

# Sci planet

EYE ON SCIENCE

## SCIENCE EVERYWHERE SCIENCE AND SPORTS



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By: Maissa Azab

# Sporting Science

Speaking of "Science Everywhere", indeed, science is not just in all the places we occupy and use, but also in every activity we enjoy. The connection between science and sports should not be surprising; after all, all physical activities are connected to science because they are basically conducted by the human body. Yet, the connection between sports and science is not restricted to biology; it expands to physics, psychology, chemistry, among other fields of science.

To begin with, understanding the structure and mechanics of the human body is fundamental to know how to best exercise for the betterment of human health, and, of course, to play sports, whether recreationally or competitively. We must also understand the impact of the environment, as well as the chemistry of what a human body consumes, to know how to maintain our fitness and sporting ability.

It is also interesting to compare the human body physical features and capabilities to those of nature's athletes, from which we can learn, not only how to better our physical and sporting abilities, but also how to develop amazing devices and vehicles to make our lives better; as with cars and airplanes. On the other hand, as I can personally attest, we must realize the blissful impact exercising and sports have on our psychology, mood, and clarity of mind and thinking.

Naturally, the topic of our issue was partially chosen to coincide with the extremely popular occasion of the FIFA World Cup, in which Egypt played for the first time in almost three decades. The same motive is behind one of our features, which discusses sports injuries; a topic that had been at the center of Egyptian football fans' attention ever since the injury of our national team's most prominent star! Although we are saddened by the outcomes of our team's performance in the tournament, we are definitely hopeful our team would redeem itself in the coming years; a prospect that requires more attention to science, among other aspects.

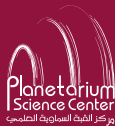
An even more important global sporting event is the Olympic Games, the next edition of which takes place in 2020 in Tokyo, Japan. Olympics is an opportunity to celebrate all sports, not just football; likewise, the Paralympics are the highlight of para-athletics, where human physical ability is more emphasized than ever.

We hope you enjoy the issue and encourage you to follow our online magazine at [www.bibalex.org/SCIplanet](http://www.bibalex.org/SCIplanet), where we will be posting further pieces about this topic. If you do not already receive our monthly e-newsletter and wish to, please write to us at [COPU.Editors@bibalex.org](mailto:COPU.Editors@bibalex.org).



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# Running for Happiness

By: Shahenda Ayman

**“Exercise is medicine” is not just a saying; it is the truth.**

Much scientific evidence proves that regular exercise—running in particular—has health benefits that go far beyond any medicine a doctor could prescribe. Studies have shown that running can prevent obesity, Type 2 diabetes, heart disease, high blood pressure, stroke, some cancers, and many other unpleasant conditions. Additionally, scientists have discovered that running also improves the quality of your emotional and mental life.

Running is an aerobic cardiovascular exercise that sends nourishing blood to the brain, which helps you think more clearly; it also makes your body release hormones like serotonin or dopamine, which help in alleviating depression. As it enhances your attention and focus, running is a viable treatment for attention-deficit/hyperactivity disorder. It also promotes all kinds of changes in the brain, including neural growth, reduced inflammation, and new activity patterns that promote feelings of calm and well-being.

Chronic stress and depression stop the birth of neurons, or neurogenesis in the brain, and shrink the hippocampus, which is the region in the brain responsible for learning and memory. This leads to cognitive deficits, where the patient has difficulty processing information and acting accordingly; running does the opposite and increases neurogenesis in the hippocampus.

With its ability to generate new nerve cells, running prevents neurodegenerative diseases as dementia, where the neurons lose their ability to function properly and eventually die. Consistent exercise can actually bring about structural changes to your hippocampus, slow down neurodegeneration, and improve learning and memory retention. It can particularly help the patients of Type 2 diabetes, who have higher risks of Alzheimer's disease and dementia.

Not only that, but running also stimulates the body to release endorphins, which are popularly known as happiness hormones. They are secreted in maximum quantity when your body is subjected to intense exercise—such as running—

which increases blood circulation to the brain, prodding the Hypothalamic-Pituitary-Adrenal (HPA) axis into releasing the endorphins. As a result, your body deals with stress better.

According to a study conducted in 2017 and published in the *Journal of Adolescent Health* “30 minutes of running during the week for three weeks boosts sleep quality, mood, and concentration during the day”. Another study in Physiology Behavior showed that running causes the same kind of neurochemical adaptations in brain reward pathways that are shared by addictive drugs.

Scientists found that running was as effective as an intervention for depression as psychotherapy. When study participants were assigned to one of three groups—a running group, Cognitive Behavioral Therapy (CBT) group, and a group that received both interventions—the three groups experienced a similarly significant decline in depressive symptoms, with little difference in outcome between the running and CBT groups.

Additionally, when you are under stress your muscles may be tense, especially your face, neck, and shoulder muscles, leaving you with back or neck pain, or painful headaches. You may also experience problems such as insomnia, heartburn, stomach ache, diarrhea, or frequent urination. The worry and discomfort of all these physical symptoms can in turn lead to even more stress, creating a vicious cycle between your mind and body.

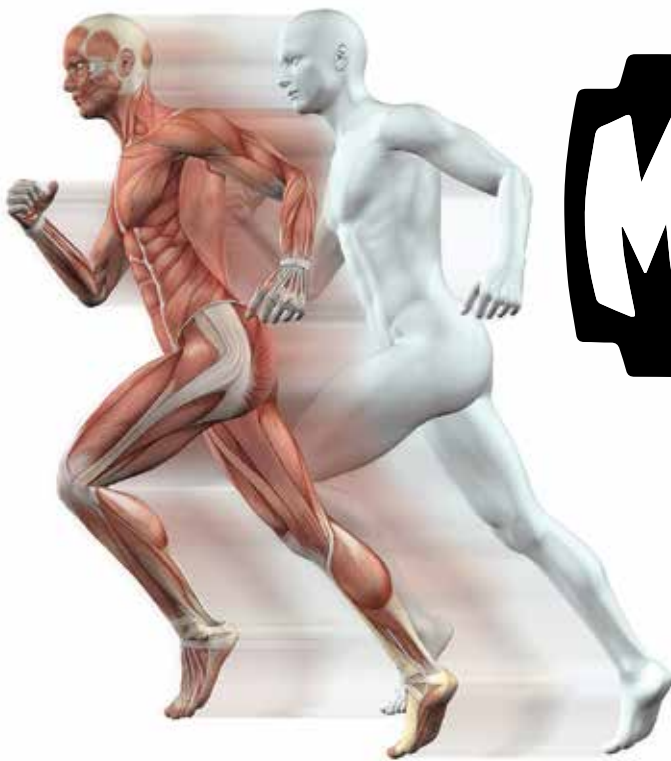
Running is an effective way to break this cycle. Besides releasing endorphins in the brain, physical activity helps relax the muscles and relieve tension in the body. Since the body and mind are so closely linked, when your body feels better, your mind will be better as well.

Even moderate amounts of exercise can make a huge difference to your health and wellbeing. It does not matter what your age or fitness level is, use exercise as a powerful tool to feel better. You can start slow, but you have to start now

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# MUSCLES AT WORK

By: Basma Fawzy

Since early childhood, we are often told to eat so that our muscles would grow. We know from the beginning that strong muscles are vital; however, our idea of muscles reflects unrealistic fantasies about strength. We dream of having huge muscles as Popeye whose biceps grow bigger when he eats spinach to show that we are superheroes.

When we think of muscles, we think of Popeye; as a result, the truth about muscles, their function, and how sports can help us improve them is often unnoticed. Today, we leave Popeye's fictional world and provide an overview of the types of muscles, focusing on skeletal muscles and sports, and what sports can "truly" do to the muscles.

What normally comes to mind when muscles are mentioned are skeletal muscle those responsible for motion and carrying heavy items. However, those are not the only type of muscles that we have; we actually have three types of muscles: cardiac, smooth, and skeletal. Smooth muscles are involuntary; their movements are beyond conscious control.

The bladder is a smooth muscle; when it contracts, it pushes urine outside the body. The uterus is also a smooth muscle; this muscle is responsible for pushing the baby outside the mother's

body. The stomach is another smooth muscle; its contraction and relaxation control the movement of food inside the body. The heart is also a muscle; it is the cardiac muscle and it is the most powerful muscle in the human body. With every beat, it pumps out about 71 grams of blood, which makes up to 9450 liters of blood per day. It works every second of every minute of your life, non-stop. The heart muscle is, of course, an involuntary muscle; it ensures the organs receive enough blood to function properly.



Muscle structures vary according to their type. Smooth muscles are nonstriated; they do not have the stripy appearance characteristic of skeletal muscles. Its contractions are slow and triggered by neurogenic impulses. Cardiac muscles, on the other hand, are striated; they are controlled by "the

autonomous nervous system" and even without any nervous input, contractions take place thanks to cells in the heart known as the "pacemaker". The heart muscle is strong due to the presence of huge amounts of mitochondria, which are organelles responsible for generating power in the cells and sufficient blood supply.

To perform any movement, from playing football, tennis, lifting weights, or just typing words on the keyboard, skeletal muscles play a significant role. They are surrounded by a layer known as the "Epimysium", which prevents friction with other muscles or bones. Every skeletal muscle has bundles of fibers known as "fascicle"; again, muscle fiber is protected by a tissue called "Perimysium". Each bundle has fibers; their number depends on how large the muscle is. The diameter of muscle fiber ranges 10–80 micrometers, and is covered by a tissue called the "Endomysium".

Between the muscle fiber and the endomysium lies the fiber cell membrane, sarcolemma; beneath it lies the sarcoplasm, which is this type of cell's cytoplasm—a fluid found in most cells containing fat, glycogen, and the mitochondria, which is the power machine of the cell. As for the muscle fiber, it has cylindrical organelles called "myofibril"; the fiber contains hundreds to thousands of myofibrils which in return contain bundles of Actin and Myosin—the proteins responsible for contraction. Nerve impulses pass from the sarcolemma through the myofibril.



## Movement

When we play sports or just move around, we move when nerve impulses reach the muscle. Once a signal reaches the muscles, chemical reactions start inside the muscles; they force the fibers to re-organize themselves creating contractions. Once the signal disappears, the muscle relaxes.

There are more than 600 muscles in the body, most of which are connected to bones; those muscles are responsible for every single movement you make. For example, when we run, we use many muscles such as the quadriceps, hamstrings, glutes, hip flexors, and calf muscles. When we run, the main muscle that moves is the quadriceps, located at the front of the thighs; it helps in bending and extending the knees, and protects your knees when your feet hit the ground. Even the rectus abdominus muscle\* that seems insignificant during running is vital because it helps the body in twisting and turning.

When we think of muscles, we only think of movement; however, this is not the only function of skeletal muscles. Beside movement, skeletal muscles control

strength training is always mentioned, such as weight lifting, resistance exercises, pushups, squats, lunges, planks, or anything that targets muscles.

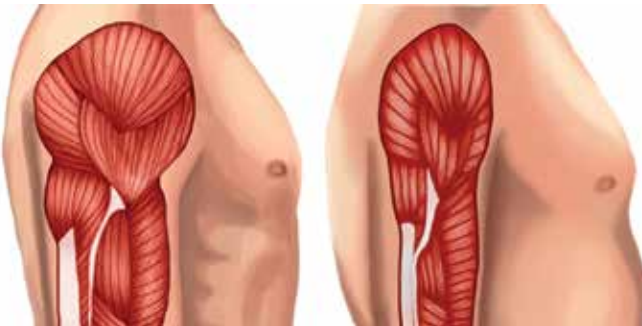
Some exercises target one group of muscles, these are known as Isolation Exercises. Other exercises target different muscles simultaneously, and those exercises are compound exercises. Of course, the more muscles are worked is better; working many muscles at the same time improves the body's overall strength, coordination, and performance.

Swimming is one of the major sports that use many muscles at the same time. Maintaining muscle health can also be achieved through stretching, which improves muscle flexibility and range of motion. Professional athletes and trainers know the importance of stretching; after working their muscles, they stretch. Yoga is a training program that includes muscle stretching beside its spiritual and mental benefits. Another training program is Pilates, which also stretches the muscles. Playing sports or exercising without stretching is ineffective; start stretching for healthier muscles.



promoting muscle growth. Magical as it may seem, there are serious side effects that arise from taking Anabolic Steroids, depending on the dosage and age. If taken by adolescents, Anabolic Steroids inhibit growth; they also raise cholesterol level and damage the liver, and may cause strokes and heart attacks.

Another substance that some athletes use to improve their performance is Human Growth Hormone (HGH). This hormone improves athletic performance and endurance; however, like Anabolic Steroids, it has many side effects. Side effects include swelling of muscle tissue, joint pain, as well as increased risk of diabetes and colon cancer.



Now that we know the structure of our muscles and how to keep them healthy, exercising should be a priority in our life. Exercising does not just make our biceps muscles large like Popeye's; it helps us maintain good posture, and good posture protects our joints from injuries. Nothing improves muscles better than getting them into action; so play sports and stretch to keep your muscles healthy.

stability; muscles known as the trunk—including abdominal muscles, pelvic muscles, and back muscles—control the balance of the body. Moreover, muscles maintain the body posture; weak muscles lead to misalignment. Strengthening your muscles is key to maintain not only good posture, but also to prevent joint injuries, as people are more likely to harm joints if their muscles are weak and do not provide sufficient support.

## Sports and Stretching

Keeping muscles healthy is a priority to anyone who wants to be healthy. Muscles love challenges; playing sports and exercising regularly are, thus, important. When it comes to muscles,

## Muscles and Hormones

Some people care about how large their muscles are, and to increase muscle volume, you should work hard. Bodybuilding is among the exercises that increase muscle size; it includes moving heavy loads, which forces the muscles to contract. The muscle contractions raise the number of contractile filaments, which in the end increases the muscle size.

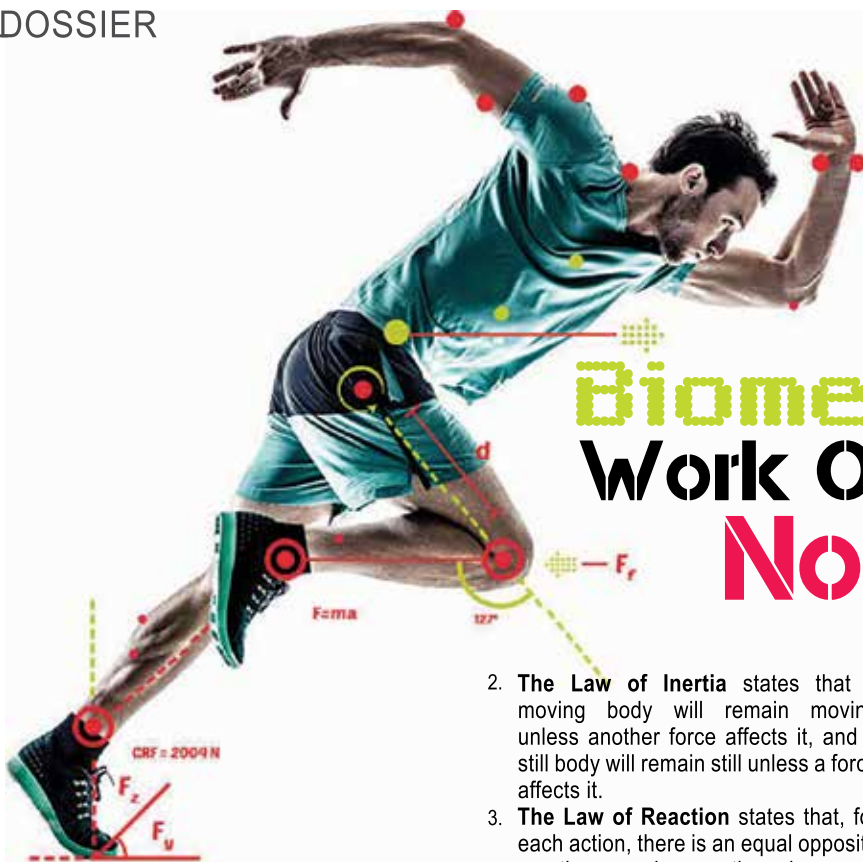
Some other people are not into working hard to improve their muscle size and performance; they, unfortunately, resort to hormones to increase their muscle size without any effort. They take Anabolic Steroids that are derived from Testosterone—the male hormone—which is responsible for maintaining and

## Glossary

\***Rectus abdominus muscle**, also known as the "abdominal muscles" or "abs", is a paired muscle running vertically on each side of the anterior wall of the human abdomen, as well as that of some other mammals.

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**“Biomechanics is an extensive interaction between biology and mechanics.”**

# Biomechanics: Work Out Smarter, Not Harder

By: Mona Shehata

Biomechanics is the science that studies the body motion; according to The American Society of Biomechanics (ASB), it is an extensive interaction between biology and mechanics. Biomechanics comprises several subfields; from amongst them, we shall shed light on Sports Biomechanics. As the name implies, this subfield aims at improving performance and reducing injury threats in exercise and sports. Generally, it can help prevent injuries, know their causes and treatment methods—as using prosthetics and improving walking devices—and treat other injuries.

First, there are some terms that we need to know. For example, the term “force” refers to any movement that alters the body movement or that of the equipment used, such as a racket. “Movement” is primarily due to muscle movement, but is also affected by external forces in the surrounding environment. While the force spins a body limb or the racket, the result creates a “torque”, the importance of which in tennis lies in the serve power—it occurs due to a spinning torque at the shoulder joint to produce more force.

Second, we must also know Newton’s Laws of Motion:

1. **The Law of Acceleration** determines the amount of movement generated by the force. For example, when a player increases his legs’ strength by training while keeping his mass fixed ( $F = ma$ ), he will be able to run faster using his legs due to having better agility and pace.

2. **The Law of Inertia** states that a moving body will remain moving unless another force affects it, and a still body will remain still unless a force affects it.
3. **The Law of Reaction** states that, for each action, there is an equal opposite reaction, such as the downward force of the legs on the ground and the ground’s upward reaction, which enables the players to run on the pitch.

Now, let us delve more into sports biomechanics. This branch is concerned with analysing a person’s movement while exercising by applying the laws of physics and mechanics. It examines people’s motion while playing sports, and accordingly instruct them to do it more efficiently. For example, it can help improve how you run or how you swing a golf club by recording and reviewing the tapes to make recommendations.

Sports biomechanics also contribute to developing and manufacturing sports clothing, equipment, and shoes, as well as constructing sports fields and facilities. For example, it offers the scientific bases for designing a racket that would provide a better grip or a shoe that would improve running. It also analyses sports methods and training approaches, and consequently introduces new, more effective ones. For example, it has been found that hand placement in swimming has an effect on propulsion.

Another example is from the 2010 Football World Cup, where players criticized the “Jabulani” ball; strikers and goalkeepers said that it had a strange and unexpected trajectory. After scientifically inspecting the ball, the results backed the players’ claims, revealing that the ball was too round to fly in a straight line. A contributing factor was its internal seams,

which turned the ball to a perfect circle. On the other hand, the unevenness of a ball’s texture enables a more fixed and controlled flight, which is what enables the baseballs’ curving and the tennis balls’ spin.

Now, let us shed some light on some other subfields of biomechanics. For example, occupational biomechanics analyses and perfects the employees’ mechanical interaction with their surroundings. It aims at improving the employee’s performance without jeopardising their safety. Thanks to it, new furniture, tools, and other factors that helped reduce work pressure were introduced.

On the other hand, there is clinical biomechanics, which uses mathematics and mechanics facts and techniques to understand and evaluate ordinary and non-ordinary human anatomy and physiology. Clinical biomechanics specialists have a great interest in the creation and development of artificial limbs. This has resulted in a significant development in physiatry, as well as the enhancement of orthopaedic implants’ mechanical effectiveness.

Furthermore, it aided in developing walking devices for people suffering from lower-leg amputations and kids suffering from cerebral palsy. It also inspired the creation of new wheelchair designs, as well as improving the surrounding environment, like the stairs to provide better mobility for the disabled.

It is marvellous how science can leave its positive stamp in every aspect of our lives, fostering our performance, promoting our abilities, and making life much easier for everyone.

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# Let Us



By: Basma Fawzy

Have you ever thought how that bar of chocolate you ate is stored in your body as fat? This is where metabolism comes in; it is a vital, ongoing process that is responsible for transforming the food we eat into energy or fat through numerous chemical reactions that take place inside the cells. When we eat, the enzymes in our digestive system break different nutrients in our food, turning them into something else that we can use as energy; amino acids, fatty acids, and simple sugars. However, not everything we eat is transformed into energy that we use right; sometimes, food is stored as fat.

Metabolism involves two activities. The first is “anabolism”, which is responsible for building tissues and saving energy that the body can use later; this includes creating new cells and repairing tissues. The second is “catabolism” and it is responsible for producing energy. So, where does burning fats fit in? This requires a glimpse at the term “calorie”, after which we can tell how exercise and which exercises help in speeding up metabolism and burning fat.

A calorie is a measurement of energy a certain food provides to the body; if you take more calories than your body needs, they will be stored as fat. Knowing what we now know about metabolism, anabolism, catabolism, and calories, how does exercise contribute to the fat burning process? In exercise, what influences fat-burning metabolism is what is known as Excess Post-Exercise Oxygen Consumption (EPOC). After exercise, the body seeks to recover and return to its resting state; hence, the EPOC process takes place. It includes restoring normal breathing, decreasing body temperature,

and re-oxygenation of blood; it requires energy and consequently expends more calories burning by more fat.

Are there certain exercises that help us burn calories and lose weight faster, or do all activities count? By building muscle mass, you can increase the rate of burning calories; 0.45 kg of muscle burns more calories a day at rest than fat. As such, increasing muscle mass is relevant when trying to lose weight. When you think of muscle mass, you think only of weight lifting; however, it is not the only way. Many other exercises help, such as push-ups,

**“When you think of muscle mass, you think only of weight lifting; however, it is not the only way.”**

pull-ups, abdominal crunches, lunges, and leg squats. Resistance tubing also works; if you like, you can also use free weights such as dumbbells and choose the weight that is most suitable for you.

There are other factors that can affect the rate of metabolism and cannot be controlled; these include genetics, body size, hormones, weather, and gender. Moreover, as you age, your metabolic rate becomes slower due to the loss of muscle mass, which you can improve by exercising. Furthermore, certain diseases slow down metabolism, such as diabetes and hypothyroidism—underactive thyroid. The thyroid gland of people who suffer from hypothyroidism does not produce enough of the thyroid hormone the body needs; as a result, their metabolism slows down and they gain weight. On the other hand, Type 2 diabetes slows metabolism as the body

If you are on a diet or know someone who is, then you have definitely heard of “metabolism”. We often hear people saying that one must do this or eat that to speed up metabolism, normally mentioned in reference to “burning fat”. What most of us know about metabolism is its miraculous ability to turn the overweight into healthy, slim human beings; let us then find out more about metabolism, while focusing on which exercises specifically improve it.

becomes resistant to insulin because of its elevated levels. Elevated insulin levels deter fat metabolism and increase fat storage.


By making healthy food adjustments and exercising, you can foster your calorie burning and lose weight. There is no magical trick that speeds up the rate at which your body burns calories while at rest, that is your basal metabolic rate. Yet, by eating right and building more muscle mass, you will burn calories. There are no shortcuts, so eat healthy and exercise, and your body will thank you for it.



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# EXERCISE PHYSIOLOGY

By: Mona Shehata

Exercise physiology is the science that studies the body's response to physical activity and sport. It aims at understanding how the body works when carrying out exercise, in addition to setting programs that improve physical fitness and help in weight loss, as well as controlling and preventing certain diseases. Research concluded that the correct combination of exercise duration and intensity enhances the quality of life and improves life duration. Exercise physiology reduces chronic health issues and obesity; it can manage and prevent certain illnesses and injuries, including cancer, diabetes, disabilities, as well as mental health illnesses.

Exercise physiology undertaken within hospitals concentrates on developing an exercise schedule based on the objectives, health risk aspects, physical capabilities and/or illness, providing lifestyle changes in order to enhance physical fitness and general health, and creating a home exercise schedule if possible and necessary. Outside hospitals, it can control your health problems, decrease the risk of hospitalization, and recover faster.

When people work out during hot weather, they lose a lot of fluids through sweating, leading to dehydration, which leads to a decline in exercise effectiveness and fatigue. Research discovered that the body has a coping mechanism when the supply of oxygen and blood flow decreases, through calculating blood flow to the brain, the blood speed, and the width of the internal carotid artery, which is the primary vessel providing blood to the brain. These calculations make it possible for us to discover the difference between the oxygen quantity entering the brain and determining the amount used in the metabolic process.

This research was carried on ten trained male cyclists to reach fatigue in hot weather and compare dehydrated and hydrated cases in a controlled environment. The published experiment findings state that exercising to the point of tiredness and dehydration result in a rapid decrease in brain blood flow; to make up for this, a rise in oxygen extraction from blood flowing in the brain preserves the brain's capability to process oxygen and operate. These findings prove that the brain handles pressure and dehydration resulting from exercise better than muscles.

This makes sense since any little deterioration in the brain functions could have dangerous consequences, such as impacting the process of making plans and visuospatial processing. As the cerebral functions are affected, concentration decreases and this can have a serious effect, for example, when driving. Studies show that dehydrated drivers make more mistakes than hydrated drivers in a two-hour journey; this is like driving intoxicated by alcohol or sleep-deprived.

Dehydration is split into three classifications: mild, moderate and severe. Mild dehydration occurs when you lose 1–2% of your body fluids; this will provoke your thirst mechanism, indicating that you should drink. In mild dehydration, you lose up to 5% of the body fluids. Severe dehydration, leads in the long run to high cholesterol, fast heartbeat, a decrease in blood pressure, trouble breathing, slow metabolism, and premature aging indications, such as dry skin. According to research findings, consuming almost half-a-liter of water daily improves your metabolism by approximately 30%; it also discovered a 2% dehydration result in a 10% decrease in exercise efficiency.



Indications that you are dehydrated include excessive hunger, especially sugar hankering, which implies that the body needs additional water. In general, hunger is the first indication of dehydration; therefore, if you are hungry, drink a glass of water and wait twenty minutes before eating something. Furthermore, you could suffer from chills and fever, muscle cramps, headaches, infrequent and dark colored urine, and weak concentration. Fever can aggravate dehydration, because higher fever leads to more dehydration; further indications are delirium and unconsciousness, which occur in the case of severe dehydration.

Dehydration leads to muscle cramps, especially when exercising in the heat; moreover, when the muscles do more work they stop working normally as a result of heat. Furthermore, electrolyte variations, like potassium and sodium, may result in



muscle cramps. However, heat is not the main factor causing dehydration as it happens in cooler weather if you do not consume fluids during exercise, but it takes longer in cold weather and the signs may be less serious.

Headaches and migraines can result from mild dehydration. It is more difficult to discover the exact reason of the headache, so the best option is to drink a glass of water and stay hydrated all day to relieve the pain. Moreover, there are several methods to know your hydration level:

1) The Skin Test: Pinch your skin; if it stays in this position for a while before returning to its normal state, then you are dehydrated.

2) The Urine Test: After urinating, consume 11 milliliters of water/kilogram of body weight. After an hour, urinate into a collection cup; if the urine amount is notably less than the water you drank, then your body is retaining water, which means you are suffering from dehydration.

3) Urination frequency: Nearly all people urinate four to seven times a day according to their bladder size. So, if you urinate fewer than four times or do not urinate at all, then you need to drink more water.

4) Urine color: The greater the water amount present in the body, the easier the kidneys combine it with waste and the lighter the urine color is. If it is darker, this indicates that the kidneys are doing more in collecting waste from the body and getting rid of it without leading to further dehydration.

5) Urine smell: Urine should be odor-free; its smell will rely on your dehydration level, the food consumed in the last 24 hours, and if you suffer from a bladder infection or not. The higher the urine concentration, the more it smells like ammonia.

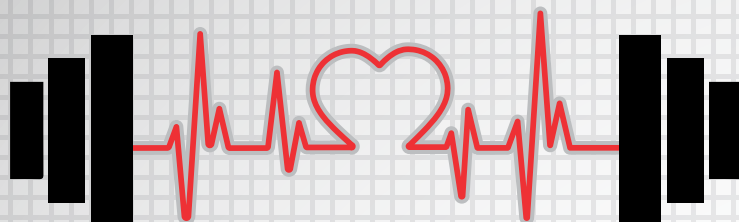
Hereunder are some daily changes to make to remain hydrated:

- Have a water bottle next to you; this will make you subconsciously drink more.
- Drink unsweetened tea with various flavors so as not to get bored of drinking water.
- Substitute your dry snacks, such as chips, crackers, and pretzels, with snacks that have more water content, such as fresh and frozen yoghurt, or fresh smoothies.
- Eat more fruits and vegetables, since fruits contain more than 90% water; for example, bell pepper, cantaloupe, cucumber, and watermelon, among others.
- Drink more when eating and that will make you eat slower and remain hydrated.

We should pay more attention to exercise physiology to be able to boost our exercise regime and improve our quality of life. However, we must not forget to drink fluids regularly while exercising to stop the variations in body mass and temperature.

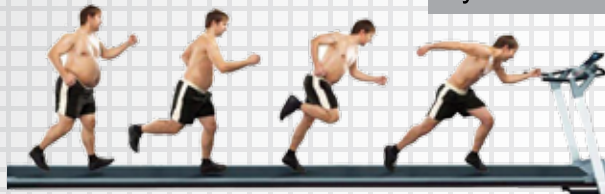
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# Cardio EXERCISES

By: Basma Fawzy



Do you want your heart to love you? How about performing some cardiovascular exercises, also known as “Cardio”? Your heart is a muscle and it pumps blood relentlessly and tirelessly; muscles love to be challenged in exercises that increase their endurance and strength. As a treat to the most important muscle in your body, you must indulge in activities that keep it healthy for the sake of living a long, fulfilling life.

When it comes to different exercises out there, your heart loves cardio; cardio activities, after all, are named after the heart—*Kardia* is the Greek word for heart. So, why do cardio exercises take their name from the heart? Any cardiovascular activity raises the heart rate and respiration; moreover, cardiovascular activities involve moving large muscle groups in a repetitive motion. Cardio lowers bad cholesterol level (LDL); any activity that lowers bad cholesterol levels is a heart-friendly activity.

The good news is cardio exercises are not difficult; there are two types of cardio exercises: high impact and low impact. In high impact exercises, both feet are not

on the ground; a high impact exercise includes jumping or jumping rope. On the other hand, in low impact exercises, one foot must be on the ground; this includes taking a brisk walk, jogging, or running. Low impact exercises are fit for those who have problems with their joints; it reduces the impact on them as they hit the ground, while giving people the chance to exercise without stressing their already aching joints. If you are not fond of walking or running, there are numerous activities out there that are heart-healthy; one popular cardio activity out there right now is Zumba. Zumba consists of dancing moves that varies in intensity; it is an enjoyable way to raise your heart rate and stay fit.

Instead of just focusing on biceps or triceps—that does not mean those are not important—you should focus on the relentless muscle that gives your life its pulses and do more cardio.

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# COMMON

By: Sara Khattab

# SPORTS INJURIES

## Shoulder Injuries

The shoulder is the most mobile joint in the body due to the joint's ball-and-socket structure, which makes it vulnerable to different injuries. Athletes of sports who depend on using the arms or need a lot of contact—such as rugby, wrestling, handball, and weight lifting—are prone to shoulder injuries.

Falling on the outstretched arm heavily can cause shoulder injuries; this is what happened to Mohamed Salah. He was diagnosed with a sprained shoulder, where the ligaments are torn or stretched; a shoulder sprain can cause swelling, bruising, stiffness, or instability of the joint. A sling may be useful to take weight off the shoulder; physiotherapists use electrotherapy treatment to reduce pain and inflammation, in addition to some exercise to strengthen the shoulder muscles and ligaments. A sprained shoulder may need 2–8 weeks to fully recover according to the severity.

Shoulder dislocation is the most common shoulder injury; it happens when the humeral head—the round part of the upper arm bone—is partially or completely detached from the shoulder's socket. The shoulder joint can be dislocated in different directions; according to the direction of the dislocation, the doctors will determine the method of treatment and the time for recovery. In some cases, a dislocation may tear ligaments or tendons in the shoulder or damage nerves, which may require surgery to repair.

An athlete with a dislocated shoulder usually suffers from swelling, numbness,

weakness, bruising, and unsteadiness in the shoulder. Recovering from a shoulder dislocation requires resting the arm in a sling for a few days. After the swelling and pain decrease, the injured player can start physiotherapy, which includes some gentle arm and shoulder exercises that help reduce the stiffness and build up strength in the shoulder muscles. It takes 12–16 weeks to completely recover from a dislocated shoulder.

## Tennis Elbow

Playing tennis or other racquet sports can cause tennis elbow, clinically known as lateral epicondylitis; this injury occurs due to the exhaustion of the elbow tendon by the repetitive motions of the wrist and arm. The inflammation of the tendons that join the forearm muscles on the outside of the elbow leads to pain and tenderness on the outside of the upper forearm, just below the bend of the elbow. Lifting or bending the

arm can cause pain, which can extend to the wrist, leading to a weak grip.

Tendon injuries heal slowly; tennis elbow can last for several weeks or months, and can heal on its own without treatment. Simple treatments can help reduce the pain; most importantly resting the injured elbow and stopping the activity that caused the problem. Using support bandage or splint is recommended; physiotherapists use some techniques, such as massaging and muscle manipulation, to relieve pain and stiffness, and encourage blood flow to the arm. In some cases, if the pain lasts for more than one year, doctors recommend surgeries.

## Knee Injuries: ACL Tear

The knee is a complex joint made up of many structures, such as bones, cartilages, tendons, and ligaments, any of which can be injured. Athletes who participate in sports activities needing stress on the knee, such as football, basketball, tennis,



**F**ootball fans, especially Egyptians, were devastated by Mohamed Salah's injury in the final match of the Champions League last May. Egyptians were worried his injury would prevent him from participating with the national team in the FIFA World Cup 2018. They keenly researched his injury, how long it would take to recover, and what methods of treatment he would depend on.

Athletes and people who work out are always prone to injury. Poor training methods, muscle weaknesses, unsafe exercising environments, and accidents are the main causes for sports injuries. Moreover, if an athlete is not properly ready to play sports, or does not warm up or stretch muscles before playing, this can also lead to injuries. Here is a brief account of common sports injuries.

and volleyball, are prone to different knee injuries: fractures, dislocations, sprains, and ligament tears.

The most common knee injury is the tearing of the Anterior Cruciate Ligament (ACL), which is responsible for the movement of the knee back and forth. The ACL is usually torn due to sudden stopping, sudden change of direction, landing from a jump wrongly, or being hit directly to the knee. After injury, athletes will not be able to bend or straighten their legs because of the pain; their knees will swell within the first 24 hours.

There are mild ACL tears that could be treated by ice compression, medications, and a short rehabilitation program. Complete tears are more common and require surgical treatment where the torn ligament is replaced by a substitute graft made of tendon. Post-surgical treatment includes an aggressive physiotherapy that helps restore full knee motion, strength, power, and endurance; recovery from this injury will need 6–9 months.

### Groin and Hamstring Strains

These injuries are common among athletes who practice sports that require a lot of sprinting and jumping, such as runners, football, and ice hockey players. These sports require the continuous contraction and release of thigh muscles during competition and practice.

A groin strain is a muscular tear or rupture to any of the groin muscles; usually one of the adductor muscles on the inside of the thigh or the front of the hip. Groin strains cause pain in the inside of the thigh while running or walking; pain can increase when injured athletes bring their legs together

or raise their knees. On the other hand, hamstrings are a group of three muscles at the back of the thighs; they attach the large thigh muscle to the bone. Hamstring strain occurs when any of the tendons or muscles are overstretched.

There are three grades of groin strains; in all cases, you have to stop doing any activities that may cause pain until the strain is healed. Immediate first aid interference in the first 24–48 hours will help reduce the swelling; mild to moderate groin strains can heal within few weeks, while severe injuries may take up to 6 weeks. Some severe strains may need surgeries to repair the torn fibers, especially where the tendon is involved.

Athletes who suffer from hamstring strain may feel some tightness in the back of the thigh; most hamstring strains heal with simple non-surgical treatment. The therapist may recommend wearing a knee splint for a short period of time to keep the leg in a neutral position to help the muscles heal. Physical therapy also helps restore the motion and strength of the thigh. There

usually takes between a few days and 6 weeks for tendinitis to heal.

If you hear a pop at the back of your heel followed by an immediate sharp pain in the back of your ankle and lower leg that will affect your ability to walk or step on your foot, this likely means that the Achilles tendon has ruptured. In this case, a surgery may be needed to fix the ruptured tendon; with the help of physiotherapy after surgery, you can return to normal activity in 4–6 months.

### Ankle Sprains

Most professional athletes and anyone practicing sports such as running, basketball, tennis, and football are prone to ankle sprains. A sprained ankle usually occurs when the foot turns inward due to wrong movement, stepping on an irregular surface, or one player stepping on another. As a result, the ligaments that connect bones of the leg to the foot and hold joints in place are stretched or torn. The injury ranges from mild to severe according to how much the ligaments are damaged.

**“Falling on the outstretched arm heavily can cause shoulder injuries; this is what happened to Mohamed Salah.”**



are severe injuries where the tendon is completely detached from the bone; in this case, a surgery should be performed.

### Achilles Tendinitis

The largest tendon in your body is the Achilles tendon running down the back of your lower leg. Although it is supposed to endure a lot of stress from walking, running, and jumping, it is still prone to injuries due to overuse or degeneration of the tendon. Exercising without warm up, straining the calf muscles, sudden quick stops, and increase intensity in physical activity can cause Achilles tendinitis, which is the inflammation of the Achilles tendon.

Those who suffer from the inflammation of the Achilles tendon feel pain and stiffness along the tendon or back of the heel that worsens with activity. It usually needs simple treatment, which involves rest, elevating the foot, applying ice, physical therapy, and compression bandages. It

Swelling and bruising are common symptoms of a sprained ankle; the pain increases with movement or placing weight on the ankle. Pain can be relieved by resting, avoiding activities, and keeping the injured ankle elevated. Applying ice and wearing an elastic bandage can reduce the swelling and stabilize the joint. Mild ankle sprains can take up to one week to heal, while severe sprains can take 6–12 weeks. Repeated and untreated ankle sprains can weaken the ankle and lead to chronic ankle pain, arthritis, and ongoing instability.

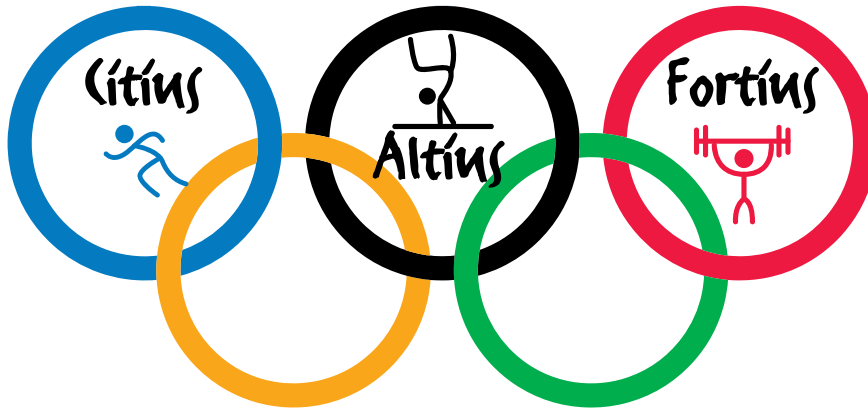
The list of sports injuries is long, as all sports and physical activities can cause injury. It is important to be cautious and always listen to the warnings your body is sending; pain means there is something wrong, so do not ignore it.

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# Let's Talk Science!



By: Esraa Ali

The Olympic motto “*Citius, Altius, Fortius*”, which is Latin for “Faster, Higher, Stronger”, reflects the history of the Olympic Games that have long been closely associated to science. It is simply about goals set by scientists, engineers, and other inventors, who all work hard with athletes to develop new technical skills, sports equipment, and clothing.

Inspired by a religious festival held in honor of the king of gods Zeus in Olympia, Greece, the Olympic Games are considered the leading sports competition worldwide. Similar to their ancient predecessor, where people from all over Greece attended to watch and participate in the festival, today, with around 200 nations participating, the Olympic Games are held every four years. It includes the Summer and Winter Games occurring alternatively two years apart.

Throughout the history of the modern Olympic Games, science has always been at the forefront. Scientific innovation and the use of emerging technology in sports have helped in the development of the overall athletic performances, including speed, strength, skills, and beauty.

The Olympic Games have not been without science and technology. Below are just a few of the examples highlighting that role.

birth date, country, and sports. For many sports, being short, tall, light, or heavy is an advantage; proving that the ideal body shape and composition has a wide range of options, all depending on the sport, playing position, and the fitness level of the athlete.

### Nutrition

Food has always been of great importance in the life of athletes. Athletes’ need for proteins to build their muscles, and carbohydrates for boosting energy during the Ancient Olympic Games was not different from today. In the time of Ancient Greece, most of the protein eaten by Greeks was fish due to its proximity to the sea. Their diet consisted mainly of bread, vegetables, and fruits; forming what is considered now the Mediterranean Diet, which is linked to low heart disease rates in the region.

Early records state that early Olympians opted to a cheese-and-fruit based diet, later on shifting to protein diets. The legend of the renowned Greek wrestler, Milo of Croton, who won the

### Anthropometry

Bringing together the best athletes worldwide in different sports, the Olympic Games have provided a great opportunity for studying the size and composition of the human body, and its relation to athletic performances.



Anthropometric measurements have provided interesting analysis of changes in the athletes’ body size and shape over time. In the 1900 Olympic Games in Paris, for example, an anthropometric program was undertaken on volunteer athletes, where height and weight measurements of different segments of the body were taken. Moreover, medical examinations for lung function, oxygen consumption measurement, and determining fluid loss by weight before and after exercise were undertaken. Photographs were also taken in three aspects: front, back, and side during performance.

Over the decades, tests of anthropometry developed to include collecting data from the Olympic Games’ participants, such as cardiovascular, X-ray, metabolic data, height, weight,





wrestling championship in six Olympic Games, was cited by Athenaeus in the ancient text *The Deipnosophists*, stating that “Milo of Croton used to eat 20 pounds (9 kilograms) of meat and as many of bread .... At Olympia, he put a four-year-old bull on his shoulders and carried it around the stadium, after which he cut it up and ate it all alone in a single day.” Other ancient diets avoided eating bread right before the competition, eating dried figs instead, for its believed importance in building muscles and stamina.

Similarly, the diets of Olympic athletes today have great impact on their performances. Researches over the past years were conducted in order to provide athletes with the appropriate knowledge needed for improving their performances. Modern day athletes, coaches, and officials are more aware of their intakes, seek advice, and look for advantages in them. Nevertheless, sport nutrition is still a growing discipline and needs further research and knowledge.

### Drug Testing



Technological advancements in sporting performance should abide to the rules of sports. As early as the Ancient Olympic Games, evidence suggests that athletes and Roman gladiators used performance-enhancing drugs, but historians studying ancient Greek and Roman texts are not sure if back then regulatory efforts about it even existed.

In the early history of the Olympics, there were rules against using performance-enhancing substances; however, drug testing was not enforced. In the 1960s, that danger was highlighted when the Danish cyclist Knud Jensen collapsed during a race in the 1960 Summer Olympics in Rome, after taking amphetamines\*; leading to a fatal skull fracture. Accordingly, several efforts started to call against performance-enhancing drugs, in 1968, the first official

drug testing was conducted on competing athletes by the International Olympic Committee to end the danger of that illegal activity that has been taking place behind the Olympic Games scenes.

Throughout the centuries, scientific advances in amphetamine production have led to dangerous effects in athletes' health. Nevertheless, drug testing methods have improved to keep pace with the developing methods of cheating. Thus, drug testing technology has witnessed great improvement throughout the decades, leading to an increased number of athletes discovered for doping violations.

### Timing and Scoring Systems

Since the first modern Olympic Games in 1896, stopwatches have been essential in determining the time for the winners. In the 1912 Olympics, a device invented by the Swedish Engineer, Ragnar Carlstedt, was introduced for athletic track events. Using a starting pistol connected to an electronic automatic timing system, the device stops manually by a timing allocated for each runner, and photographs the winners as they cross the finish line.

Over the centuries, timing technology has continued to develop. In 1932, the Kirby camera, which simultaneously photographed the finish line and imprinted the time on each frame, was introduced. Later on, the continuous slit camera—on which all athletic timing systems used today are based—was introduced in the 1948 Olympic Games. Since then, the technology has developed with higher resolutions, reaching the Quantum Timer that measures the accuracy to one-millionth of a second.



Track events are not the only sports that have witnessed significant changes in their timing systems. Other sports that require precise time measurements, such as swimming events, use more complicated timing systems. In 2008, for

example, swimmer Michael Phelps, was announced the winner as he finished one-hundredth of a second ahead of his competitor Milorad Cavic. Thanks to the technology, the camera was able to record 100 frames a second to confirm Phelps as the winner despite that slightest of margins.

Today, we can witness a selection of high-technology timekeeping systems that include high-speed digital cameras, electronic touch pads, infrared beams, and radio transmitters, just naming a few.

Technology has prevailed over the scoring systems in the Olympic Games too. In Taekwondo, for example, a more developed technology for obtaining a fairer scoring system has been utilized. In 2012, sensors were placed in the vests to record successful hits as they were activated by magnetic socks. In the 2016 Olympic Games, sensors in the headgear transmitted signals wirelessly were used too; for the first time, the athlete had the right to ask for a video replay within the contest.

**If the Olympic Games inspire millions of people worldwide through the athletes' hard work and pushing boundaries, science has relentlessly been standing in the back scene. The role science plays in the Olympic Games is a very rich topic covering various aspects, including data analysis, result prediction, and studying the anthropology of athletes. The Olympic Games is not only about how fast athletes run, how high they jump, or even how strong they lift; it is about culmination over the years of study, research, training, and sacrifice.**

### Glossary

\***Amphetamine** is a powerful central nervous system stimulant that produces wakefulness and alertness. Medically, they are used in treating sleep disorders, obesity, and fighting depression. Some people take amphetamines to enhance their athletic performance.

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Being an athlete has always been related to having successful relationships with others, being loved by fans, enjoying self-confidence and personal traits of leadership, as well as achieving success in one's career. On the contrary, however, there are great athletic talents that quickly fade as a result of certain issues that negatively affect them and their talents, as well as their social relationships. That is because physical training is not sufficient to demonstrate special athletic talents; the psychological aspect is essential and should not be overlooked by those responsible for athletes, and that is what sport psychology is all about.



By: Fatma Asiel

# Sport Psychology

## History

Sport psychology is a modern science that emerged in the early 20<sup>th</sup> century at the hands of Coleman Griffith. In 1918, while still a student, he started out by studying how vision and attention predicted basketball and football performance.

In 1925, Griffith established the first-ever laboratory of athletic research at the University of Illinois. There, he conducted his research on athletic performance and published in the same year his famous essay "Psychology and Its Relation to Athletic Competition", which tackled why psychology is valuable to athletic performance.

Having shown value in enhancing players performances and achieving magnificent successes, the field was further developed by other researchers. Sport psychologists became responsible for several tasks regarding athletes, such as psychological counseling, sport teams assistance, relevant researches to develop athletic skills and enhancing performance.

## Concept

Sport psychology studies the influence of psychological factors on athletic performance. Some specialists in this field are interested in enhancing the athletic performance by adjusting these factors, while others use exercise in improving people's lives in general in the long term.

It is an essential branch of psychology that studies all aspects related to the psychology of athletes, their abilities, personal traits,

physical fitness and training, and the exploitation of their talents and characteristics effectively; in order to achieve great success.

Sport psychology studies several concepts and theories; most important of which are:

Issues and techniques of psychological assessment and the mental skills of athletes. Medical issues and players counseling.

Developmental and social issues related to sport participations.

Behavioural rules of sports and exercises. Studying the science of training and the technical requirements of sport competitions.

## Significance

The significance of sport psychology cannot be denied thanks to its continuous support of athletic talents towards achieving more and greater successes. That importance could be summarized in several points:

**Enhancing player-performance:** Sport psychologists apply several techniques, such as imagination or visualization, self-talk, and relaxation methods; in order to achieve natural psychological stability, without which the player cannot reach success and achievement.

**Assisting players to overcome their fears:** Unfortunately, several promising talents fade over time because of fear; either of failure or audience. That is why several sport psychologists study that topic in an attempt to encourage the players to cope with their fears.

## Relieving psychological pressures on players:

Players are exposed all the time to psychological and physical pressures, whether from their coaches, parents, or audience, all of whom are eager for the player to succeed regardless of his/her psychological or physical condition. Here comes the role of sport psychology in reducing that pressure. It is not concerned only with the player, but also entails talking to coaches and parents as well.

**Injury recovery:** Most people think that physical injuries have nothing to do with mental health, which is totally wrong. Among the tasks of sport psychologists is assisting players with injuries to bear the pain, commit to treatment, and accept being away from matches or competitions during their treatment, and until their full recovery.

**Continued training:** Although most players—if not all—keep training with their coaches, some players remain unable to achieve the required goals. In this case, a sport psychologist intervenes to motivate the player and tries to solve the problems he/she is exposed to, being it physical or psychological.

**Enjoying sports:** Sport psychology does not deal only with professional athletes, but also with children and amateurs; by motivating them to play sports and create the appropriate environment to enjoy them.

Physical exercise alone is not enough for athletes to achieve success. Equally important, sport psychology shows athletes' talents and skills, and its absence puts an end to that talent.

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# The Importance of *Sports* for People with Special Abilities



By: Hossam Ragab

I have always been fascinated by sports miracles, watching them on television fighting with all their might in the different sports; as if it were a matter of life or death! Yes, exactly... I am talking about people with special abilities who have stormed into the world of sports courageously, amazing people around the world!

I can never forget a scene I watched on one of the shows while flipping through the channels without a clear goal; what a scene it was! A young man without feet enters the arena in front of an audience and gets ready; in a moment, he was lifting a huge weight in the air amid the cheering and applause of the audience. The young athlete broke into tears and his coach embraced him strongly; it was a moment I have never and will never forget! Since then, I have been asking myself frequently: What was the feeling of this champion at that moment? What was his motive over the past years to achieve this?

Thus, I decided to explore this world, to find answers to these questions that have intrigued me and found that practicing sports is one of the most important necessities in the lives of those with special abilities. Through sports, they can express themselves and release their anxieties and energy in spite of the disability. Sports can also help them integrate into the society by joining competitive markets with others.

Dr. Ludwig Guttman, Founder of the Paralympic Games in England, supported

the idea, stating that "Sports can help people with disabilities restore their physical and moral balance, helping them integrate into the society, and develop their physical and mental abilities". This was during the World War II, when the issue was not of interest to the people, societies, and organizations. Recently, however, this has changed completely; these heroes have become an integral part of the fabric of society.

There are many games that people with special abilities can practice, and where competitions occur periodically. There are around 23 officially recognized sports that are now practiced just like the ones practiced by people who do not suffer any disability; I am almost certain that people with special abilities practice them better at times!

The individual's body, appearance, and characteristics can tell a lot about the personality; they are basic means of dealing and interacting with oneself and others. Through this interaction, the relationship of a person with his body is generated, in addition to the ability to recognize it; this is called the individual's mental physical image, which is characterized by continuity and change throughout the different stages of life. Individuals are prone to injury on their body level, which leads to a body image that differs from the image that was formed before. As a result, some resort to certain fields to prove themselves and send clear messages to all that "I always can!".

In this respect, Kamar El-Sherif, Events Manager at the Abu Dhabi Special Care Center, stated that sports can help people with special abilities accelerate their rehabilitation process, giving them strength,

flexibility, tolerance, and neuromuscular correspondence. Due to the promotional role of sports, they acquire social skills and experiences that can help them enjoy their life, communicate better with others, and develop self-confidence. She also calls for the establishment of sports programs that suit different age groups according to each case, then following up on these programs and writing reports about them to become a reference to the Center to identify the development resulting from the programs and the treatment plans based on the latest scientific studies.

We have to seek the merging of all sports federations, as the main aim of sport is to develop social and spiritual relationships; get out of introversion, isolation, and fear from others; cooperate with others; and develop physical fitness. A healthy mind resides in a healthy body, and a healthy body is an athletic body; through an athletic body, even people with disability can move and interact within the society in an effective and serious manner is more lively; this is the simplest benefit of sports.

Every person suffering a disability wonders: Is it time to look inside for strength and develop it? Is it time to choose the right sport that we can excel at and prove that we are strong and that our disability does not weaken us, but strengthen us?

We will always be legends and stars shining in the sky for anyone who thinks we cannot... We will tell them with pride and strength, just watch us and enjoy!

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By: Maissa Azab

# As Able As Anyone

The Ancient Olympic Games were primarily a part of a religious festival that took place in Olympia in honor of Zeus, the father of Greek gods and goddesses. They began in 776 BCE and were held in Olympia every four years for almost 12 centuries. It took 1503 years for the Olympics to return in Athens, Greece, in 1896, thanks to Frenchman, Baron Pierre de Coubertin.

While sport has value in everyone's life, it is even more important in the life of a person with disability due to its rehabilitative influence. Adaptive sports, also known as disability sports or parasports, are sports played by persons with disability, whether physical or intellectual. As many disabled sports are based on existing able-bodied sports, modified to meet the needs of persons with a disability, they are sometimes referred to as adaptive sports.

The number of people with disabilities involved in sports and physical recreation is steadily increasing around the world with organized sports for athletes with disabilities divided into three main disability groups: deaf, people with physical disabilities, and people with intellectual disabilities. Each group has a distinct history, organization, competition program, and approach to sports.

### The Sands of Time

The Ancient World was a very different place than the world we live in today. Constant war efforts, lack of medical knowledge, and poor sanitation resulted in the disablement of a vast proportion of ancient peoples. Disease, illness, and congenital defects struck indiscriminately and unstopably; thus disability prevailed as the dominant social state. The ancients did not even have a word for "disability"; to be "disabled" was not a category, as everyone—rich, poor, young, old, disabled, or not—was simply trying to survive and thrive in the unforgiving Ancient World. If you were able to do so with a disability, then you were just as able as anyone else.

In the Modern World, however, advances in prenatal care, vaccinations, corrective surgery, and many other breakthroughs in the medical profession have led to an overall decrease in the rate of physical disability. Consequently, the term "disabled" has come to represent a

social sub-category; disabled people have become a minority. In today's world, over one billion people are estimated to live with some form of disability; this corresponds to about 15% of the world's population.

### Reality Check

According to the World Health Organization (WHO), the International Classification of Functioning, Disability and Health (ICF) defines "disability" as an umbrella term for impairments, activity limitations, and participation restrictions. The term is often used to refer to individual functioning, including physical impairment, sensory impairment, cognitive impairment, intellectual impairment, mental illness, and various types of chronic disease.

Disability is extremely diverse; however, all forms of disability lead to challenges and obstacles. Persons with disabilities, the world's largest minority, generally have poorer health, lower education achievements, fewer economic opportunities, and higher rates of poverty than people without disabilities. This is largely due to the lack of services available to them and the many obstacles they face in their everyday lives, including those relating to the physical environment, or those resulting from legislation or policy, or from societal attitudes or discrimination.

However, having a disability does not mean a person cannot be healthy. Being healthy means the same thing for all of



us—staying well, so we can lead full, active lives. That means having the tools and information to make healthy choices and knowing how to prevent illness.

### Against All Odds

Sport for athletes with impairment has existed for more than one century; the first sport clubs for the deaf were already in existence in 1888, in Berlin. The first sportsman who competed at the Olympic Games was Hungarian, Karoly Takacs, who did not have a right arm; he competed in shooting in 1948 and 1952. The second competitor in Equestrian events was Lis Hartel, a Danish woman who was paralyzed by polio, but still won the silver medal.

In 1944, at the request of the British Government, Sir Ludwig Guttmann opened a spinal injuries center at the Stoke Mandeville Hospital in Great Britain. In time, rehabilitation sport evolved to recreational sport, then to competitive sport. To promote the rehabilitation of soldiers following World War II, in 1948, Guttmann organized a multi-sport event between several hospitals to coincide with the 1948 London Olympics. Guttmann's event, known then as the Stoke Mandeville Games, became an annual sports festival.

For the 1960 Olympic Games in Rome, Guttmann had 400 athletes to compete in the "Parallel Olympics", which became known as the first Paralympics. Since then, the Paralympics have been held in every Olympic year. The Paralympics has grown from a small gathering of British World War II

veterans to become one of the largest international sporting events by the early 21<sup>st</sup> century. It has grown from 400 athletes with a disability, from 23 countries in 1960, to thousands of competitors from over 100 countries in the London 2012 Games.

Given the wide variety of disabilities that Paralympic athletes have, there are several categories in which the athletes compete. Permissible disabilities are categorized into ten eligible impairment types: impaired muscle power, impaired passive range of movement, limb deficiency, leg length difference, short stature, hypertonia<sup>(1)</sup>, ataxia<sup>(2)</sup>, athetosis<sup>(3)</sup>, visual impairment and intellectual impairment. These categories are further

broken down into classifications, which vary from sport to sport.

### If There Is A Will

The Tokyo 2020 Paralympic Games will feature 22 sports, one of which is **archery**, which has the greatest Paralympic history of all sports. Originally, athletes were grouped into three classes depending on their degree of impairment: W1 (impairment in all four limbs, uses a wheelchair), W2 (full arm function, uses a wheelchair), and ST (in which athletes stand or sit in a chair). Currently, W2 and ST are combined as an open class at the Paralympic Games.

Originally developed as a sport for blind athletes, who first competed using tandem bicycles, **cycling** is now one of the largest and most varied sports of the Paralympic Games. The popularity of the sport with both athletes and spectators is reflected in the fact that 50 gold medals in cycling will be awarded at Tokyo 2020, with a total of 230 athletes competing. Athletes with physical or visual impairments compete in cycling, divided into four classes: impairment to all four limbs (C), use of upper half of body only (H), cerebral palsy (T), and visual impairments (B). Finer divisions exist to account for the degree of impairment, and events are split by gender.

Offering skill and drama in equal measure, **football 5-a-side** is played by athletes with visual impairment; they must pass, tackle, and shoot by relying on the sound of the ball, which has a noise-making device inside, and the voice of their guide. Each team consists of four outfield players and one goalkeeper who can be fully sighted or partially sighted. Although the outfield players may have different degrees of visual impairment, all four must wear blackout masks to ensure fairness. To keep players safe, they must say "Voy" or a similar word when moving towards an opponent, tackling, or searching for the ball.

The guide stands behind the opposition goal and communicates information, such as the distance to the goal and location of other players; the team coach and the goalkeeper are also permitted to give cues during a game. Spectators must stay silent during play so that the players can hear the ball moving and respond to the voice of

their guide. Like its 11-a-side counterpart, Paralympic 5-a-side football is a fast and physically demanding game. Players not only need to have speed, strength, and stamina, but also excellent spatial awareness despite their lack of vision, allowing them to be effective on the pitch and play together as a team.

**Sitting Volleyball** is played by two teams of six players, who remain seated with the rears on the floor. The ball used is the same as that for standing volleyball; the major differences are a smaller court and a lower net, allowing the players to remain seated while playing. Players must always keep their rears on the floor when serving, spiking, or blocking; only when receiving the ball can they lift their rears off the floor momentarily.

The above are just a few examples of how Paralympians brilliantly shine despite adversity in ways abled athletes cannot match without ardent training. Paralympians are simply the perfect manifestation of human will, and ability to persevere and overcome physical and intellectual hardship.

### Glossary

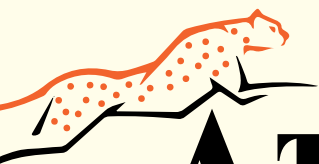
- (1) **Hypertonia** is a condition in which there is excessive muscle tone so that arms or legs, for example, are stiff and difficult to move. Muscle tone is regulated by signals that travel from the brain to the nerves and notify the muscle to contract.
- (2) **Ataxia** is a degenerative disease of the nervous system. Symptoms include slurred speech, stumbling, falling, and incoordination; all are related to degeneration of the part of the brain, the cerebellum, which is responsible for coordinating movement. Ataxia is a disease that affects people of all ages; age of symptom-onset can vary widely, from childhood to late-adulthood. Complications from the disease are serious, frequently debilitating, and can be life-shortening.
- (3) **Athetosis** is a condition in which abnormal muscle contraction causes involuntary writhing movements. It affects some people with cerebral palsy, impairing speech and use of the hands.

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# ATHLETIC

## by *Nature*

Everyone looks up to athletes and sports champions; everyone dreams of a fit body. While many work out to get fit, others practice sports to maintain their fitness; some champion the sports they practice, but only a lucky few are athletes by nature. Different wild animals enjoy very unique physical abilities that are essential for their survival. If we can say so, these amazing features would enable their owners to achieve historical Olympic records. From super-fast runners to mind-blowing weightlifters and skilful swimmers, the animal kingdom is ready to set impressive examples.

### Faster than a Ferrari



Ask anyone which is the world's largest creature, and they will say blue whales; ask them which is the world's fastest creature and the simple answer will be cheetahs. Cheetahs (*Acinonyx jubatus*) are the fastest animals on land, reaching speeds up to 120 km per hour; these incredible cats shatter all records. While the Jamaican runner Usain Bolt set the world's fastest record—100 m in 9.58 seconds—the fastest recorded cheetah, named Sarah, clocked a time of 5.95 seconds. A Ferrari Enzo can accelerate to 97 km per hour in 3.14 seconds, whereas cheetahs can go



from 0 km to 104 km per hour in three strides in only 3 seconds. Amazing, is it not? How does this happen?

Well, we can say that cheetahs are built for speed, and that speed is the result of some very special aerodynamic physical attributes. For example, it has a slender lightweight body, a small head, a flattened rib cage, and long thin legs that minimize air resistance. A cheetah's tail is more than half of its length, which maintains control and balance during running so it does not spin out during fast turns.

The wide strides cheetahs can make are striking, reaching 7.5 meters wide thanks to their flexible spine; moreover, cheetahs have special cleat feet that help them grip the ground while running. They can complete up to three strides in one second with one foot on the ground at any time. Additionally, cheetahs are equipped with oversized powerful hearts that pump huge amounts of blood, as well as large lungs and nostrils that allow for fast and deep air intake. They also have long eyes that provide a fast, wide-angle view of their surroundings even at top speed.

However, speed has its drawbacks; namely, the need to rest as it puts serious strain on the animal's heart. As a result, a cheetah's chase is short-lived, typically lasting about 30 seconds covering about



By: Hend Fathy

550 meters. Another drawback is that their slender small bodies make them weaker than other predators. This means that they will always run, rather than fight, when attacked. They also would run rather than defend their young against predators, which contributes to the survival problem of such an endangered species. Unfortunately, only an estimated 9,000 to 12,000 cheetahs live outside zoos today in Africa and Iran.

### Small but Mighty

Speaking of strength, we may think of mighty bodybuilders and weightlifters; yet, some much tinier but equally impressive, wild athletes accomplish astonishing feats of strength. Back in 2010, researchers from Cambridge University photographed an Asian weaver ant (*Oecophylla smaragdina*) lifting 100 times its mass. Four years later, a study published in the *Journal of Biomechanics* found that the neck joint of a common field ant (*Formica spp.*) can withstand 5000 times the ant's weight\*. Such extraordinary powers seem out of this world; yet, it is all down to a quirk of physics.



Scientists explain that smaller creatures are proportionately stronger than larger ones. While big animals have



big muscles, most of their muscle power goes to supporting their weights and sustain essential biological functions. In contrast, with smaller bodies and much simpler internal systems, tiny creatures invest most of their muscle power in weightlifting. The points of strength vary across different ant species; for example, the trap-jaw ant (*Ondontomachus*) has extremely powerful mandible muscles, while the field ant neck has a microstructure of bumps and folds that support its shoulder loads.

Other famous super power lifters are some beetle species. Hercules beetles (*Dynastes hercules*)—as implied by the reputation of the ancient demi-god they are named after—can carry up to 100 times their bodyweight. However, champion beetles come from a much humbler background than Olympus. Surrounded by manure, lives the horned dung beetle (*Onthophagus taurus*) which, according to researchers, can hold 1,180 times its own weight and pull 540 times its own mass with its mighty horns.

### Fast and Furious



Meeting a shark could be the worst nightmare for swimmers, snorkelers, or wave surfers; we all have this image of notorious white sharks rapidly and fiercely attacking with jaws lined with razor-sharp teeth. However, there is much more to these masterful and highly maneuverable swimmers.

Sharks (*Pleurotremata*) can hardly be outswam, which is no wonder given their more than 400 million year evolutionary

history in the ocean. American Olympic swimmer Michael Phelps—the most decorated Olympian of all time, with a total of 28 medals—challenged a shark. The race, held in July 2017, was organized as part of *Discovery Channel's* Shark Week. In fact, Phelps competed with a computer simulation of a great white shark whose swimming speed was calculated using real data. Phelps, the holder of seven world records, finished the 100 m course in 38 seconds, two seconds slower than the shark.

Sharks' swimming prowess is attributed to very specialized tools; namely, their tails, fins, and skin. The main function of a fish's tail is to provide thrust and drive the animal forward through the water; as it moves, the tail creates one jet of water that travels backwards and propels the fish forward. Sharks, in contrast, can stiffen and manipulate the shape of the tail swing, creating two jets of water and generating double thrust. As for the fins, according to Frank Fish, a biomechanist at West Chester University in Pennsylvania, sharks can use their fin muscles to modify the shape, and possibly the texture, of the fin to modify

the water flow.

Last but not least, sharks' bodies are covered structures known as dermal denticles, which make their skin texture as rough as high grain sandpaper. These denticles acquired their name because they are structurally similar to vertebrate teeth and likely have the same evolutionary origin. In most shark species, the points of the crown are directed backward, creating a smooth feeling when touched from head to tail, and a rough feeling when touched the other way round. As these denticles move on the flexing skin, they create a vortex that sucks the shark forward and increase thrust.

Several studies were conducted on the shark's swimming skills, which have inspired different technological

applications, from faster swimsuits to airplanes. For example, a study led by George Lauder, a biomechanist at the Museum of Comparative Zoology at Harvard University, studied the shark's skin structure and used a 3D-printer to build their own artificial version. The study found that the shark's skin structure could increase swimming speed by 6.6% and reduce the energy expended by 5.9%.

Again and again, Mother Nature surprises us; this time, with its gifted champions. This brief account is only an invitation for eager minds to know how different amazing creatures work and to speculate "the work of Allah, who perfected all things"—*Surat An-Naml* (verse 88).

\*It is to be noted that withstanding a weight is different from carrying a load; actual carried loads are usually much smaller because they involve other aspects, such as balancing.

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By: Esraa Ali

# And the Winner is ...

Animals with psychic powers have become a tradition at major football events. As football fans worldwide were passionately following the 2018 FIFA World Cup in Russia, the clairvoyant cat Achilles was busy predicting the results of the matches using its “cat sense”.

A deaf, white, blue-eyed mouse hunter at Russia’s famous Hermitage Museum in St. Petersburg, Achilles’ supposedly psychic abilities and record of correctly predicting the results of three out of four matches during the FIFA Confederations Cup got it named the official animal oracle for the World Cup. It made its predictions by choosing between two bowls of food, each bearing a team’s flag; it made a perfect start to the World Cup by successfully predicting the winner of the first game.

Eight years ago, Achilles’ World Cup predecessor, Paul the Octopus had quickly become famous for his flawless record in predicting the outcomes of football matches. Its extraordinary psychic abilities made him the star of the 2010 World Cup in Germany as it correctly predicted the results of 12 out of 14 football matches, ultimately picking Spain as the champion. Paul communicated its insights by selecting between two glass boxes of mussels, each decorated with the flag of one of the competing nations.

Since the Octopus passed away in October 2010, other species have emerged to claim its talent in picking winners, catching the attention of football fans; perhaps for their novelty, rather than the accuracy of the results. During the 2014 World Cup in Brazil, several imitators tried to recreate Paul’s extraordinary success as zoos and wildlife centers across the world unveiled

their own “psychic” animals. A guinea pig named Madame Shiva, and a piranha named Pele, were considered as potential oracles; however, both lacked the foresight and aptitude shown by Paul to make it a worldwide sensation.

Achilles is the latest animal hoping to carve out a niche as a World Cup oracle following the breakout success of Paul the Octopus. Similar to major athletes involved in the 2018 World Cup, including Mohamed Salah, Leo Messi, and Cristiano Ronaldo, Achilles underwent a strict diet and exercise to get in shape for the tournament. Anna Kondratyeva, the Hermitage’s veterinarian, said that “People tend to feed him more than they should. When he came to us, he looked like a football, not a cat, so we decided to put him on a strict diet”. Additionally, Achilles received intense training in “intuition skills” and went through an adaptation process in preparation for the World Cup.

The existence of psychic abilities as clairvoyance is neither supported nor accepted by the scientific community; even parapsychology, including the study of clairvoyance, is regarded as pseudoscience. However, animals with psychic powers are deeply rooted in history; in ancient Egypt, for example, cats were revered and considered godlike. They have always been considered magical and several people believe in their psychic abilities; for example, they can detect natural disasters at a geographical distance before their occurrences. They warn people that something bad is about to happen by a flight-or-fight response; their ears point backward and their hair stands on end with no enemy in sight. They will also cry and howl without a clear reason.

Scientists have attempted for decades, to study psychic abilities in animals. One of the pioneers in this field is Joseph Banks Rhine (1895–1980), who is acknowledged as the “Father of Modern Parapsychology.” He is an American botanist who founded parapsychology as a branch of psychology and came up with the term Extrasensory Perception (ESP). He and his wife, Dr. Louisa E. Rhine, investigated the existence of psychic abilities in animals as part of their research; the results were encouraging as millions of people were convinced by the existence of ESP.

As researchers continue to attempt to prove, or disapprove, clairvoyance using scientific methods, there are surprising stories about animals that sense things in a way that cannot be explained yet, such as “World Cup Animal Oracles” and their accurate predictions of sporting events. Although oracle animals have to choose from two options only, their predictions will remain surprising and amusing, but not as extremely improbable as they may seem to football fans.

## Glossary

‘Clairvoyant’ from French literally means “one who sees clearly”; clairvoyance is the ability to see things with full perspective, which includes the past, present and the potential future.

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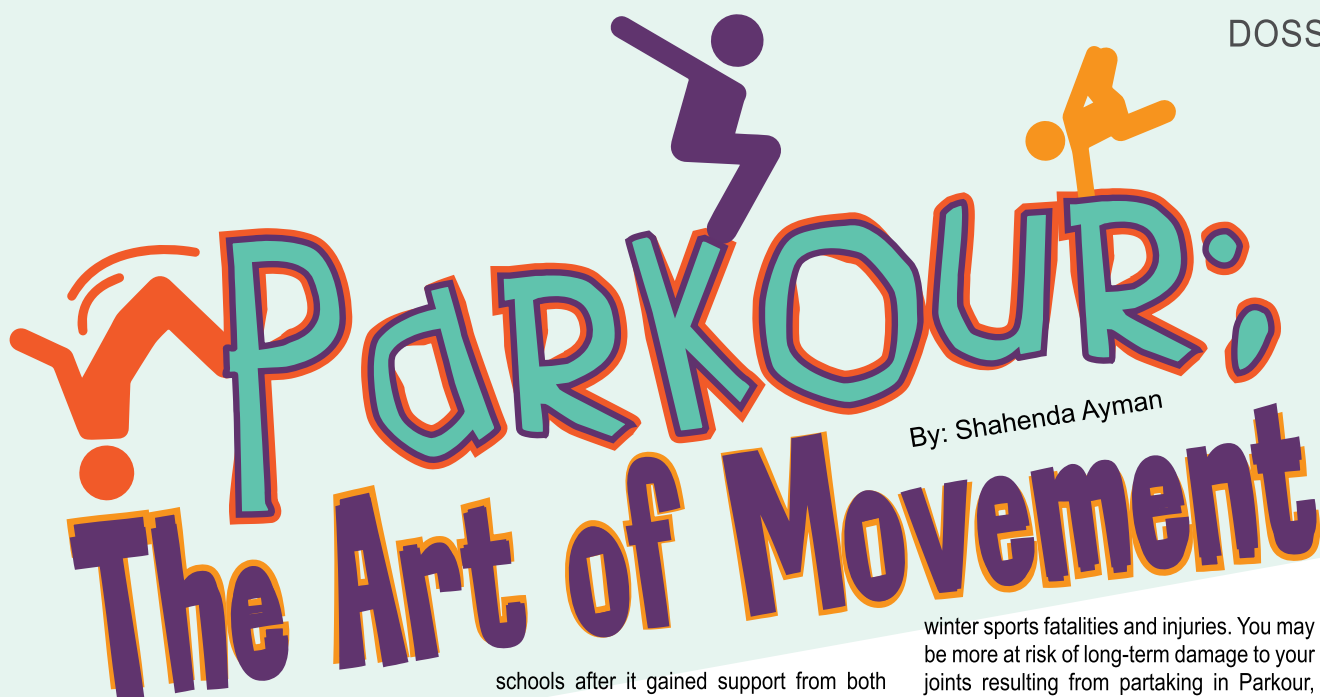
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# PARKOUR;

## The Art of Movement

By: Shahenda Ayman

Running, leaping, and climbing through the city is not restricted to Spiderman or Ninja Turtles, it is now an official sport called Parkour. The word "Parkour" was derived from the French word *parcours*, literally meaning "the way through" or "the path". The discipline, developed in France in the late 1980s, was promoted through Internet videos, television commercials, documentary and feature films, including the famous James Bond movie *Casino Royale* (2006).

Parkour is a non-competitive physical discipline of training to move freely over and through any terrain using only the abilities of the body; mainly through running, jumping, climbing, crawling, and other movements as deemed most suitable for the situation. Parkour is usually carried out in an urban space; its aim is to see the same environment in a new way. It does not require any equipment; however, in order to train on new moves, a mat or spring flooring can be a safe option.

Initiated in France as a military activity, Parkour later spread into many other countries, where national and local organizations were formed to provide training and education. While some theorists opposed the idea of competition in Parkour, international organizations such as the World Free Running Parkour Federation (2008), *Fédération Internationale des Arts du Déplacement* (FIADD; 2012), and *Mouvement International du Parkour*, *Free Running et l'Art du Déplacement* (MIPFA; 2014) were established, aiming to create a structure for worldwide Parkour competitions.

In 2016, Britain became the first country to officially recognize Parkour as a sport. The sport could also soon be practiced in

schools after it gained support from both the Youth Sport Trust and the Association for Physical Education, which described it as an exciting and motivating activity.

Parkour's main aim is to move from one point to another as smoothly, efficiently, and quickly as possible; its experts are known as "Traceurs", a noun derived from the French verb *tracer*, which normally means "to trace". Accordingly, it requires functional strength and fitness, balance, spatial awareness, agility, coordination, precision, control, and creative vision. Some people regard the sport as dangerous, anti-social, and even criminal. However, evidence suggests that these fears are wrong, as Parkour endorses the connection people can have with the city; it encourages people to work together, learn from each other, and fleetingly reclaim city as a common civic space.

Some people claim that Parkour is less dangerous than other extreme sports, such as snowboarding and skateboarding, because practitioners do not rely on any external equipment, only their own bodies. Others think that it is much riskier than any other sport; however, statistics support the first opinion. According to the National Ski Areas Association, an average of 41.5 people have died in skiing/snowboarding accidents each year over the past decade. On the contrary, a study carried out in New Zealand in 2013 stated that 44% of Parkour enthusiasts have never been injured and there are no official figures available for Parkour deaths.

The most common injuries that can result from Parkour are strains, sprains, fractures, and tendonitis, in addition to some serious injuries, leading to taking time off work to recover or even surgery. Parkour injuries are generally less common than

winter sports fatalities and injuries. You may be more at risk of long-term damage to your joints resulting from partaking in Parkour, because of frequent falls from height and jumps; learning how to fall and land safely helps reduce your risk of injury.

Avoiding injuries whilst practicing Parkour is not complicated; as with any sport there are things you can do to protect yourself. In 2012, the National Health Service (NHS) reported a 14% rise in sports injury cases compared to the previous year, with an estimated 388,500 people being treated for sports-related injuries, so if you have been injured while parkouring, then you are not alone. It is important not to push yourself beyond your abilities, as it can be tempting to try and compete with others whilst taking part in free running. Hereunder are some tips that could help you stay safe whilst practicing Parkour:

- Stay hydrated and ensure you always warm up properly;
- Train with an experienced Parkour practitioner;
- Learn how to land and fall safely to reduce your risk of being injured;
- Do not practice when you are tired as your reactions will be slower.

Parkour improves physical and mental health. It offers a way for citizens to resist the increasing privatization taking place in cities around the world. It promotes creativity, connectivity, and civic activity, all while showcasing what incredible things the human body is capable of. In many ways, Parkour offers us a glimpse of the future of sport, which seems to be bright and interesting.

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# Summer Program 2018

Modern and  
Exciting Programs

By: Rania Farouk  
Marketing Specialist, Planetarium Science Center

Every summer, the Planetarium Science Center (PSC) organizes the Summer Program for school students aged 4–18 years old; scientific programs specialists make sure to choose and prepare a number of modern and interesting practical workshops every year.



During the Summer Program 2018, the PSC organized two programs for students aged 9–12 years old: "I am different, I am Nano" and the robotics program "EV3". The first program introduces the general basics of nanoscience to students through various interesting experiments and activities to help them understand nanoscience. The robotics program "EV3" entails forming teams and testing their skills in programming, designing robots, and using them to solve problems and perform certain tasks. Another robotics program was organized for students aged 6–9 years and entitled "We Do".

As physics is one of the fundamental sciences that we use in our daily lives, the PSC prepared another program for the same target age group entitled "Fantastic Six". This program sheds light on six important branches of physics through various hands-on activities, practical experiments, and some important facts that all aim to simplify the scientific terms of physics for a better understanding of the science.

Students begin to think about their future and choose their preferred



scientific field ages 12–18 years old; as such, the PSC organized various programs in different fields that might help them determine their preferred future field of study. There are many robotics programs, such as "Arduino", "EV3", and "IBM", which revolve around computer science. For the first time, the PSC organized a program for interior and exterior architectural design for architecture lovers; moreover, as usual, the PSC offered a special program for astronomy amateurs and celestial observation entitled the "Amateur Astronomy Club".

To create a science interested generation during a young age, we are always keen to organize interesting hands-on programs for children aged 4–5 years old, such as the "Games Factory: I Play, I Learn". The program aims to develop the children's cognitive skills, which in turn control their logical thinking, problem-solving skills, decision-making ability, in addition to the ability to learn, acquire knowledge, and apply it. Every participant has to perform several tasks in each workshop, which enables him/her discover new ideas and acquire



many skills, so that by the end of the program every child is able to learn, play, and rely on his/her senses.

By the end of the Summer Program every year, we feel enthusiastic to organize up-to-date, useful, and entertaining programs during the next years to impress the participants and present science in a simple, modern, and interactive way.



# PLANETARIUM SCIENCE CENTER

"Science for All"

## History of Science Museum

### Opening Hours

Sunday–Thursday: 9:30–16:00  
Saturday: 12:00–16:00

### Guided Tours Schedule

Sunday–Thursday:  
10:30, 11:30, 12:30, 13:30, 14:30, 15:30

**Fees:** EGP 2.- for non-audience of the Planetarium

## ALEXploratorium

### Discovery Zone

#### Opening Hours

Sunday, Monday, Wednesday, Thursday:  
9:30–16:00  
Tuesday: 9:30–12:30  
Friday: 14:00–16:00  
Saturday: 12:00–16:00

#### Guided Tours Schedule

Sunday, Monday, Wednesday, Thursday:  
10:00, 11:00, 12:00, 13:00, 14:00, 15:00  
Tuesday: 10:00, 11:00  
Friday: 14:00, 15:00  
Saturday: 12:00, 13:00, 14:00

**Fees:** EGP 10.- (EGP 5.- for students)

#### Listen and Discover

##### Fees:

DVD shows: EGP 4.- (EGP 2.- for students)  
3D shows: EGP 10.- (EGP 5.- for students)  
12D shows: EGP 20.-

## Available Planetarium Shows

**Enlightened Mind;** 19 min.

**The Mission;** 24 min.

**Stars Show;** 45 min.

**Oasis in Space;** 25 min.

**Stars of the Pharaohs;** 35 min.

**Seven Wonders;** 30 min.

**The Life of Trees;** 33 min.

***Kaluoka'hina:***  
**The Enchanted Reef;** 33 min.

**To Space and Back;** 25 min.

**Alexandria, The Cradle  
of Astronomy;** 22 min.

The Bibliotheca Alexandrina Planetarium Science Center (PSC) invites its visitors to spend a day of fun learning, where they can enjoy amazing scientific shows that cover a diverse variety of scientific fields and are suitable for a wide range of groups at the **Planetarium Theater**.

Visitors can also enjoy tours of the **History of Science Museum**, which highlights scientific discoveries throughout three eras: Pharaonic Egypt, Hellenistic Alexandria, and the Golden Age of Islam.

Moreover, visitors can enjoy a collection of interactive exhibits that targets children and adults, workshops, DVD and 3D shows at the **ALEXploratorium** as well as shows at the **12D Theater**.

For schedule and fees, please visit the Planetarium Science Center website.

  
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BAPSC





# CATCH ME IF YOU CAN!



Key champ,  
how about racing  
a cheetah?

OK,  
why not!

