THE RUNS IN PRACTICE."* Some neophyte runners have to learn that they do not need to walk during long runs.

At practice, individuals or groups who are observed walking at any time during a running workout should be checked for signs of extreme fatigue or injury and then either pulled out of the workout or encouraged to try to keep running. In practice if runners walk during a run one of two things could be wrong.

- The individual has been running too fast and is fatiguing too soon. If that's the case then the runner needs to be advised to slow the pace down so that the entire workout can be completed by running.
- The runner is sick, injured, or has some other problem that is keeping the individual from being able to run. If any of that is the case, then the runner should stop running immediately and go to a coach and explain the problem. If a runner is too sick or injured to make his/her way to a coach, the runner should send a teammate to a coach immediately.

Teaching runners not to walk during practice runs may require a personal approach by a coach. Through observation it becomes easy to determine who is walking due to injury, illness or distress or just walking due to habit. Pacing adjustments can be made for walkers who are not injured, ill, or in distress. Sometimes the only thing these walkers need is verbal encouragement. Any individual who after being encouraged to keep running walks a second time in a workout should be pulled from the remainder of that workout. Athletes who continually refuse to stop walking in practice or races should be asked to leave the team and program and encouraged to try a different sport or activity. With the proper encouragement and supervision it should not take long to get all team or group members running for all of the practice time. Once a "no walking culture" is created within a team or group, the problem tends to disappear.

CONCLUSION

The Timed Run, Loop Concept can be a mainstay of a school's or club's cross country, middle distance, and distance program. This concept allows for measurable, graduated, individualized workloads for all runners while still maintaining a team or group setting. Because of the individualization of this type of workout, all participants can experience positive development and consistent improvement of performance. This method of timed. loop course running can work for the inexperienced neophyte as well as for the top-level runner all in the same workout. A little preplanning and course setup by a coach can make it happen, so that all team or group members continue to grow and develop through an entire season. It works!

INJURY PREVENTION IN TRACK AND FIELD

Track Coach editor Russ Ebbets provides a comprehensive account of "pre-hab" in track & field, injury prevention for each body joint complex.

BY RUSS EBBETS

Sports injuries can fall into two categories. Some are caused by trauma. One can use football, boxing or ice hockey as examples. Forces are introduced to the body that cause different types of damage ranging from bruises to broken bones. This fact is complicated by one being thrown or knocked forcefully to the ground. A second set of injuries stems from repetitive actions due to misuse or overuse. These are forces that are repeated hundreds or thousands of times and cause wear and tear on the body. The body can neither accommodate or recover from these micro-traumas without treatment. Track & field athletes traditionally suffer from repetitive-type injuries.

For many coaches and athletes injuries are a foregone conclusion. They see it as one of the "costs" of athletic participation. On a certain level this can be rationalized, especially for the elite athlete who is constantly pushing the point, constantly making the body do things it has never done before. F. Scott Fitzgerald once commented "brave men (and women) play close to the line."

But what if this perception of injuries as a "given" is wrong? What if injuries are due to a lack of preparation, lack of forethought or faulty planning, all translating to something preventable. It's an interesting idea.

What this article will discuss are strategies and tactics that work to prevent injuries. Six biomechanical concepts will be presented that will serve as foundational concepts. An understanding and appreciation for these concepts will allow one to better understand the injury prevention recommendations that follow as we progress through the body joint complex by joint complex.

MOVEMENT BIOMECHANICS

The human body can only assume one of six positions at any given time. The six boxes will be discussed as if one is in the standing position (Figure 1). Box A is a **neutral posture**, standing in a relaxed upright position. Box B is **compression**. Compression happens when joints



Figure 1



Figure 2

are forced together. This would happen if one were to stand on a chair and jump down. As the feet hit the ground there would be compression taking place throughout the body, at the feet, knees, hips, low back, etc. Gravity causes compression of the body but so do the different landings of the jumps and the foot strike of running.

Box C is **distraction**, or a pulling apart. The eccentric phase (lengthening action) of muscle movement would be a distractive force. There are distractive forces with the plant in the pole vault and to a lesser degree using the arms to accentuate the take-off in the high jump. Box D is shearing forces. This is where forces are moving in opposite directions. The quick stop of a basketball player in order to pivot causes the femur to slide forward on the tibia. In the bench press the weight of the bar causes a shearing action at the shoulder joint because of the anatomy of the shoulder joint (it has a "flat" socket). While some sliding or shearing actions are normal, too much can cause serious injury.

Box E is bending forces. For our body model this could be flexing at the waist forward or extending backward. This would also include laterally bending to the right or left. It is important to note here that bending is a combination of two forces: one side of the body undergoes compression while the other side undergoes distraction. Once again, with proper elasticity and staying within one's range of motion this is not a problem. Hyperflexion or hyperextension both can cause tissue damage on either the hyperflexed or hyperextended side or even both sides at once.

The final position is torque or twisting, represented by Box F. Torque is a twisting action which can be created in two ways. If two body segments are moving in opposite directions this would be called counter rotation. If one body segment remains stationary and a different body segment twists left or right (think of turning to look over your shoulder with your feet planted) torque is created at the joint. The classic examples here are the power positions of the throws. When the hips lead the shoulders there is body separation that activates

a rotary stretch reflex and can increase performance. A second example is when the shoulder leads the throwing hand in the javelin. Still photographs of the javelin release can lead to dramatic illustrations of torque (Figure 2). In either case too much force on unprepared tissues can lead to injury.

The critical take-home point to all these boxes is that these are the only ways the body can move. For the coach or athlete to develop an intuitive appreciation of this fact will go a long way towards understanding how to prevent a host of commonly seen injuries in track and field.

FORCE—FREQUENCY— DURATION

A legitimate question to ask is why one athlete gets hurt running, jumping or throwing while another athlete, doing the same workout, workload, etc., thrives and actually improves with the work? At its core it boils down to how the athlete can handle force, frequency and duration. If there is too much force, too much frequency or too long a duration there will be a problem.

In Figure 3 are some common forces from track & field that the body must sustain. Too much force in any of the biomechanical directions discussed above can be the recipe for injury, whether that be an acute tissue failure (pulling a hamstring), sub-acute condition (Achilles tendinitis) or chronic tissue failure (herniated back disc or worn out knee cartilage).

Example of forces . . .

TJ — 10-22X body weight HJ — 2000+ pounds on take-off leg with 8' jump 2/3 body weight above navel Running produces 5-7x body weight force on legs Mile = 750 steps (7') 900 (6') SP — 60' throw greatest horse power production In sprinting hamstring moves hip 55mph

Figure 3

"Too much frequency" can be thought of in two ways. If the athlete trains "hard" without adequate rest between training bouts, this could be an example of too much frequency. But frequency can also be used to describe how fast an action happens. If one "moves too fast" one loses coordination. Recall as a child the first time you ran down a steep hill. There was momentarily exhilaration with the speed that suddenly changed to terror as one could not move the legs fast enough to maintain balance and a fall resulted. Poorly coordinated actions with poorly conditioned muscles are a recipe for injury. If the foot pronates "too fast" this action can lead to excessive stress on the soft tissues of the foot and foreleg and result in shin splints. Achilles problems or plantar fasciitis from the weak, uncoordinated dynamic stabilizers of the foot, notably the posterior tibialis.

Duration is the final quality why some athletes get injured. If one trains for too long a time, once again without taking proper rest and recovery this can wear down the body. The daily and weekly demands of marathon training for the runner would be one example. Throwers can suffer from excessively heavy lifting programs that incessantly "beat up" the body from one workout to the next and may impact the length of one's career, especially at an elite level due to a chronic tendinitis, cartilage wear or damage to the musculotendinous iunctions.

ANATOMICAL ADAPTATION

The tissues that routinely become injured in track and field are: muscles, bones, joints, tendons, ligaments, musculotendinous junctions and fascial planes. Anatomical adaptation is the programmed use of exercises and conditioning methods to make these tissues "stronger" or more resilient to the stresses of running, jumping or throwing.

ANATOMICAL ADAPTATION ALSO PLAYS A SIGNIFICANT ROLE IN CAREER LONGEVITY

For the most part these tissues go unseen. While one can see muscular development, tendon or ligament strength is invisible. Anatomical adaptation has been called invisible training. Because of its invisible nature anatomical adaptation is often ignored. This is unfortunate because it is the functional integrity of these tissues that stabilizes joints, optimizes the stretch reflexes and combines to create a summation of forces that performance level sport demands. Anatomical adaptation also plays a significant role in career longevity. These tissues are best trained with isometric actions, non-movement actions which again, do not produce hypertrophy and visible results. This can present a challenge to our Hollywood, visually oriented culture.

THE CLOSED KINETIC CHAIN

A closed kinetic chain is a multi-link (joint) system in contact with the ground. In a closed kinetic chain one joint affects the next joint, and the next, and the next, etc. A simple experiment is to stand and place your finger tips on the point (ASIS) of the hips. Now slowly roll the foot to the instep and outside of the foot. You should feel movement at the hips. Movement of the foot (pronation and supination) affects actions at the knee, hip joint, sacroiliac and lumbar spine. Excessive movement at the foot (too much force, frequency or duration) can negatively impact any of the joints or tissues within this closed kinetic chain.

Uncoordinated, asymmetric body movements place uneven stresses on the tissues of the leg and over time can present with injury. Proper technique, good posture, symmetrical body movements and overall body balance, in the true sense of that concept, become fundamental training goals.

TWO THEORIES—THE LINEAR MOVEMENT THEORY AND THE WEAK FOOT THEORY

The Linear Movement Theory states that as we age we become more linear in our actions. If you doubt this statement answer honestly the question, when was the last time you played "tag?" Track & field for the most part is a linear sport with "straight ahead" movement. We move straight ahead in all events except the hammer and discus. One can argue that there is the turn in track events and the curve in the high jump but there are no events where a "pivot" is part of the event such as commonly seen in ball sports.

Linear movements are essentially sagittal plane movements (Figure 4) that characterize most aerobic fitness activities. If the training maxim "the body adapts to the stresses placed upon it" is true the repetitive movements demanded by event techniques will develop



Figure 4

muscles and tissues that help drive the body in the desired linear path. The problem that arises is that the dynamic stabilizers (at the ball and socket joints, low back, foot) begin to atrophy due to disuse, leading to decreased joint stability. An unstable joint has a "wobble" that translates into poorly mitigated forces (shearing, bending, compression, etc.) that can negatively affect immediate performance (a diluted stretch reflex, reduced force application or increased ground contact time) and over time result in an overuse injury.

While it could be argued that lateral motions are not "important" in track & field I would counter that the functional integrity of the dynamic stabilizers (whose role is to stabilize a joint complex) is critical for one to move with force, frequency and duration and to lessen the chance for injury.

The Weak Foot Theory states that Americans (and most Western Industrialized citizens) have weak feet. One of the characteristics of an industrialized nation is the proliferation of cement and hard level floors. Necessarily the foot must be protected from this unrelentingly hard surface. This is done with shoes. Shoes essentially represent a soft cast for the foot. But if one were to wear a similar structure on the hand for an extended length of time one's manual dexterity would disappear.

The foot is the terminal point of the longest neural pathway in the body. This can be translated to "slowest" or the pathway that takes the longest time for a signal to be sent and received. Hard level floors present a consistent, unrelenting, challenge to the foot that in turn decreases one's balance and proprioceptive sense. This presents a double whammy as all the events in track & field are performed on or with the feet. Couple that fact with the repetitive nature of running, the forces the feet sustain with weight training or the forces that must be mitigated with jumping and the incidence of foot and lower leg injuries becomes understandable, especially for the "untrained" or "weak" foot.

THE ARGUMENT FOR PRE-HAB EFFORTS

If track and field is mostly repetitive linear efforts with forces, frequencies and durations that commonly exceed the body's ability to sustain these forces does it not make sense to spend time and effort on areas that commonly break down by bolstering the ability of these areas to withstand those forces? The solution here runs counter to the training maxim of "train movements, not muscles." This exception to the rule can be justified because repetitive movements, by their very nature, are not "all-around" movements. The functional integrity of a joint complex requires "all around" movements. Pre-hab efforts then become of paramount importance, to insure this "all-around" development, especially in performancebased athletics (Figure 5).

A second point to this argument is that failure to do pre-hab efforts often results in tissue breakdown. One must consider the time necessary for one to rehabilitate the injured area and return the athlete to "normal," however that is defined. Note that during this rehab time period no development takes place. Necessarily alternate or reduced training loads will be used in an attempt to maintain fitness but new and improved levels of fitness are not achieved with these rehabilitative training workloads.

This becomes problematic when one considers that the "athletic life" of an athlete is limited. For the sake of argument, we'll use 10-12 years

Pre-hab Goals

- Postural, core & dynamic stability
- Movements not muscles
- Multi-lateral development
- Muscles, joint capsules, ligaments, tendons, fascia
- Technical development
- ALLOWS for growth and development

Rehabilitation Choices

- Restoration of ill or injured to "normal" state
- Muscles over movements
- Strength, flexibility, endurance, ABC's (**NO** speed)
- Attention to weak/broken links
- "Return to Play" concerns/testing
- DELAYS growth and development

Neuromuscular education v. neuromuscular re-education

Figure 5

of peak performance. A yearly onemonth loss over this time leads to a loss of "time" over the career of 8%. That means that 8% of the athlete's training time was spent not improving, up to one year's worth of time. This directly precludes the athlete from achieving or maximizing his/her potential. To that end a well-designed pre-hab routine can eliminate or at least significantly decrease this loss of time and directly benefit a career.

The remainder of this article will take a joint complex by joint complex view of strategies that can be considered to bolster the body for the demands of the sport so that training and competition can be undertaken more aggressively and safely.

THE SHOULDER

To prevent injuries to the shoulder it is necessary to consider three situations regarding the shoulder: the function of the rotator cuff muscles, the habitual gathering actions required by modern life and how "poor" adaptive postures can accelerate shoulder problems.

The rotator cuff muscles are a group of four muscles that initiate all shoulder movements. The anatomical design of the shoulder socket, (the glenoid fossa) is similar to that of a pear (Figure 6). In a neutral, non-weight bearing position the humerus hangs in the lower portion of the fossa. When the arm moves in whatever direction the rotator cuff muscles contract. This contraction raises the head of the humerus into the narrower portion of the fossa and allows for a snug fit. At this point the larger muscles of the shoulder (pecs, lats, deltoids) can take over and accelerate the arm as necessary.



Figure 6

The supraspinatus lifts the arm to the side (abduction), the subscapularis internally rotates the arm and both the teres minor and infraspinatus are involved in external rotation. The supraspinatus has a poor mechanical advantage and is the most frequently injured. The subscapularis controls the circulation and nervous innervation around the shoulder (Murnaghan, 1988) and the arm. The external rotators are the weakest due in no small part to the fact that external rotation of the arm is not something one routinely does.

Much of arm and hand usage is due to gathering actions (bring-

ing objects towards one's chest). This habitual use leads to an excessive development of the subscapularis muscle which becomes short and tight. A common presentation of this is the person standing with backwards facing palms of the hand. This arm/hand posture constricts circulation to the arm and can create a negative cascade of events that includes the "proliferation of scar tissue" and accelerates wear and tear of the shoulder. Add to this fact that poor postures (forward head carriage, rounded shoulders, excessive cell phone use) further accelerate problems.

Proper shoulder posture dictates that the acromioclavicular joint (AC joint) should be below the ear (Figure 7). If the ear is ahead of the plumb line it is a condition called "forward head carriage" (FHC) which begins to stress tissues of the head, neck and shoulders (Figure 7). Modern society has promoted this posture from the student study posture, with daily computer use and the time a white-collar worker spends hovering over his/her desk work. Even the sleep posture of propping the head up with multiple pillows can promote FHC leading to neck and shoulder problems.

Most shoulder injuries seen in track & field athletes are not so much due to the demands of the events but rather ancillary activities like weight training. Lifters have a tendency to lift for the muscles they can "see." This strategy leads to overdevelopment of the muscles on the anterior of the body to the



Figure 7



Figure 8

neglect of the posterior musculature. This combination of poor postures and gathering actions can create joint and muscular dysfunction and eventually injury. Promoting shoulder stability, especially for weight training throwers becomes of paramount importance.

A simple but effective means to develop the shoulder musculature is to do the Talking Arms exercise (Figure 8). The exercise is performed by dribbling a medicine ball (recommended weight equal to competitive shot class) above the head with two hands as rapidly as possible (30-60 seconds, or 150x to start). This one exercise proves to be a great conditioner for the hands, wrist/forearm, shoulder girdle and also the serratus anterior muscle that stabilizes the scapula to the thorax. This exercise can easily be integrated into a training plan as a warm-up exercise, as a station in a circuit routine or as a stand-alone training unit with sets and reps. Olympic great Al Oerter stated that this exercise, more than any other lift, was the key to his success.



A second recommended exercise is to perform Side Lying Flys with a minimal weight (i.e., 1-5 pounds. Note: Using greater than 5 pounds can lead to muscle hypertrophy and may create a shoulder impingement problem). Figure 9 from The 7-Minute Rotator Cuff Solution (Horrigan, 1993) demonstrates this simple exercise. Note that this exercise focuses on the external rotation rotator cuff muscles, the teres minor and infraspinatus. Other common lifting exercises (bench press, lat pulls, overhead presses) address the other three rotator cuff muscles.

THE LOW BACK

Low back pain is a plague for modern society. There are numerous reasons why the general public suffers from this condition. One of the things that characterizes industrialized societies is the fact that the majority of the populations spend their waking hours on hard level floors. There are three bones in the pelvis, two ilia and the sacrum. The ilia rotate around the sacrum with ambulation. Leg dominance, muscular development and the technical demands of different events (i.e., jumping off one leg) can cause the ilia to become uneven in relation to the sacrum.

This unevenness in turn causes an asymmetric gait pattern that is repeated 1000's of times per day, day after day, week after week for a lifetime. This puts uneven stresses on the joints of the closed kinetic chain mentioned above. This in turn stresses the soft tissues that surround these joints. The challenge then becomes to fortify the individual links that help stabilize the low back.

In track & field both training and competition present assaults to the low back area. Olympic lifts and power lifting squats all produce significant forces on the lumbar spine as one goes through those actions. Long jumpers, pole vaulters and high jumpers all have a rapid hyperextension of the lumbar spine during the execution of their event. The 1000's and 1000's of steps a runner does over a season and career places a tremendous stress on the discs of the lumbar spine, particularly the L5-S1 disc.

Low back pain is actually a series of possible scenarios that include: a disc injury, facet problem, sprain of the sacroiliac joint, piriformis syndrome, muscular strain of the erector spinea muscles and quadratus lumborum and possibly stress fractures. Whatever the cause there are several preventive measures that can be taken that will fortify the area, especially for the rigors of the individual events of track & field.

Figure 10 is of the stabilizing muscles of the lumbar spine. Note the thickness of the muscles that form four "pillars" that stabilize the spine. Also note that they are essentially the same size (ideally). The psoas is about the size of one's forearm. Most coaches are familiar with the anterior psoas muscles that are trained directly and indirectly with running actions, simple sit-ups





or abdominal crunches. It bears repeating that these are anterior structures. The erector spinea are the posterior muscles that stabilize the spine. These are not readily visible, don't have the "6-pack" appeal and are often out of mind. But for the lumbar spine to be stable all four of these muscles (2 psoas, 2 groups of erector spinea) need to be conditioned.

Core planks have come into vogue over the last decade and are a part of most people's weekly training schedule. What is usually missing is any core work to the side of the trunk or for the back. Performance of core work *around* the body will help tone this stabilizing network of muscles. Figures 11 and 11a give suggestions on positions that challenge the whole body.

A question that has yet to be answered is how long to hold the plank position. Aaron Mattes taught that any isometric position (Mattes, 2012) held longer than 10 seconds creates an ischemic (lack of blood flow and oxygen) situation in the body. This causes a histologic



change in the muscle tissue akin to scar tissue which has less elasticity and more easily damaged due to excessive forces.

There are fitness gurus who recommend planking for upwards of a minute or more. When one considers that sprinters are taking 4-5 strides per second, someone doing an Olympic clean and jerk completes the motion in less than 5 seconds and that there is no event in track and field that requires one to hold an isometric position continuously for over a minute, the wisdom of doing planks for 60 seconds or longer may be questionable.

Back hyperextensions and side lying lateral bends (use a "gentle" range of motion, don't jam the back at an end

range) both isolate the musculature of the low back (Figure 12). Use of these conditioning methods violates the "train movements not specific muscles" rule again but isolates and conditions this critical link in the body. This simple machine allows one to isolate that musculature that would otherwise be ignored.



Figure 12





Abdominal work seems to fall in and out of favor but to do 20 sit-ups daily will keep those muscles toned without putting excessive stress on the low back discs.

A final pre-hab type exercise for the lumbar spine is the use of the pelvic tilt. As illustrated in Figure 13 the athlete lies on the back and simply presses the lumbar spine to the ground. This is done in a slow and rhythmic manner with an emphasis on control. This is true neuromuscular education of the musculo-skeletal system of the lumbar spine. One of the reasons the general public suffers such frequent episodes of low back pain is that they have lost the "sense" of this area of the body and engage in activities (raking leaves, snow shoveling, vacuuming the floor) until they have strained these relatively insensitive structures. Periodic use of pelvic tilts will restore this sense.

THE HIPS

In the shoulder the rotator cuff muscles were discussed at length. In the hip there are a group of analogous muscles (piriformis, obturator internus and externus, quadratus femoris, gemellus superior and inferior) that play a similar role in the stability of the hip joint and that play

a critical role in one's ability to run, jump, squat, bend forward and to stabilize the femero-acetabular joint (hip joint) in the isometric positions of dynamic stability needed for single-leg support.

"Weak hips" (admittedly a lay person's term) are responsible for not only hip pain but also knee and low back pain. Once again, the coordinated functioning of the closed kinetic chain is critical for the safe participation of the athlete. Figure 14 illustrates a fit young female performing a drop jump and clearly illustrates "valgus collapse" of the knees, the result of weak hips. This is an ACL injury waiting to happen.

Dynamic stability at the hip is created by the gluteus medius, the psoas and the adductor magnus. These



Figure 15



Trendelenburg" Sign (Figure 15). Ben Johnson showed this sign in spite of having a 42" vertical leap, 600-pound squat and the ability to run the 100m in 9.79 seconds. This was an area that Charlie Francis felt was "unimportant" because sprinting is a linear action and was not subsequently trained (Francis, 1988). When performing a straight leg rise (aka hamstring stretch) to 90 degrees, if the athlete complains of "tight hamstrings," the hamstrings feel tight to the athlete because his body is trying to stabilize the hip joint with the hamstring muscles that do not have the proper mechanical advantage to stabilize the hip joint.



Their dynamic stabilizers are weak, poorly conditioned and not doing their job.

There are three exercises that can strengthen the muscles surrounding the hip. The first is a leg-over drill commonly used by hurdlers. Set the hurdle height about "groin height" and from the side of the hurdle bring the leg up and over (Figure 16). This can be repeated up to 10-20 times. The second exercise involves using elastic bands at the knees. These bands are about two inches wide and should be placed just above the knee joint. The exercise is to step sideways, slowly for 25 meters. This can be repeated a few times.



Figure 17

The final hip exercise is a total hip machine (or some variation thereof). This machine allows one to focus on strengthening the hamstring as a hip extensor along with strengthening the adductor magnus and gluteus medius. When sweeping the leg to the side in either abduction (leg away from midline) or adduction (leg towards midline) both the gluteus medius and adductor magnus receive specific attention respectively. Toning of adductor magnus (Figure 17) will go a long way toward preventing hamstring strains as a strong, healthy adductor magnus acts as a fourth hamstring and helps to powerfully extend the hip. Use of a hamstring curl machine is more a bodybuilding exercise. This machine trains the hamstring as a knee flexor, not hip extensor which is the running and sprinting action.

THE KNEE

The knee is certainly a problem area for runners. The constant pounding of training can wreak havoc on this joint over the course of time. The odd thing is that knee injuries are often the consequence of problems somewhere else in the closed kinetic chain. We established that "weak" hips can create instability here with

> "valgus collapse" but also iliotibial band problems or patellar tracking problems. But if the foot is not properly conditioned for the stresses of running, jumping and weight training on this unstable foundation can contribute to problems at the knee.

> One thing that helps alleviate knee problems is to make sure that the quadriceps muscle is strong. As was established most of the efforts in track & field are linear motions moving

forward. This tends to develop or overdevelop the musculature on the posterior of the body. Something as simple as leg extensions done 1-2 times per week will tone this muscle group enough to prevent a host of potential problems.

Other exercises that can effectively condition the quadriceps are wall sits-sitting with the back against a wall with the hips and knees flexed to 90 degrees. Once again, the time of this exercise seems to be in question. A compromise of 30 seconds a few times a week would be worthwhile. Squatting either with weights or without weight will also develop the guads. Squats should be performed in a slow and rhythmic action. There should be no "valgus collapse" as noted above and the patella (knee cap) should not travel ahead of the great toe.

Squatting until the thighs are parallel to the ground is recommended, going deeper into a full squat is counterproductive. Introduction of weights should be a gradual process. If working with novice athletes honing the squat pattern with literally hundreds of squats over the course of several years is a safe way to promote good knee and leg heath. Bompa recommended at least three years until an athlete could do moderate to heavy plyometrics which would translate to a similar ramp up time until one gets to squatting 2x body weight (Bompa, 1993).

Patellar tendinitis is an endemic problem for high jumpers. On a *healthy leg* the use of eccentric lifts in the preseason or early conditioning phases of the seasonal cycle will help mitigate the forces of the single-leg take-off. On a leg extension machine both legs can contract bringing the weight to ground parallel with one leg lowering it (an eccentric contraction). Remember that eccentric efforts are neurologically fatiguing (Siff, 2004) so this type of training should be used judiciously with more rest in the subsequent days.

For more mature, sophisticated athletes squats can be done where the athlete squats with a heavy load and teammates remove a plate from each side of the bar before the athlete returns to the standing starting position. The plates are put back on the bar and the eccentric portion of the squat is performed again. Understand that to try either of these types of lifts on an already injured leg will prolong the problem.

FORELEG—SHIN, ANKLE, HEEL AND FOOT

As mentioned, if one were to wear an apparatus on the hands similar to a shoe the ability of the hands to execute fine motor skills such as threading a needle, combing one's hair or simply writing would soon become next to impossible. The muscles of the hand that execute these fine movements would atrophy and we would lose the ability to do those skills.

Also as mentioned previously, one of the things that characterizes industrialized nations is the proliferation of cement. Cement and hard level surfaces (hard level floors) present a continual assault on the foot. So what do we do? Shoes are made for protection. But unfortunately, shoes have also become a potential "fashion statement" that can lead to questionable decisions. High heels, narrow toe boxes, poor heel counters and the absence of any arch support can individually or in combination pres-



ent foot problems for most people.

Add to this fact that most people's "typical" linear movement patterns and the development of foot issues are a logical progression. Steps must be taken to strengthen the foot creating a more stable foundation for the body. This has far reaching consequences that include better balance, force production and decreased ground contact times at the foot while also decreasing the possibility of problems further up the closed kinetic chain.

Oddly "strengthening" the foot is not on the radar screen of ANY of the fitness gurus in their quest for the perfect Hollywood body. If you check any of the bodybuilding magazines, books or DVD's produced you will not find anything that deals with strengthening the foot. Yet virtually all sports are conducted on the feet. The length of this longest neuromuscular pathway in the body also plays an important role in one's balance. A poorly refined pathway allows for a "slower" signal that may have implications in the severity of an ankle sprain one suffers. This certainly is a factor for the 65+ population and can contribute to the severity of falls this age-group suffers.

One way to develop foot strength is with the six-foot drills (The 6 Foot Drills on YouTube). This simple series of foot drills works all the muscles of the foreleg and helps to develop one's balance and proprioceptive sense of the lower leg (Figure 18). Interestingly the muscles involved in the inversion, eversion, toeing in and toeing out, forefoot walking and heel walking (always with the shoes on) challenge all the different neural pathways coming from the low back. Repeated daily for 25m the foot drills will tone these muscles and develop the various pathways so that the foot has a "margin of error" with regards to injury development. The foot becomes better able to withstand the forces of ground contact seen with all running, jumping or throwing activities.



Figure 19



Figure 20

A second preventive step for the foot is to wear a plastic heel cup. This would be a recommendation for all jumpers, hurdlers and steeplechasers. At the bottom of the heel bone is what is called the calcaneal fat pad (Figure 19). This is tissue that cushions the foot and absorbs the shock of heel contact. The problem develops that over the course of a career the fat pad can break down, offering less protection.

A common injury here is a stone bruise to the bottom of the calcaneus. In either case a hard-plastic heel cup (Figure 20) helps keep the fat pad more tightly bunched and makes its shock absorbing qualities more effective. Note the recommendation is for a hard-plastic cup. While one might think that this is uncomfortable it is not the case. There are soft, highly flexible models on the market but they effectively raise the heel potentially allowing for rearfoot instability. To prevent heel blistering it is recommended to routinely trim the back off the heel cup (Figure 20 - black line).

The final point in the foot area is to develop a better sense of balance. Balance is the most important biomotor skill and probably the least trained. Virtually everyone takes their balance sense for granted. Whether this is through ignorance (don't understand its importance) or denial (loss of balance is a precursor to death) the fact is that for most balance is poor and for many it can be simply, quickly and significantly improved. One study on collegeaged students achieved over a 200% improvement in six-weeks (Balogun, 1992). That is like taking a 10' long jumper and having him jump 30'!

A balance board is easy to make and probably could be built from scrap wood in one's cellar. The dimensions are 16" x 12" with a 2x2" square center piece. (Figure 21). The 2" centerpiece will allow for a 22-degree tilt to the board which is the range of motion of a normal ankle joint. If the boards are built to the 16x12 dimensions one can make 24 from a standard 4x8' sheet of plywood. There are higher tech circular boards on the market but I have always questioned the need for a more sophisticated and expensive model when most will be challenged to master the simple 16x12 model.

POST-WORKOUT SUGGESTIONS

The use of a foam roller is a simple and effective means to self-massage various muscles in the body. It is recommended this be done after practice for up to 10 minutes. The age-old practice of yoga has recently come into widespread use. The problem is that for many people it is simply another undirected form of stretching. Richard Hittleman's (1969) book 28 Day Guide to Yoga is an excellent step-by-step progressive plan that stresses proper technique, posture combinations and breathing techniques that are consistent with a programmed approach. Each "day" takes approximately 20 minutes and over the course of a month one develops a heightened sense of body awareness and becomes well versed in how to attend to problem areas in the body.

IMPLEMENTATION

Improvement necessitates change. There are many suggestions here. No doubt most reading this article already have a "pattern" used for daily practice. Regardless of your current pattern virtually all these suggestions can be fit into 8-minutes of practice time. The foot drills take three minutes. Balance board work can be done in one minute. Use of the elastic bands can be done in two minutes. Medicine ball work can be done in about 90 seconds. Yoga and specific lifting exercises can be done at the end of practice and may take 15-20 minutes of the warm-down.

Cost is always a factor. All the recommendations could be done for



about \$250 and that is with the back extension equipment costing about \$200. The planks and foot drills are free. The heel cups cost about \$2 each. The 24 balance boards can be made for about \$36 of plywood. The elastic bands are about \$1 each. A good, unbreakable medicine ball runs about \$25-30 dollars each and Hittleman's yoga book is about \$7. When to fit these drills and exercises into practice plan? See the suggested pattern for the daily practice plan (Figure 22). There is much flexibility here so feel free to tailor it to your specific needs or problem areas. Movement patterns are recommended in the warm-up portions of practice. During warm-down work



CONCLUSIONS AND FINAL RECOMMENDATIONS

There are different philosophies on what role injuries and the risk of injury plays in performance development. No pain, no gain and no risk, no reward are sentiments many coaches express at one time or another. I always took it personal when one of my athletes got injured. I tried to find out what I had done "wrong" and what could have been

done to prevent the injury from happen-ing.

There also must be some level of personal responsibility on the part of the athlete for his/her own welfare. If you are dealing with 10-yearold Junior Olympians getting them to wear a coat in the winter may be the big challenge. The transition into early adolescence presents its own challenges. The growth and development of late adolescence also presents a different set of aches and pains for these athletes that may or may not be related to training.

The ability to keep the mature athlete injury free cannot be underscored enough. If their athletic "lifespan" is only 10-12 years then any down time due to injuries is lost time. This time will never be regained and will limit one reaching full potential. Individuals must take responsibility, self-leadership for their own care, in terms of sleep, hydration and all the other factors and distractors that make up everyday life and become the challenge of "good decisions."

Finally, it is important that the team internally promote a mindset where they, as a group, refuse to get injured. This will lead to internal promotion of the team's values with teammates encouraging each other to do the foot drills, stretch, do a proper warm-down, etc. essentially promoting healthy habits and responsibility to the team. There is certainly a degree of luck involved as far as injuries go but just as luck favors the prepared mind, luck also favors the prepared body.

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RESOURCES

Heel cups and elastic bands – MF Athletic, Cranston, RI. www.everythingtrackandfield.com 888-556-7464



GENERAL WARM-UP . . . foot drills . Speed — Strength — Endurance —

TECHNIQUE

CORE

2

BALANCE

DYNAMIC STABILITY

MAIN PART OF WORKOUT

- 1. Foot Drills
- 2. Planks, balance board, elastic bands

DAILY TRAINING PLAN

... clas ... jogging . Flexibility — ABC's

EVENT

SPECIFIC DRILLS

3

stretchina

CONDITIONING

4

ATTENDANCE

BIOMOTOR SKILLS

CIRCUITS

- 3. Medicine balls
- 4. Conditioning circuits-all

WARMDOWN . . . stretching . . . weights . . . conditioning . . . circuits

5

COACHING CUES . . . motivational saying . . . action thoughts . .

5. Back extensions, yoga, weights, circuits—planks, med ball, balance

Figure 22

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HAMMER THROW: LEGS OR ARMS?

Strelnitski teams with Olympic champion and longtime world record holder Yuri Sedykh to recommend more active use of hands and arms for advanced throwers.

VLADIMIR STRELNITSKI, SPRINGFIELD COLLEGE, AND YURI SEDYKH, POLE UNIVERSITAIRE LEONARD DE VINCI, PARIS, FRANCE

ABSTRACT

Contrary to widespread opinion, in advanced hammer throwing technique the arms are not a passive continuation of the hammer's wire but rather an active driver of the hammer. Braced to form a rigid "triangle," preventing sideways movements relative to the torso, the arms increase the radius of the "drive circle," which increases the tangential force accelerating the hammer along its orbit.

INTRODUCTION

Although any throwing implement discus, shot, javelin, or hammer—is sent to flight by the *hands* of the thrower, the laws of physics tell us that the primary source of energy and momentum imparted to the implement to secure its maximal possible release velocity are the *legs* of the thrower interacting with the ground. One of the first problems every hammer coach encounters while working with beginners is to prevent throwers from the natural desire to use their arms and hands primarily to move the hammer.

"Don't bend the elbows, relax your arms completely!"—doesn't this coach's command sound familiar? The ultimate goal of the coach, in many cases, seems to be making the arms a completely relaxed continuation of the hammer wire. This is certainly preferable to strained arms with bent elbows. However, does it mean that, in contrast to the shot or javelin, the arms should play *no* role in the hammer throw? Here, based on the rich personal experience of one of us (Professor Sedykh), and on theoretical considerations, we present some arguments in favor of an active participation of the arms in the process of hammer acceleration.

THE ARMS-CHEST "TRIANGLE"

Historical videos of hammer throwing available online, from the beginning of the 20th century till the present, show that before the 1960s it was customary to "drag" the hammer in turns, pull it with the left arm and shoulder stronger than with the right arm and shoulder and lead the movement with the head turned to the left, as if the thrower wants to see in advance where he or she drags the hammer. Starting in the late 1960s, more and more throwers were abandoning this technique.

Probably the first who did that was the Soviet thrower Romuald Klim, the 1964 Olympic champion, who also established a world record in 1969-74.52 (244-6). In the new technique, the thrower is supposed to look in the direction of the hammer and keep a rigid isosceles triangle made by the arms and the chest, from the entry into the first turn to the release. Most contemporary elite throwers follow this pattern. The better the thrower, the more symmetric, "more isosceles," the arms-chest triangle is. An example can be seen at https://www.youtube. com/watch?v=mTIReluteEQ.

"Keeping the triangle" means that the muscles responsible for the sideways movements of the arms relative to the torso are braced. However, the arms must have the freedom to move up and down following the orbit of the hammer. Contrary to common belief, the hammer and the thrower's body do not rotate around the same axis. The axis of the hammer rotation is inclined by 15-30° from the vertical in the direction opposite to the direction of the throw in the first turn and by $\sim 40^{\circ}$ in the last turn, whereas the axis of rotation of the thrower's center of mass is also inclined back but much less than the former axis. This difference in



Figure 1

the axes' inclination causes a "flapping" motion of the arms relative to the torso during the turns. Thus the shoulder line should work like a cylindrical pivot allowing the rotation of the arm triangle in a vertical plane but preventing any sideways movements relative to the torso.

THE "DRIVE CIRCLE" AND THE ACCELERATION OF THE HAMMER

The orbit of the hammer's ball during its acceleration in turns can be described as a three-dimensional spiral—a sequence of inclined circles whose center propagates, from turn to turn, in the direction of the throw. The thrower accelerates the orbital speed of the ball in each turn by pulling on the wire in a special way: ahead of the momentary center of hammer rotation.

Slightly simplifying the situation, one can imagine the hammer as a "whip" with a heavy ball at the end of its "lash" (whose role is played by the wire and the arms), the other end being the midpoint between the thrower's shoulders (Figure 1). This latter point (we call it "Point X") is where, effectively, the "lash" of the "whip" is attached to its "handle"– the torso of the thrower. The thrower accelerates the hammer by moving the torso so that Point X follows a "drive circle" whose radius ρ is smaller than the radius *r* of the hammer's orbit.

The acceleration occurs because Point X is moved along the drive circle with a lead angle φ relative to the line connecting the ball of the hammer with the center of rotation (Figure 1). This makes the force of the pull F_p resolvable into two components: the centripetal force F_{cp} that keeps the ball on a circular orbit, resisting its tendency to move by inertia along a straight line, and the tangential force F_t that accelerates the hammer along its orbit.

It can be shown that the acceleration of the hammer is most efficient when the direction of the drive is perpendicular to the direction of the hammer motion. In this optimal case (it is shown in Figure 1), the tangential force speeding the ball up is

$$F_t = F_p \cdot \rho / L ,$$

where *L* is the length of the "lash" (wire plus arms). Thus, *the force accelerating the hammer is directly proportional to the radius of drive.*

DRIVING THE HAMMER WITH THE HANDS?

The situation presented in Figure 1 corresponds to the throwing style in which the shoulders are completely relaxed, the arms are passive, and the midline of the arm "triangle" is a mere continuation of the hammer's wire. This model is an adequate first approximation to the physics of the hammer acceleration, and a good theoretical guide for athletes of the initial and intermediate levels. However, with the development of technical skills, when the basic principles of the rotation with the hammer and, in particular, the correct footwork and the comfortable mechanical balance of the thrower/ hammer system (sufficient countering of the hammer) have become more or less automatic, the thrower may wish to increase the efficiency of the hammer acceleration by using his/her arms and hands more actively.

Suppose the thrower keeps moving the Point X along the same drive circle as before, keeping the freedom of the up and down movements of the arm "triangle" (to account for the difference of the hammer and thrower axes of rotation), but braces the muscles that control the sideways movements of the "triangle." The acquired stiffness of the connection between the torso and the arms excluding their relative sideways movements will allow the hands to be on the forefront of the hammer acceleration-to "push" the hammer actively to the left. This will



Figure 2: The addition $\Delta \phi$ to the lead angle ϕ is exaggerated for better clarity on the figure.

break the straight-line wire/arms and will effectively move the Point X farther from the axis of rotation increasing the radius of drive from ρ_1 to ρ_2 and the drive angle from ϕ to $\phi + \Delta \phi$ (Figure 2). Now the role of the handle of the whip is not played by the torso alone, but by the torso plus arms, and Point X shifts from the shoulders area to the hands.

The case marked in Figure 2 with the sub-index "1" corresponds to the original model, where the arms are just a continuation of the wire of the hammer. The base of the "arm triangle" moves counterclockwise along the circle of drive of radius ρ_1 . The pull of the hammer with the force F_{p1} creates the centripetal force F_{cp} and the tangential force F_{t1} .

The case marked with the sub-index "2" corresponds to the modification of the "whip" model when the "handle of the whip" includes not only the torso of the thrower but also the arms firmly braced to the torso, so that the torso and the arms rotate as a unit. It is seen that the increase of the drive radius and the lead angle due to the inclusion of the arm triangle into the "handle of the whip" tends to increase the tangential component of the pull force ($F_{t2} > F_{t1}$) and thus the effectiveness of the hammer acceleration.

CONCLUSION

We conclude that an advanced thrower should use not only his/ her legs and torso in the double support phase, while accelerating the hammer between its highest and lowest points, but should also use the arms and hands actively pushing the hammer to the left and down. In the single support phase the thrower does not influence the hammer actively, and the arms can be completely relaxed, without breaking the symmetry of the "triangle."

FROM THE EDITOR Continued from page 7128

creation of a new awareness by the athlete cannot only refine the level of skill but also make the expression of that skill more dynamic in a safer way.

In a true sense pre-hab is a component of progressive overload. Progressive overload is all about change, albeit little changes, but

DOHA, QATAR

if you understand progressive overload and believe in it then the fact that improvement necessitates change should be a no-brainer.

I have always felt that half of all injuries are preventable. I always worked diligently to safely accomplish the goals I needed with minimal risk. Push and back off, challenge and allow recovery. As for the other 50%, the space junk? I kept my eyes open and looked twice.

In this issue you can take an indepth look at why injuries happen. I've generated a joint complex by joint complex guide with suggestions and simple "tweaks" that can be easily and economically implemented into one's daily training plan.

Great Track And Travel Vacations



TORYO, JAPAN

WORLD RELAYS, Nassau, Bahamas. Tour dates: May 2-6. This increasingly popular event will again be held at Tom Robinson Stadium, Nassau, Bahamas. 4 nights at the British Colonial Hilton Hotel, adjacent to downtown Nassau. \$100 deposit per person.

U.S. NATIONALS/WORLD CHAMPIONSHIPS TRI-ALS, \$100 deposit per person now accepted. \$100 deposit per person now accepted. Drake University, Des Moines, IA. Probable dates, July 25-28.

WORLD TRACK & FIELD CHAMPIONSHIPS, Doha, Qatar. Tour dates: Sept. 26 - Oct. 7 (11 nights). \$1000 deposit/person.



OLYMPIC TRIALS. The site is undetermined at present—possibly Eugene, Sacramento? The scheduled dates are June 19-28, 2020. This is the meet that will

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select the U.S. team for the Tokyo Olympics, always one of the great meets of the quadrennium. \$100 deposit per person.

SUMMER OLYMPIC GAMES, Tokyo, Japan. Game dates: July 24 - Aug. 9. Tour dates: Entire Games—18 nights (Arrive July 23, Depart Aug. 10) or just for the track & field period—12 nights (Arrive July 29, Depart Aug. 10). This will be our 18th Summer Olympic tour. \$1,100 deposit per person.



U.S. NATIONALS/WORLD CHAMPIONSHIPS TRIALS, \$100 deposit per person now accepted. Probably Eugene.

WORLD TRACK & FIELD CHAMPIONSHIPS, Eugene, OR. We are accepting deposits for this, the first outdoor IAAF World Championships to be held in the U.S. We expect to have lodging, walking distance to the stadium. \$100 deposit. Aug. 6-15.

For more details, check our website: www.trackandfieldnews.com/tours

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ACHILLES CARE

Achilles injuries are rife among runners. In an extract from his book, *Running Free of Injuries: From Pain to Personal Best.* physiotherapist Paul Hobrough tells how best to look after the tendons. This article is adapted from *Athletics Weekly*, 11/24/16.

BY PAUL HOBROUGH

THE ACHILLES—the tendon that attaches the gastrocnemius and soleus muscles (known together as the calf muscles) to the calcaneus (heel bone)—is such a common area for runners to injure that only the knee can knock it off the top of the injury leader board. Pain is noticed more as Achilles stiffness initially, first thing in the morning. It's only when the pain starts to influence their running do runners repair to clinic in search of some answers.

COMMON REASONS FOR INJURY

Why the Achilles is such a common site for injury is largely unknown despite several internet articles suggesting that it's down to poorly fitting shoes, bad running technique or, my personal bugbear, overpronation. The fact is that we just don't know what the main cause is. What we do know is that the tendon itself



Achilles pain starts as heel stiffness, but can become debilitating

breaks down. When it becomes injured it affects the collagen fibers that make up the tendon and this causes stiffness and pain. The fibers have a shortlived period of inflammation and then what's left is a sort of inflammatory soup that causes disruption to the fibers, which creates the common bump seen on the distal third of the tendon.

During the acute phase (although these injuries are chronic in nature there has to be a starting point of injury which we refer to as acute or onset of injury), the additional fluid within the structure creates an opportunity for blood vessels to work their way into the tendon from the fat pad just anterior to the Achilles.

Early-stage management of an Achilles tendon injury is the key to success. In patients who present on first signs of soreness, it is highly likely that just the outer layer, known as the paratendon, will be inflamed. The paratendon can become Inflamed and irritated, causing similar symptoms to a fullblown Achilles tendinopathy.

The methods used to treat an Achilles have changed more times since I became a physiotherapist than the approach to any other injury. Research is always evolving in this area and there is a great number of research papers currently, largely owing to the increased numbers of those suffering.

PROGRESSION OF THE INJURY

Research indicates that the injury is caused by the Achilles breaking down, that the collagen fibers start to spread and ground substance (water-based, gel-like substance found in connective tissue) infiltrates the spaces between them.

With this expansion of the fibers comes an increase in Achilles size, usually in the distal third of the tendon,

just above the heel. The tendon is usually 0.6m from back to front and a thickened Achilles will increase towards a full centimeter. This can be measured using either ultrasound scan (USS) or magnetic resonance imaging (MRI). My preference is a USS as you can scan in real time, scan through movement and switch to dopla mode to look for blood vessel involvement.

Self-assessment

Try first squeezing the tendon along its length to see if you identify a clearly defined most painful spot. Take hold of the Achilles tendon with both fingertips and gently distort the tendon, lifting with one hand and pulling with the other so



ISOMETRIC LOADING

Start with isometric loading (muscle contraction without movement).

• Stand on the floor using the wall for balance if necessary. You can add weight through handheld dumbbells or a

filled rucksack (to keep your hands free) • Lift up on to your tiptoes and hold for 45 seconds

• Slowly lower down and return to the floor.

Hold this pose for approximately 45 seconds at a time and repeat four times. Move to single-leg isometric holds after a few days.

CONCENTRIC CALF RAISES

Perform concentric calf raises from the floor (moving

onto tiptoes before lowering yourself down). Move to double leg then single leg as you are able to progress. Do 3x15 reps per day for three

weeks. Eccentric loading is where you stress the muscle only on the return against gravity or resistance.

Therefore, you need to do as little work as possible to get into the start position on tiptoes, then work in a slow motion down to the end of your available ankle range (which has to be done single leg), 3x15 reps with weight on alternate days. Lower slowly, taking six seconds from tiptoes to end range, then raise up either with support or using the good leg back to the starting point.

it bends side to side. If this elicits pain, then, given nothing else is being manipulated, it's likely the issue does lie with the tendon itself. Try a stretch to the tendon (a calf stretch off a step) and if this also gives pain, you are likely to have an Achilles problem.

TREATMENT

A physiotherapist will use soft-tissue massage on the calf muscles and into the foot, ankle joint mobilizations and foot mobilizations. You may well be prescribed in-shoe orthotic inserts if the biomechanics of the foot and ankle are perceived to be at fault. Eccentric or appropriate loading as outlined above and on the next page are the key route to being free from this common running ailment.

Shock wave therapy

If all conventional treatment options fail, for those resistant tendons that just don't respond to the normal physiotherapy, there is shockwave therapy (SWT), a series of shocks derived from lithotripsy, which in layman's terms is breaking up of hard substances. Cells responsible for soft tissue and bone regeneration and healing are known as fibroblasts and osteoblasts. SWT has been shown to stimulate these cells and therefore promote healing. Finally SWT has a pain-reducing element to it, working on the brain's transmission of pain, first of all as a transient, shortlived pain reduction. However, it is also being shown to work on the "pain-gate", acting as a reset button for the perception of pain and therefore having potential long-term effects on pain reduction. Recent scientific study into SWT revealed 75% of patients reporting their Achilles pain-free at their six-month follow-up and a further 14% with greater than 50% reduction in pain.

Injection

Another option is high-volume injection, known as a bolus, whereby saline is injected between the tendon fibers and the fat pad that sits anterior to it, thus separating the two (similar to a surgical intervention).

Polypill

If you don't get better, a new polypill under a GP's guidance could help. Recent research in sports science has suggested that putting three medications together has a beneficial effect on chronic tendon issues. Doxycycline (a penicillin available on prescription), taken 100mg per day alongside 400mg of ibuprofen four times per day and as much green tea as you like make up the polypill. You are unable to self-administer this as you need a prescription from your GP for the Doxycycline, and just taking ibuprofen and green tea does not have the same effect at all, but may cause some stomach issues.

Surgery

Finally, while I am not an advocate, surgery could be an option. Instead of looking to perform surgery on the Achilles itself, some orthopedic surgeons favor cutting (resecting) the small muscle that sits alongside the Achilles "plantaris"— although not everyone has one to start with—as chronic Achilles pain can be attributed to an issue with the plantaris, and not the Achilles tendon itself. By having the plantaris surgically resected, some individuals have found their pain has subsequently gone.

SELF-TREATMENT

Self-treatment centers around three key types of muscle contractions:

- · Isometric contraction
- Eccentric contraction
- Concentric contraction

The key here is to understand how to do these contractions in the correct way at the correct time. Initially you may well be just matching resistance, contracting the muscle without movement known as isometric contraction. Then you can move on to eccentric exercises, whereby there is no load on the upward movement but resistance against the lowering back to the neural position. Finally, concentric movements are included whereby the muscle is being used in both the upward and lowering movements through range.

It is easier to explain these movement patterns in relation to the biceps muscles and the patient can then take this model on to the more complex ankle exercises.

The Achilles requires appropriate loading via exercise. "Appropriate loading" means loading the tendon using the best methods for that individual to stress the fibers for optimal healing.

It is universally accepted that eccentric loading of the Achilles tendon through the heel raise is optimal for healing. However, the patient may be in too much pain or lack the strength to achieve an eccentric contraction.

Heel raises, as in pushing up on to your toes, can be done in several different ways. The heel raise can be done from the flat surface up on to tiptoes, or lowering off a step, enabling a greater degree of movement into dorsiflexion.

This can be done single-leg and double-leg, as well as with the feet positioned for internal or external rotation. Such is the variety, it's difficult to give just one method of exercising all Achilles injuries, but the norm is shown in the illustrations on the previous page.



Paul Hobrough is a chartered physiotherapist at physioandtherapyuk.co.uk. He is lead physiotherapist for Lucozade Sport and Sweatshop UK and counts Steve Cram among his clients. *Running Free of Injuries: From Pain to Personal Best* by Paul Hobrough is published by Bloomsbury books and is available from amazon.com (\$23.56).



http://www.usatf.org/Resources-for---/Coaches/Coaching-Education/Calendar-of-Schools.aspx

Level 1

	June 29-Jul 1	Ithaca College - Ithaca, NY	
	July 7-8	Ironwood Throws Facility - Rathdrum, ID	
	July 20-21	The Orthopedic Specialty Hospital (TOSH) - Murray, UT	
	July 20-22	Johns Hopkins University - Baltimore, MD	
	July 20-22	Nassau Community College - Garden City, NY	
	Aug. 3-5	Yale University - New Haven, CT	
	Aug. 3-5	Bishop Gorman High School - Las Vegas, NV	
	Aug. 10-12	St. Martin's University - Lacey, WA	
	Aug. 11-12	San Diego Mesa College - San Diego, CA	
	Sept. 28-30	Community College of Philadelphia - Philadelphia, PA	
	Oct. 12-14	Marian University - Indianapolis, IN	
	Oct. 13-14	University of Southern Maine - Portland, ME	
	Nov. 10-11	Ventura College - Ventura, CA	
	Nov. 17-18	Allen High School - Allen, TX	
	Nov. 17-18	Wellesley College - Wellesley, MA	
	Nov. 24-25	Virginia Wesleyan University - Virginia Beach, VA	
	Dec. 1-2	Tennessee State University - Nashville, TN	
	Dec. 7-9	Westerville South High School - Westerville, OH	
	Dec. 8-9	Cerritos College - Norwalk, CA	
Level 2			
	Aug 6-10	Chula Vista Elite Athlete Training Center – Chula Vista, CA	
		Sprints/Hurdles/Relays, Jumps and Endurance	
	Dec 27-31	IMG Academy – Bradenton, FL	
		Sprints/Hurdles/Relays and Endurance	
Level 3			
	Dec 2-8	USATF/IAAF Academy	
		IMG Academy – Bradenton, FL	
		Sprints/Hurdles/Relays and Endurance	



To further elevate the professional credibility of the USATF Coaches Registry and its members, USATF has established a new **Education Standard** for qualification into the **USATF Coaches Registry**. The Education Standard provides for a baseline standard of professional education <u>or</u> coaching accomplishment in the sport of track and field for coaches seeking admission to the Registry.

By establishing a baseline standard of professional education or coaching experience, the Education Standard aligns with the best practices for professional certifications in other fields, within the coaching industry at large, and with licensing protocols of other Olympic family national governing bodies.

Overview

To be part of the USATF Coaches Registry, an individual must, currently, be a USATF member, undergo a background screen from approved screening agency, and have completed USOC Safe Sport training.

This Education Standard is a <u>one-time requirement</u>. Once a coach has met the Education Standard, he or she has fulfilled the requirement for as long as the coach is part of the Registry.

Timeline

The Requirement of the Education Standard to receive benefits of the Coaches Registry will take effect beginning <u>January 2019</u>. USATF coaches may begin adding their Education Standard to their Coaches Registry profile beginning fall 2018. Instructions to complete the process will be provided prior to the start of the enrollment period. Coaches should be prepared to produce proof of qualification if so requested.

Eligibility

Any person who has completed one of the approved coaching education courses for track or field or who qualifies based on career accomplishments as a track and field coach is eligible.

Meeting the Education Standard

There are two different paths to meet the Educational Standard for the Coaches Registry: Complete a verified educational course, OR achieve a specified coaching accomplishment.

Path 1: Complete a verified course of education. Complete any one of the following courses:

- a. Level 1, 2, or 3 of the USATF CE Professional Pathway of Coach Certification
- b. USATF Cross Country Specialist Course
- c. Completion of a USATF Event Skill Specialist Clinic (Learn By Doing)
- d. NFHS Coaching Track and Field (online) AND any approved sports science course on USATF Campus (online)
- e.Technical Basic course of the USTFCCCA Academy or any advanced course (online or classroom)

Certificate of completion for any of the above courses serves as verification of Education Standard.

Path 2: Accomplish an Education Standard equivalency during one's coaching career, through a body of work, a career honor, or demonstrated professional coaching career. *Demonstrate any one of the following:*

- a. Member of an international coaching staff selected by USATF over the last 5 Olympic quadrennials.
- b. Primary coach of record of a medalist athlete on any one of the "big three" teams (Olympics, World Champs, Pan-Am Games)
- c. Elite technical coach of USA National Team athletes over a 10-year period (coach must list athletes' names and contact information)
- d. Hall of Fame Coach for USATF, USTFCCCA or National Scholastic Track Coaches Association
- e. National Coach of the Year for USATF or USOC
- f. USTFCCCA National Head or Assistant Coach of the Year for men's or women's (NCAA, NAIA, or NJ-CAA) cross country, indoor or outdoor track & field
- g. Employment as a track coach at a scholastic or collegiate institution for a 10-year period verified by employers' information.

The USATF National Office staff will provide oversight of all components of the Coaches Registry. An oversight subcommittee from the Coaches Advisory Committee will review and evaluate any issue with a coach's education standard.

For more information, contact <u>Terry Crawford</u>, USATF Director of Coaching.



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Go to summer school on USATF Campus to propel your coaching knowledge. For a limited time, enroll in any course(s) on USATF Campus and receive 25% off.

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- Energy Systems and Motor Performance Abilities in Athletes
- Sport Specific Strength and Power
- · Acute Fatigue Due to Overtraining
- Chronic Fatigue Due to Overtraining
- Science of Skill Acquisition
- Training Science

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- Eligible Level 1 Recertification option for current certified coaches towards the 2021-2024 quad

Offer Details

Valid for 25% off any course(s) on USATF Campus. Must be redeemed by July 31, 2018. Enter coupon code **HEATWAVE25** in the check out on USATF Campus to redeem.

Learn more at courses.usatf.org



USATF is pleased to offer select grants for the 2018 year to assist coaches in opportunities to enhance their professional growth. All applicants must be a member of the USATF Coaches Registry to be eligible; program description, application deadline and additional criteria are outlined below. For additional opportunities and to submit a grant application, click the link below.

http://www.usatf.org/Resources-for---/Coaches/Coaching-Education/Special-Programs/2018/Coaching-Enhancement-Grants.aspx

Master Coach Fall Mentorship

Location: Chula Vista Olympic Training Center or a designated High-Performance Training Center where a Master coach is in residence.

Date: Fall Training season, October – December 2018

Application Deadline: July 31, 2018

Grant: Four (4) emerging elite coaches will be awarded up to \$800 towards expenses to visit on location a Master Coach to observe for 3 days of "on the field" routine as Fall training begins for the elite athlete. Locations to be selected: Chula Vista OTC; Los Angeles, California, Bradenton, Florida, Manhattan, Kansas, Eugene, Oregon. Applicants can request a Master Coach who must be approved by the Chair of the Coaches Advisory Committee.

Criteria:

- Member of the USATF Coaches Registry
- Level 2 Coaching Education Certificate in event being requested
- · Current high school, college, or professional elite coach
- Application to include a brief statement of how you can use the information
- Complete coaching resume submitted at time of application

USATF/IAAF Academy Course: Sprints/Hurdles/Relays or Endurance

Location: IMG Academy, Bradenton, FL

Date: December 2-8, 2018

Grants: Four (4) \$1640 grants towards tuition, academy expenses. All expenses must be receipted and submitted within 30 days of completion of Academy for reimbursement.

Application Deadline: October 1, 2018

The USATF/IAAF Academy is a high-performance course which earns a coach a USATF Level 3 Certificate and an IAAF Academy diploma in a specific event. An international faculty presents over 51 hours of lectures and laboratory sessions.

Criteria:

- Current member of the Coaches Registry
- · Coaching resume submitted at time of application
- Minimal of 10 years of coaching as a full-time head or assistant coach in an interscholastic, collegiate, or elite athlete club
- USATF Level 2 certificate in selected event
- Worked with athlete who has competed in USATF Junior or Senior Championships

PHILOSOPHICAL DIMENSION FOR TRACK & FIELD & CROSS COUNTRY AT ADAMS STATE COLLEGE

BY JOE VIGIL, WITH A FOREWORD BY TERRY CRAWFORD, DIRECTOR OF COACHING, USATF

Coaches are encouraged and inspired by their mentors to develop a personal coaching philosophy which frames the structure and organization of their track and field program. While one's philosophy may change with experience and life-long learning, the core of the coach's philosophy should be constant as it speaks to the values and belief system of the coach.

As the coach of today takes on new challenges each day, the article below penned by Dr. Joe Vigil to the Adam State track and field athletes in the 80's takes on a significant message. Dr. Vigil, USATF Legend Coach, currently coaches several of USATF's elite athletes and continues to attest to the principles in the article. This article was recently circulated among the Bowerman TC athletes and coaches. This club led by Jerry Schumacher, the 2017 Nike and National Coach of Year for USATF, is producing world class times in the endurance events. Some things are timeless!

The combined Track & Field & Cross Country programs at Adams State College have been labeled as one of the most successful in the United States. There are probably many reasons for this acclaim, but one stands out more than any other; a strong belief in the philosophy that athletics are a true function of education. Those that become firm believers in this educational doctrine achieve high degrees of success.

Athletes that come to Adams State College must pay close attention to the <u>qualities of mind</u> that are needed for athletic success. Most athletes are ready to make an effort in a race, few are ready to carry their efforts through months or years of training and racing. One quickly realizes that these are not overnight sports. The enthusiasm on which such persistence is built, "the impassioned will", is the possession of very few athletes. All that can be said is that it is necessary, and that it can be found but never imposed. Like Nurmi, Zatopek, Ryun, Viren and other great athletes: Each developed a degree of concentration and enjoyment, which was allied to a clear-sighted sense of purpose that reveals and creates the outstanding athletes that they were and are. These qualities also become inherent in the athletes at ASC. They achieve "All American Status", or become members of many national championship teams.

The athlete must understand there

can be no hurry. The fundamental condition of the body cannot be changed overnight, but it can be changed over a period of years, by intelligent, planned employment of all that is locked up in your personality. The athlete must listen, learn, persevere and perform. You must not turn back once you have started out. It is best described by the word *decision*, and it is not an easy thing to come by. It has to be part of the mind and character of an athlete.

If you decide there is to be no turning back you will have to be ready for many difficult experiences, simply because training and competing is at least very difficult and timeconsuming. Many times, injuries delay progress; it does not stop it. Also, illness may prevent training; the training can be resumed under these conditions. Athletes don't give up they work harder and dig deeper. One thing is certain, that the farther along the road you get, the more confident you become, and therefore, the more able to go on. For most athletes, there is one step back for every two forward. But this need not be so, the firmness of the forward movement will restrict the backward one.

In the beginning, our athletes do one thing; they take a long thorough look at what they wish to achieve, how they think it can be achieved and how long it will take them. The time that we spend surveying our ambitions is time well spent. We have to understand and study carefully the factors involved in long-term preparation.

Intelligent forethought is the foundation of success, and positive pride its creator; the thinking will map out a route and the pride will ensure progress along that route. Intelligence, seeking and using knowledge, is a necessary quality of an athlete. The more you know about training and competing, the better you will be as a competitor. The more self-respect you have, the more you will stay on the route that you have worked out. It certainly helps in all states of your training to have somebody to persuade and support you, but in the end you will train and race successfully because you want to, not because somebody else wants you to.

The strength of mind and character is perhaps best seen in those men and women who do essentially solitary deeds, or who carry out solitary responsibilities. The genuine athlete must have a strong spirit, vigorous and sane, not easily demoralized or defeated. The cultivation of this will power, or spirit is possible. It is capable of tremendous development under training and stimulus, or of near extinction under neglect. This development may not be purely mental. It is possible to train the nervous system, to nurture the reserves, to increase the body's durability. It is also possible to deplete the nervous energy and produce a malnutrition of spirit as well as of the body. All defeats do this and unintelligent overexertion of the will can break down the physique, and in turn, demoralize the athlete; thereby he defeats himself.

It is necessary to accept the very severe limitations under which the animal body must work: need for sleep, rest and proper diet, capacity to function only within a narrow range of temperature, sensitivity to any heavy and repeated loads of chemical fatigue. He must disregard slight signs of discomfort, learn to judge when he has started to break himself down rather than build himself up. The history of the sport is littered with the bodies of men who believed that all they had to do was exert an even will in order to succeed. Their successes finally were not much greater than that of men who lacked the necessary will; their disappointments and frustrations were bigger.

Nature cannot be hurried. There are no crash programs in the preparation of an athlete, though the iron-willed athletes who lack intelligence think there are. Men like Viren, Moses, Ovett, Rono and their kind believed and lived by the notion that years of training was necessary for athletic greatness to emerge. Cultivate your physical resources; don't try to thrash them into life, or you may end up destroying them.

The pride which has been mentioned as an integral part of the athlete's character operates to make him, or her, want to carry through whatever plans have been conceived. It also operates to make athletes want to beat other athletes. This, after all, is what sports is all about. There is satisfaction in beating a watch, there is more satisfaction in beating other runners. While this kind of pride should not become an arrogance that sees defeated opponents as necessarily inferior people, it will be a pride which, though unobtrusive, remain nevertheless, stubborn and evident to its owner. Such lack of modesty will belong to the athlete's nature. It need only function in training and competition, and even there, silently. The noisy athlete does well to remember that most of the world is not listening, and the interested public applauds the arrogant competitor who leaves his arrogance behind when he steps off the track.

Finally, the young athlete would be well advised to keep athletics in its place. Be passionately involved in the activity, exert yourself to succeed. Gain from competing the massive satisfaction that competing offers. Yet be a well-rounded, sensitive, literate human being. It is not the job of athletics to produce people who know, or care for nothing except athletics. Keep it in its place, behind your family, your concern for the general life of the world, and your education. There are athletes and coaches who prepare to act as if athletics were life; it is not. It is but a corner-and a rich one-of life, which will contribute immensely to the holistic development of the individual.

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