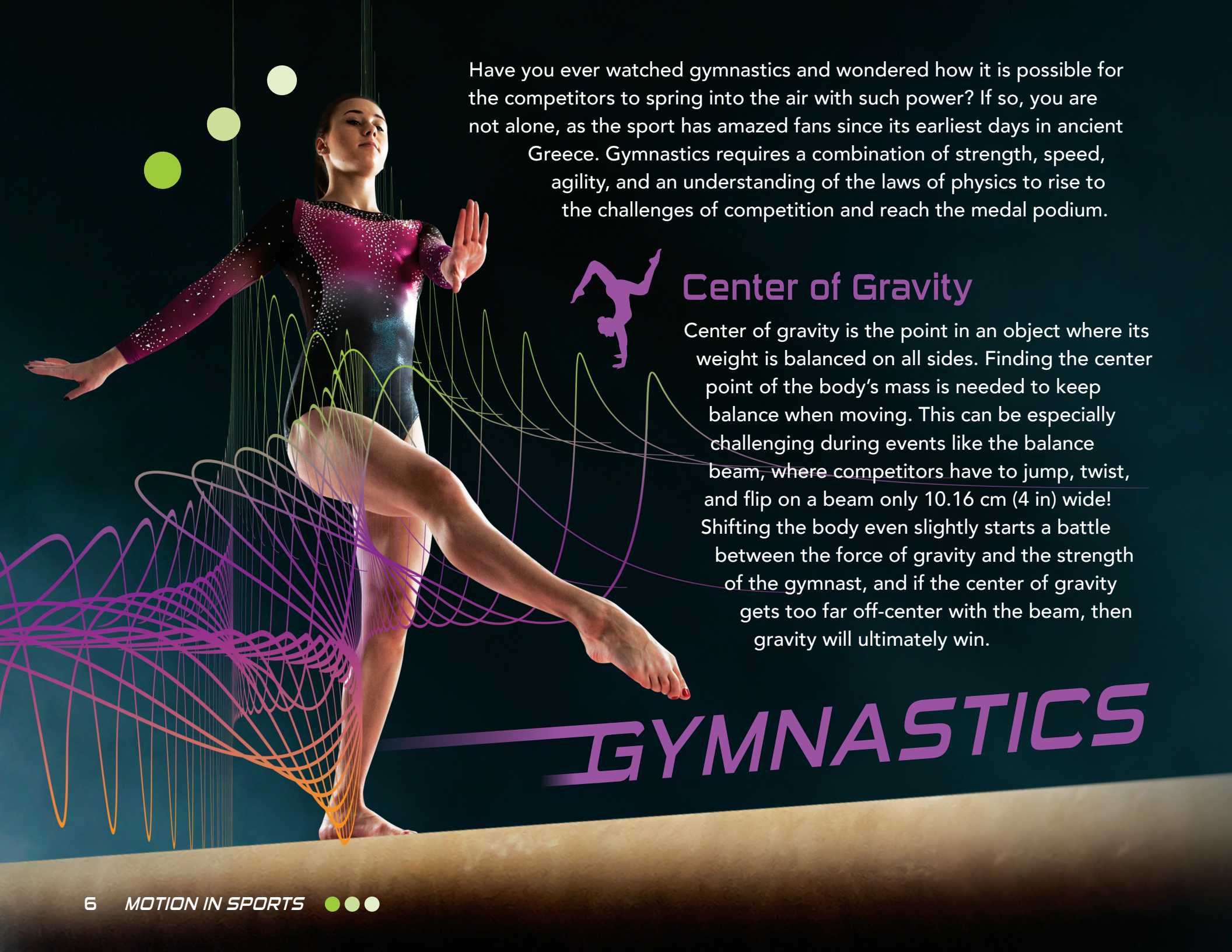
Motion in SPORTS

Written by

David Wiseman

THE GOOD AND THE BEAUTIFUL LIBRARY



Have you ever watched gymnastics and wondered how it is possible for the competitors to spring into the air with such power? If so, you are not alone, as the sport has amazed fans since its earliest days in ancient Greece. Gymnastics requires a combination of strength, speed, agility, and an understanding of the laws of physics to rise to the challenges of competition and reach the medal podium.

Center of Gravity

Center of gravity is the point in an object where its weight is balanced on all sides. Finding the center point of the body's mass is needed to keep balance when moving. This can be especially challenging during events like the balance beam, where competitors have to jump, twist, and flip on a beam only 10.16 cm (4 in) wide! Shifting the body even slightly starts a battle between the force of gravity and the strength of the gymnast, and if the center of gravity gets too far off-center with the beam, then gravity will ultimately win.

GYMNASTICS

Vault

Vaulting is one of the most exciting events in gymnastics! It is also packed with physics principles that start with a full sprint and hopefully end with a perfect landing.

	APPROACH	SPRINGBOARD	VAULT	FLIGHT	LANDING
ACTIVITY	The gymnast runs 25 m (82 ft) or less as fast as possible toward the vault.	The gymnast does a low jump or handspring onto a springboard in front of the vault.	The gymnast places his or her hands on the vault table and pushes the body upward.	The gymnast performs a variety of flips and twists in the air.	The gymnast lands on his or her feet with as little movement as possible.
SELECT FORCES	The speed of the run gathers kinetic energy used to increase the force of contact with the springboard and vault.	Downward force causes the springs to compress, becoming elastic energy that pushes back against the gymnast.	Hands create force against the vault and help align the body's center of gravity for more lift and rotation.	Rotating around axis points on the body is possible due to a spinning force called torque.	Legs are used as shocks to absorb the force when the gymnast hits the landing pad.

QUICK TIP

See if you can feel your center of gravity shift as you safely do a variety of twists and jumps.

SOCCER

Soccer is sometimes referred to as the world's sport due to its popularity around the globe. The energy of soccer fans when their team scores a goal is electrifying, but energy transfer from natural laws of motion is what makes these goals possible. Soccer players understand how friction, spin, wind, and other forces can impact the direction of the ball. The control they show on the field is the result of endless hours of practicing using these forces to their advantage.

Bending a Kick

Sometimes a soccer ball seems to mysteriously curve in the air as it flies into the net to score a goal. This curve actually isn't a mystery at all. It's due to the Magnus Effect. This means a spinning object with forward velocity will move in the direction of its spin due to lower air pressure on that side. If you want a soccer ball to bend left, kick it slightly on the right side. To go right, kick it on the left. The force of the kick, how high the ball is kicked, the direction of the wind, and other factors can also change the ball's curve. It takes a lot of practice to get everything just right, but experimenting with the Magnus Effect can lead to more goals!

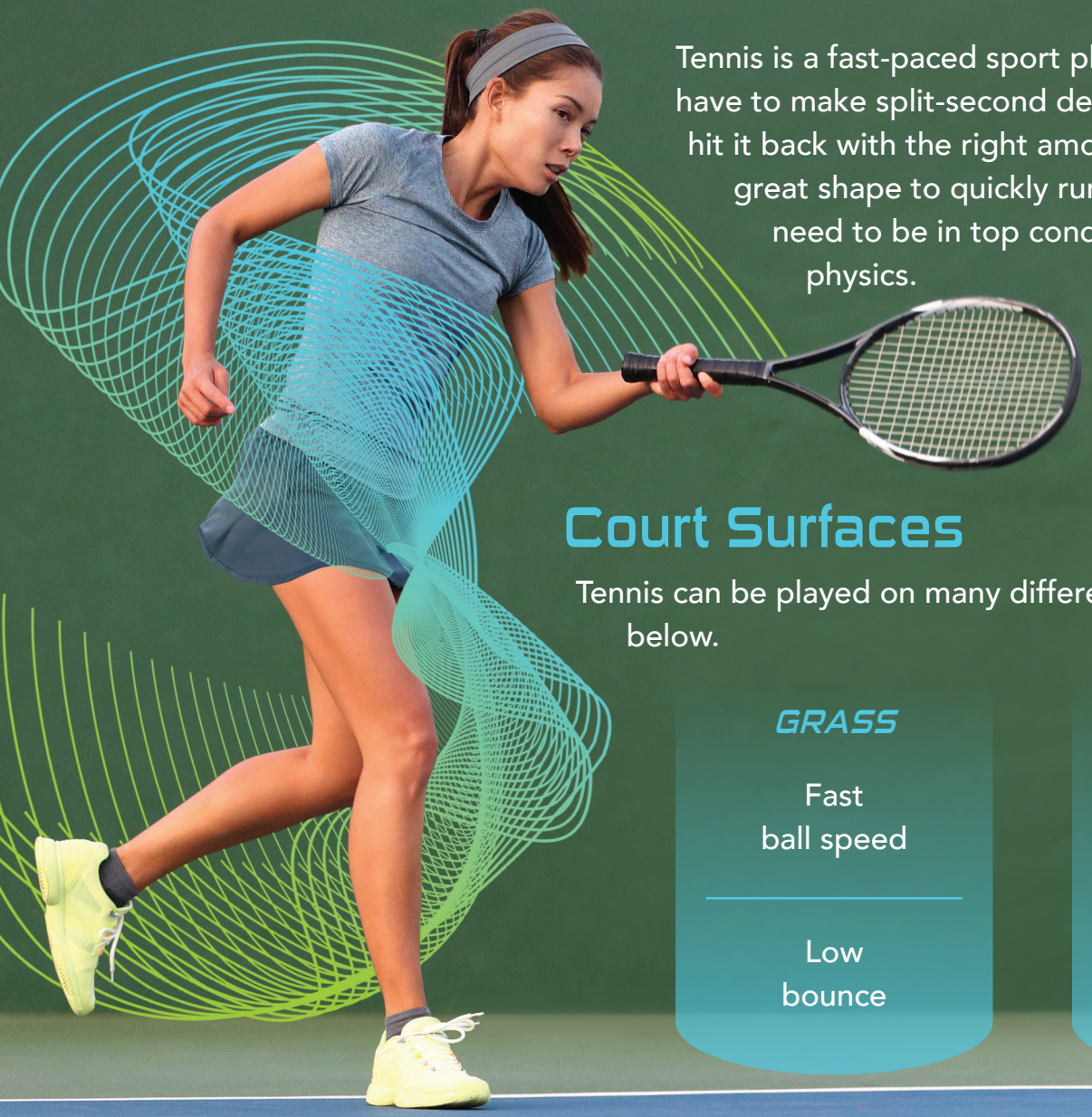
Surface Friction

The surface a soccer match is played on impacts the way the players and the ball move. Most of the time, matches are played on grass fields. Friction between the ball and the grass slows the ball down. Players, on the other hand, sometimes slip on the slick grass, which is why they wear shoes with spikes to grip the ground as they run. Playing on dirt or a solid surface like cement changes the speed of the game completely since there is less friction with the ball, causing it to move much faster.

QUICK TIP

Kicking a soccer ball with the side of your foot gives you more control for passing, but kicking it on the laces of your shoe will give you the most power.

TENNIS



Tennis is a fast-paced sport played on a variety of surfaces. Expert players have to make split-second decisions to react to the direction of the ball and hit it back with the right amount of spin and velocity. They have to be in great shape to quickly run back and forth on the court, but they also need to be in top condition mentally to understand and apply laws of physics.

Court Surfaces

Tennis can be played on many different surfaces. Check out some of the differences below.

GRASS	CLAY	HARD COURTS
Fast ball speed	Slower ball speed	Medium ball speed
Low bounce	High bounce	Highest bounce

Serving

The serve begins when a player tosses the ball in the air before striking it. It's important to hit the ball at its highest point because this is where the gravitational potential energy is at its peak. At impact, it is not just the force of motion from the swing that sends the ball flying to the other side of the net. It is also the elastic energy from the racket's strings. They act like springs to absorb the contact and push it back to the ball. Finally, the downward angle of the strike means that gravity is also working in the server's favor to increase speed. The combination of all these forces allows the most powerful serves to reach over 241.40 km/h (150 mph)!

Spin

Tennis players use spin and angles to control the flight of the ball. Topspin makes the ball move downward. This type of spin is created by angling the racket downward but swinging upward to make the ball spin forward. Players can hit the ball harder using topspin because its downward motion helps it stay on the court. Backspin (when the ball spins backward) also has its advantages. It keeps the ball higher in the air, making it harder for the opposing player to return a shot with as much force.

QUICK TIP

The "sweet spot" on a tennis racket is where the strings hit the ball with the most power. Try holding a racket on your lap and dropping the ball on it to see where it bounces highest.

Motion in SPORTS

How does a gymnast stay balanced on a thin balance beam? Why doesn't a surfer sink into the ocean while on a surfboard? How much force is behind a golfer's swing? If you've ever asked questions like these, you'll love *Motion in Sports!* In this book you'll learn what terms like velocity, inertia, force, and friction mean and the important roles they play in many different sports. Along the way, discover tips that will help you enjoy your favorite sports even more.

ORIGINAL PUBLICATION

THE GOOD AND THE BEAUTIFUL
goodandbeautiful.com

$7.99
ISBN 978-1-957561-00-4
50799>
9 781957 561004

SKU 762.2