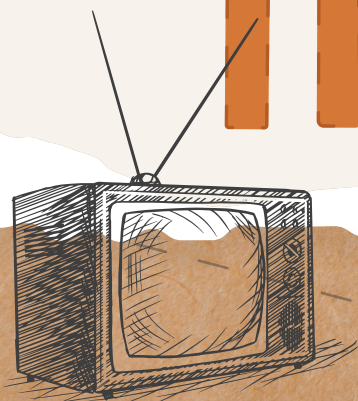




# *The* STORY *of* INVENTION

by David Wiseman

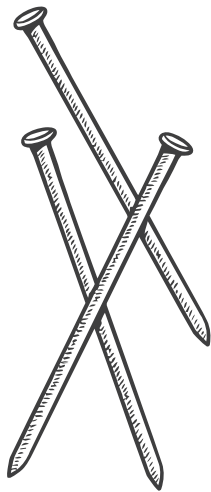


THE GOOD AND THE BEAUTIFUL LIBRARY

# Are you ready to become an inventor?

Maybe you have already designed a useful gadget or perhaps you have simply imagined new possibilities, but as children of God, each of us is born with the power to create. As you read about how fifteen amazing inventions came to be, try to think of ways you can improve the world through your own creative spirit!

## The Nail:



Around 3400 BC, the ancient Egyptians really nailed it with their new idea to use pointed strips of bronze to bind things together. Other ancient civilizations, such as the Romans, also depended upon the nail to construct powerful empires. Before the 1790s, with the rise of machines to cut nails from raw iron sheets, individual nails were typically crafted by hand. The world now produces trillions of nails for a variety of purposes, but their basic design has been the same for thousands of years. From houses to horseshoes and boats to railways, nails connect much of the modern world—literally! The mighty nail proves that good things really can come in small packages.

## Inventor tip:

An idea is never too small to have a big impact.

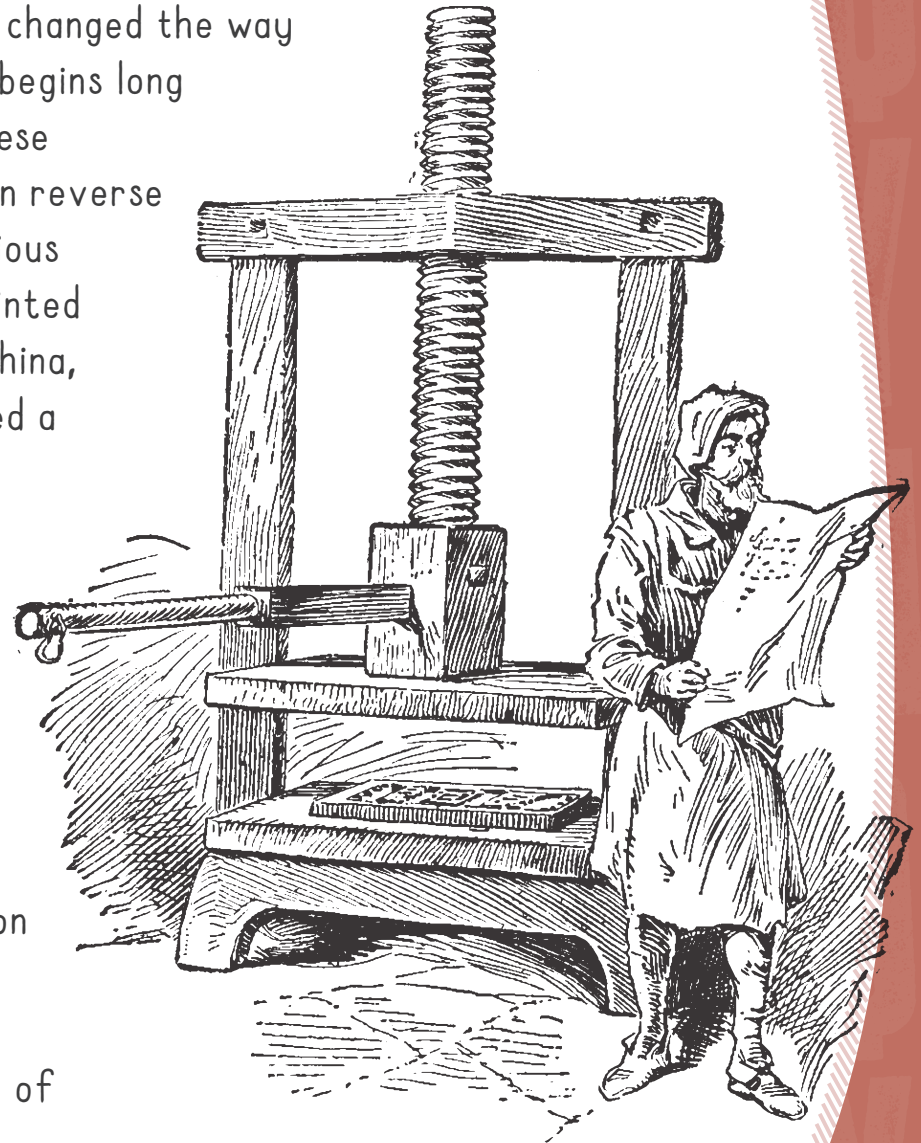
## Fun facts:

- Due to the unique designs of nails over time, dating nails by their shape and material is one of the primary ways experts determine the age of antique furniture and historic buildings.
- Carpenters use the term penny to measure the length of nails. This name comes from medieval England when the price of nails was set by how many pennies it would cost to buy 100 nails.
- Before machines started mass-producing nails, shortages made them so valuable that they were often traded as currency. Abandoned homes and older buildings were even burned to the ground just to collect the nails.
- An average wood-frame home today can require over 20,000 nails to build!

"In our private pursuits, it is a great advantage that every honest employment is deemed honorable. I am myself a nail-maker." —Thomas Jefferson

# The Printing Press:

Stop the presses! This next invention actually created the front-page news. By inventing the Gutenberg Press (designed between 1436-1450), Johannes Gutenberg changed the way the world shares knowledge, but the story begins long before that. As early as AD 868, the Chinese developed block printing by carving letters in reverse into wooden boards to press ink against various types of paper. By the twelfth century, printed books were common among the wealthy in China, but it was the Gutenberg Press that sparked a printing revolution. Gutenberg used molten lead to design moveable letter pieces that could be adjusted within a machine to speed up the printing process. As the Gutenberg Press traveled throughout Europe, it increased literacy rates, spread news, advanced scientific discovery, and challenged systems of power by placing books and pamphlets in the hands of common people. Today, we can share our thoughts electronically with a simple click, but that would not be possible without the influence of the printing press.





### Inventor tip:

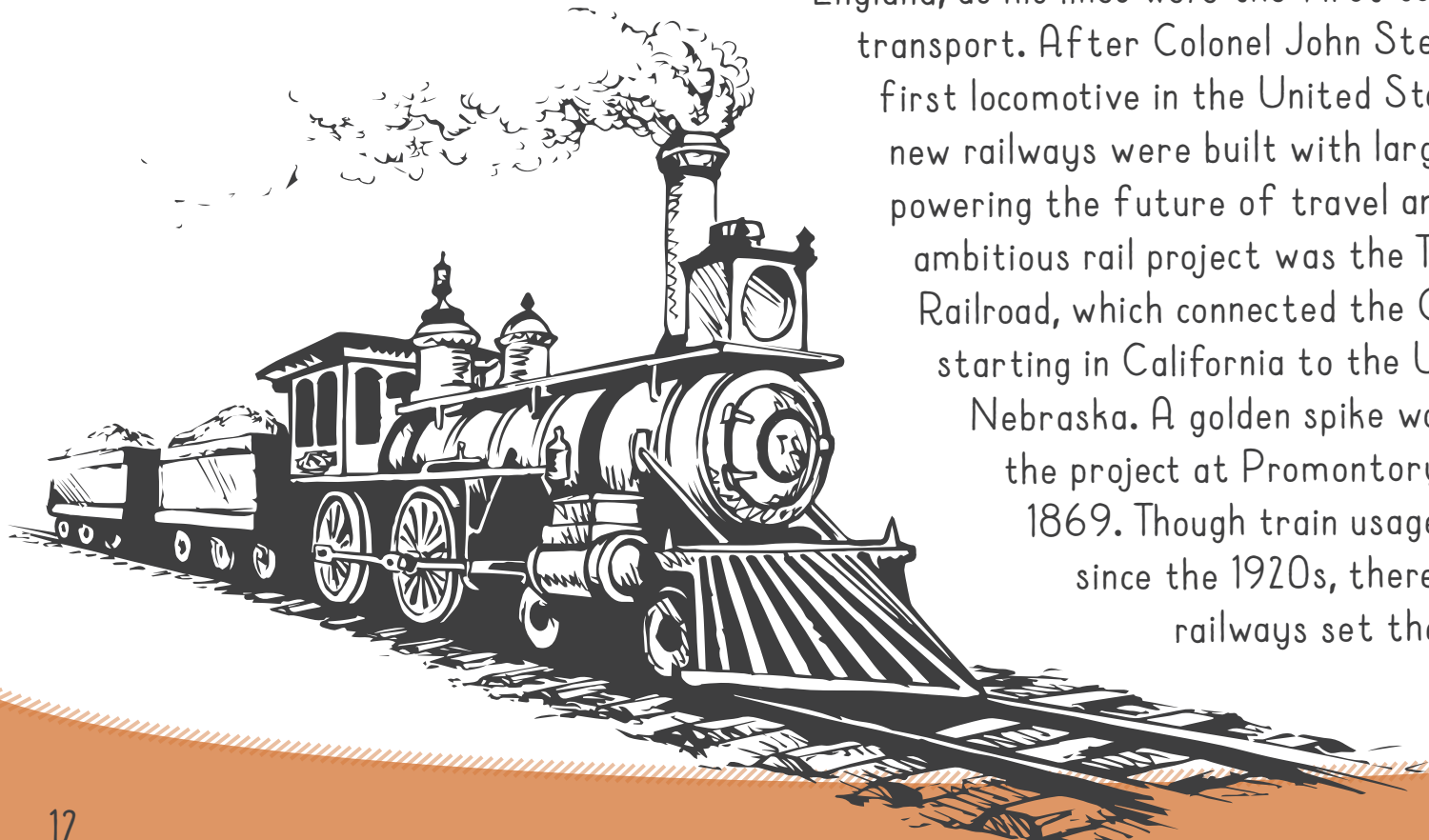
Sharing ideas can speed up the progress of inventions.

### Fun facts:

- Even in the digital age, we still use the term typesetting to describe the layout of books in recognition of the process of setting letters in place for the printing press.
- Johannes Gutenberg produced the now-famous Gutenberg Bible around 1455 to give glory to God for his new invention.
- Martin Luther's German translation of the New Testament is sometimes called the first best-seller, with 5,000 copies sold about two weeks after printing.
- The first official newspaper, *Relation*, was printed in 1605 in Strasbourg, France. Due to the impact of the printing press on the spread of news, reporters are still referred to today as the Press.

# Railways:

All aboard! Next stop, the invention of the railway. Though ancient railway systems existed as early as 600 BC, it wasn't until the 1500s that wooden rails called wagonways first appeared in Germany. By 1776, iron tramways began appearing throughout Europe. Over time, the strength and durability of railways improved, but horses still pulled the wagons and carts. Then came the mighty steam engine. British inventor Richard Trevithick built the first steam-powered locomotive for tramways, but George Stephenson is considered the father of railways in England, as his lines were the first to be used for public transport. After Colonel John Stevens constructed the first locomotive in the United States in 1825, many new railways were built with large train companies powering the future of travel and trade. The most ambitious rail project was the Transcontinental Railroad, which connected the Central Pacific line starting in California to the Union Pacific railroad in Nebraska. A golden spike was placed to complete the project at Promontory, Utah, on May 10, 1869. Though train usage has been in decline since the 1920s, there is no doubt that railways set the world on a new track.



## Fun facts:

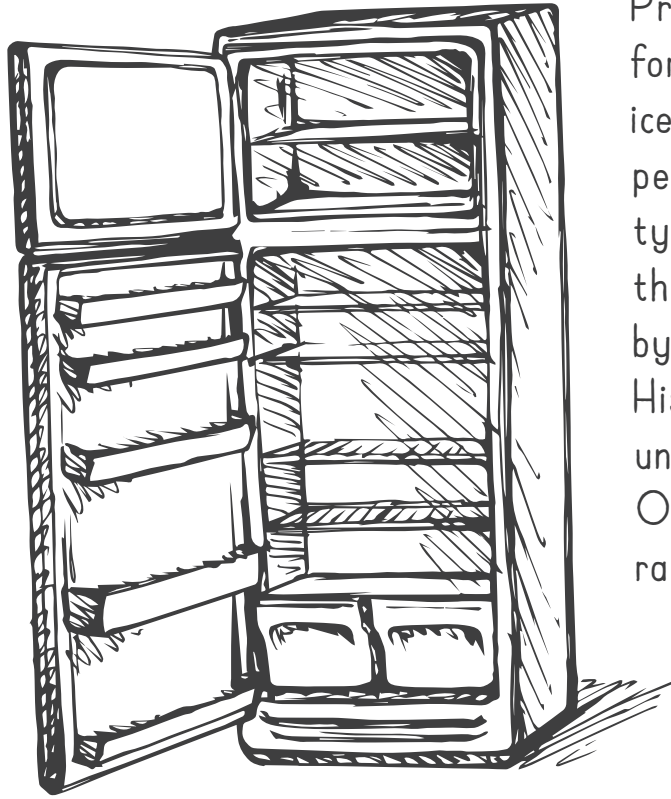
- The ancient Greeks carved grooves into paved roads to make transport easier. The Diolkos, which helped carry boats by land over the Isthmus of Corinth, is one of the most famous examples.
- Many brilliant women made major railway improvements. Some examples include better axle bearings that decreased derailments (Eliza Murfey, 1870), a sound-dampening system to reduce noise (Mary Walton, 1881), and railway crossing gates for safety (Mary I. Riffin, 1890).
- The Czech Republic has more railways per square mile than any other country.
- High-speed trains traveling at 321.87 kilometers per hour (200 miles per hour) are now found throughout the world. New experimental trains have achieved test speeds close to 1,126.54 kilometers per hour (700 miles per hour)!



### **Inventor tip:**

Drafting plans first can help your project not get derailed in later stages.

# The Refrigerator:



Preserving food has always been a high priority for humans. Before the refrigerator, packed ice or underground cellars extended the life of perishable foods. Artificial refrigeration, which typically removes heat from an enclosed space through evaporation, was first displayed publicly by Scottish professor William Cullen in 1756. His ideas, however, were not put into practice until years later. In 1805, American inventor Oliver Evans designed a machine that used vapor rather than liquid for cooling, but it wasn't until 1834 that Jacob Perkins actually made the first working refrigerator of this type. The electric refrigerator was first sold commercially by Fred W. Wolf in 1913. A

year later, Florence Parpart patented an attachment that used electricity to circulate water through the refrigerator to keep it colder. She sold her system at a high price to large companies, but William C. Durant's launch of the Frigidaire Company truly grew the refrigerator market. Unfortunately, the expanded home use of refrigerators also led to problems, including deaths caused by toxic gas leaks. Freon then replaced ammonia, methyl chloride, and sulfur dioxide as the standard coolant in refrigerators.

Environmental concerns over Freon have prompted researchers today to search for even safer ways to keep food cold, including the use of solar and magnetic energy. Thanks to the work of many talented inventors, the refrigerator is truly one of the coolest inventions to date.



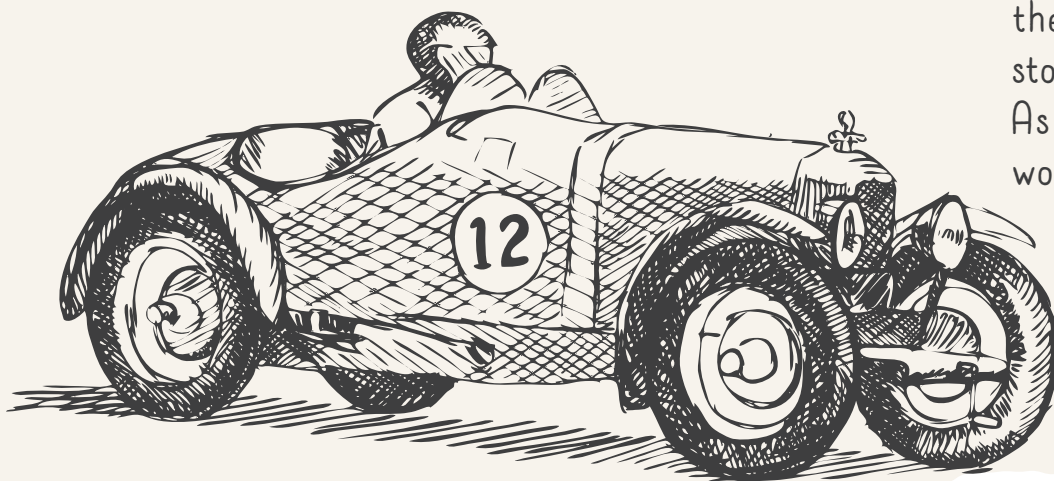
## Fun facts:

- Thomas Jefferson took pride in using his ice houses to make frozen treats for guests. Though he did not invent ice cream, he recorded the first known written recipe in the United States.
- Lillian Gilbreth, the first woman admitted into the Society for Industrial Engineers, was the inventor of shelving on refrigerator doors.
- "Smart" refrigerators are now on the market with internet, cameras, touch screens, and televisions.
- November 15th is celebrated as Clean Out Your Refrigerator Day.

### Inventor tip:

Always take safety precautions when trying out new inventions.

# *The* STORY of INVENTION



Have you ever wondered how the greatest inventions came to be?

From airplanes to dishwashers and mighty locomotives to the tiniest nail, this book explores fun facts and inspiring stories about fifteen of the most life-changing inventions! As you read, inventor tips will also help you improve the world through your own creative spirit.

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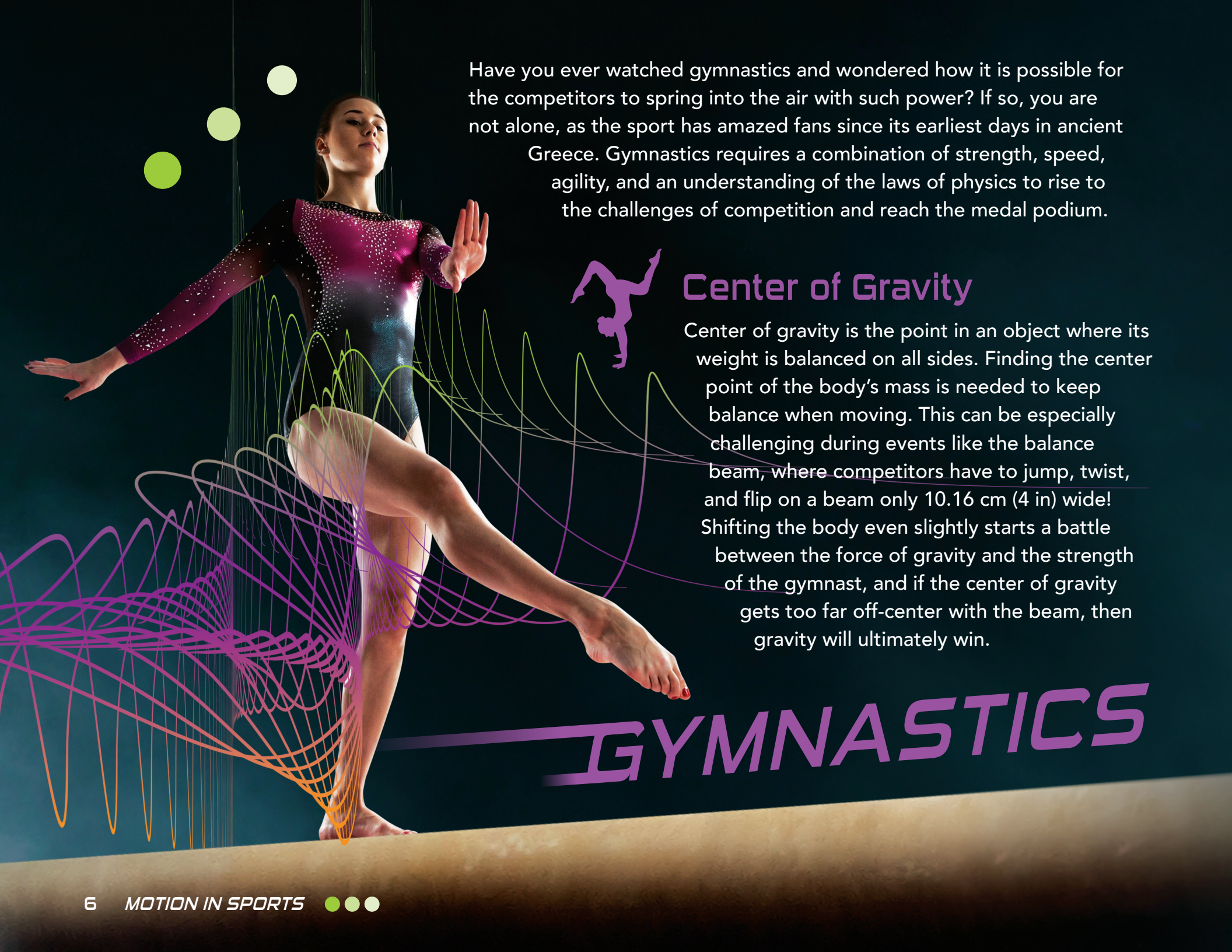


# *Motion in* SPORTS

Written by  
David Wiseman



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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.

	<i>APPROACH</i>	<i>SPRINGBOARD</i>	<i>VAULT</i>	<i>FLIGHT</i>	<i>LANDING</i>
<b>ACTIVITY</b> 	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.
<b>SELECT FORCES</b> 	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

Fast  
ball speed

Low  
bounce

### CLAY

Slower  
ball speed

High  
bounce

### HARD COURTS

Medium  
ball speed

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.



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