

# **SMART CYCLING**

**Promoting Safety, Fun, Fitness,  
and the Environment**

Includes

**DVD  
VIDEO**

that teaches  
skills and  
safety

**League of  
American  
Bicyclists**

**ANDY CLARKE**  
*Editor*

GT 872.3

# SMART CYCLING

Promoting Safety, Fun, Fitness,  
and the Environment

League of American Bicyclists

  
Andy Clarke  
Editor



Smart cycling

智能自行车运动



Human Kinetics

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# PREFACE

**F**rom one of the main modes of transportation in China to a beloved and popular transportation option in the Netherlands, bicycling is a popular and commonplace tradition around the world. In the United States, bicycling had its peaks and valleys throughout the 20th century, and as we end the first decade of the 21st century, its popularity is again soaring. As people seek exercise solutions simpler than joining a gym and look for ways to save money on transportation, bicycling presents an easy option for both. Americans are also coming back to cycling because our country is investing in making it more attractive. Federal transportation funds, as well as state and local investments, are transforming our communities and making it much easier for people who want to ride to do so.

An inspiring example is Portland, Oregon. This city, recognized by the League of American Bicyclists as a platinum-level Bicycle Friendly Community, has spent the past 20 years promoting cycling and investing in infrastructure and education for cyclists. Today, the city's statistics indicate that the number of cyclists in Portland has quadrupled since 1990 while the accident rate has plummeted. (For more information on Portland and the other top 13 U.S. cities for cycling, see appendix B.)

With cities building roads for bicyclists, a bike in almost every garage or shed, and so many good reasons for getting on a bike, the only things missing are the skills and confidence to ride those bikes well with traffic. This book, *Smart Cycling: Promoting Safety, Fun, Fitness, and the Environment*, fills in those missing skills. There have been some exciting changes in cycling in the United States during the past few years. In response to a growing interest in outdoor adventures and increased concern about obesity, bicycling offers a fun and easy way to exercise and explore. This book is a resource for anyone with an interest in bicycling—teachers who want to instruct their students in cycling, recreational center and park employees who want to encourage cycling, and anyone who loves the outdoors. There is also a DVD containing instructional videos on cycling skills and safety for children and adults; for more details, see Using the DVD on page 154.

There is a good deal of instruction in this book, from how to signal correctly to emergency maneuvers you may need to know in a tricky situation. Bicycles are considered vehicles in all 50 states, and their riders must observe the same rules of the road as do the drivers of any other vehicle. Because cyclists' size and speed relative to cars and trucks have the potential for dangerous crashes, this book offers tips and techniques on safely and correctly riding with traffic.

The most important message in *Smart Cycling*, though, is this: Cycling is open to everyone, is a great way to get around, and is a lot of fun. If you want to invest thousands of dollars in a bike and get outfitted in the latest spandex gear, that's fine. If you want to resurrect the abandoned bike in your garage, take it to a bike shop to get it up to speed, and then ride it around town in shorts and a T-shirt, that's fine too. Cycling is an equal-opportunity adventure, open to anyone willing to pedal uphill, coast downhill, and enjoy all the moments in between.

The book is especially aimed at educators and others who teach children. A 2010 study by the Kaiser Family Foundation found that 8- to 18-year-olds spend an average of 7 hours and 38 minutes using entertainment media (cell phones, television, video games) in a typical day. Rather than stay indoors connected to electronics, children

need to be outdoors, able to explore and learn independence. A bicycle can be the vehicle that opens an entire new world to them. Reversing the downward trend of children who bicycle to school is an important part of the mission of this book, but children must be ready to ride on the road. The techniques in this book are specifically designed to help children and adults use bicycles safely as transportation.

Protecting the environment is also on everyone's mind: encouraging people to reuse bags at the supermarket, to compost, to drive fewer miles, and so on. Bicycling is an easy way to sharply lower carbon emissions while sharply increasing fun. Going green can feel a bit overwhelming—remembering to take those bags back to the market is a heroic effort in and of itself!—but bicycling is an easy and fun way to reduce the environmental footprint. Saving money on fuel and other vehicle-related expenses is another benefit.

This book was written in cooperation with the League of American Bicyclists (hereafter referred to as the league). The league was founded as the League of American Wheelmen in 1880. Bicyclists, known then as “wheelmen,” were challenged by rutted roads of gravel and dirt and faced antagonism from horsemen, wagon drivers, and pedestrians. In an effort to improve riding conditions so they might better enjoy their newly discovered sport, more than 100,000 cyclists from across the United States joined the league to advocate for paved roads. The success of the league in its first advocacy efforts played a role in the national highway system.

Today, the league still advocates for cyclists in the nation's capital and across the country. In addition to advocacy work, the league promotes cycling, educates cyclists and motorists on sharing the road, and works to build a bicycle-friendly America. At [www.bikeleague.org](http://www.bikeleague.org), you can find information on our education programs (such as this book); our recognition program through which businesses, communities, and states earn the Bicycle Friendly designation; and our national advocacy work in Washington, DC.

This guide will allow you to master the art of cycling as well as teach it to others. The information in this book has been tested on the road by hundreds of thousands of cyclists. Enjoy the ride!

# ACKNOWLEDGMENTS

In 2004, the League of American Bicyclists self-published *A Guide to Safe and Enjoyable Cycling*. The book was our first real attempt to popularize the content of the league's education program, then called simply BikeEd, and share with a wider audience the helpful, practical, and potentially life-saving tips and techniques for riding a bike safely in traffic. The book was written by staff and volunteers over several years and was an important step forward for the organization and the subject matter.

The book has served us well—but the opportunity to update the material, include a particular focus on children, and publish the book with Human Kinetics was timely and most welcome. The additional rigor with which the material has been checked and double-checked by Gayle, Ray, Derek, and the team at Human Kinetics has been both essential and illuminating. The league's education director, Preston Tyree, has ensured we stick close to the core principles of our education program—now called Smart Cycling—which is taught by thousands of league-certified instructors across the country; and colleagues Anna Kelso and David Herlihy graciously contributed “Cycling for the Fun of It” and the history section of “History and Benefits of Bicycling,” respectively.

*Smart Cycling* would not have happened without the leadership and commitment of Elizabeth Kiker on the league's staff. She has tirelessly shepherded the book through stages of publication some of us didn't realize even existed and has painstakingly pulled together the pictures, graphs, and references so that we all end up looking good.

Finally, the inspiration for a book like this has to be the next generation of riders. My own children, Jacqueline and Ashton, are already avid riders to and from school and around the neighborhood—and I hope this book will encourage them to reach even further afield a-wheel. Elizabeth's kids, Oliver and Allyson, are a little younger and have a year or two more of being carried around by Mom, but their time will soon come when they too can learn the simple pleasure of a bike ride and enjoy it more safely.



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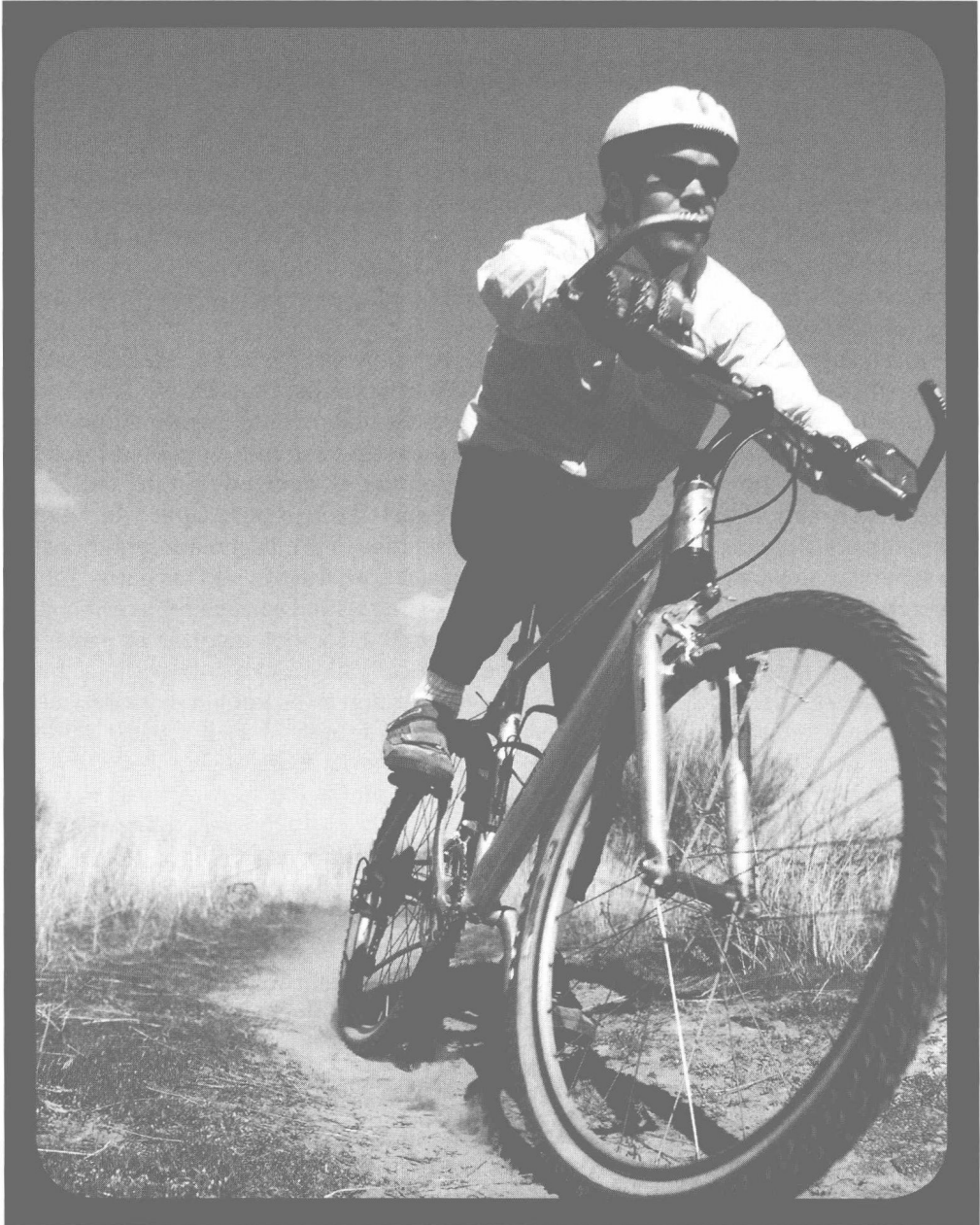
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CHAPTER  
**1**

# **HISTORY AND BENEFITS OF BICYCLING**



When I see an adult on a bicycle,  
I do not despair for the future of the human race.

—H.G. Wells

**I**t took hundreds of years for bicycles to develop from the idea of human-powered transit to the fun, easy vehicles seen everywhere today. Inventors, passionate cyclists, and creative thinkers all played a part in the development of the bicycle. Today's bicycles, the result of all this hard work, provide cyclists with a great way to lose weight, improve their mental health, and help the environment.

## HISTORY OF BICYCLING

"History of Bicycling" contributed by David Herlihy

More than three centuries ago, the distinguished French mathematician Jacques Ozanam recognized the compelling theoretical advantages of a human-powered carriage "in which one can drive oneself wherever one pleases, without horses." The modern bicycle, a remarkably efficient and economical machine, is in effect the culmination of an ancient quest to design and build a practical vehicle propelled by that abundant resource known as willpower.

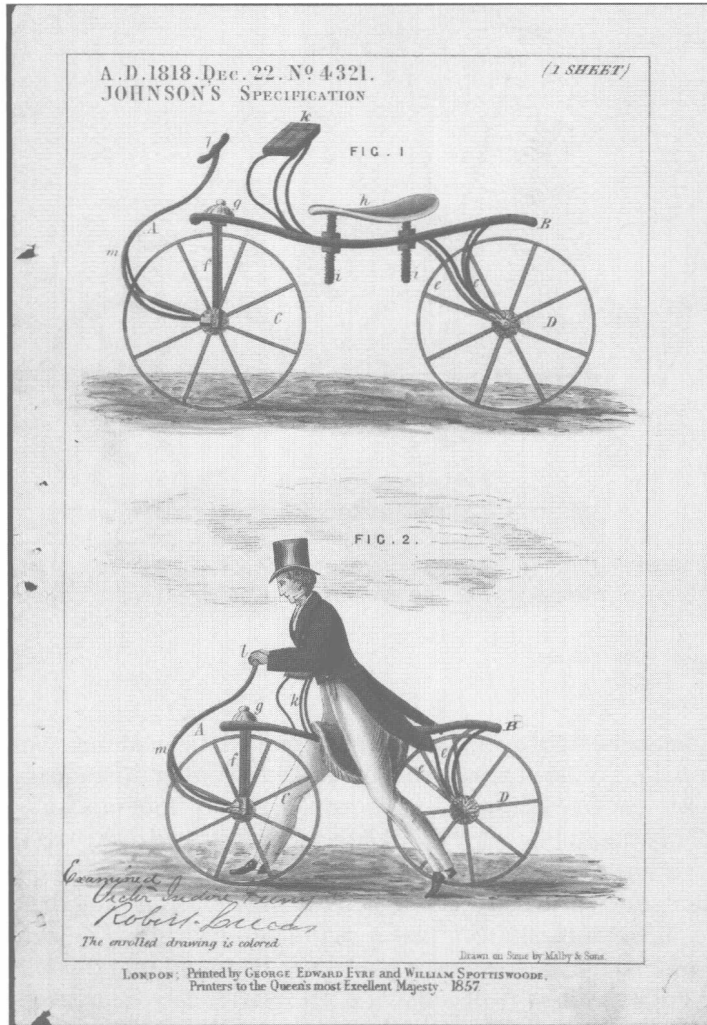
By the early 19th century, the Industrial Revolution was picking up steam, energizing inventors of all stripes. In 1813, Karl von Drais, an eccentric German baron from a distinguished family in Karlsruhe, built a four-wheeled vehicle seating up to four passengers. Several passengers supplied the power by working a cranked axle with their legs, while another steered by means of a tiller. Convinced that he had finally achieved a practical horseless carriage, Drais courted the public's approval. Several journals published descriptions, and a few luminaries offered accolades, notably the Russian tsar, Alexander I. Still, the patent offices of both Austria and his native Baden rejected his pleas for protection. One examiner even issued a harsh rebuke, insisting that no man-made device could ever improve on the God-given means of walking.

A few years later, in 1817, Drais proposed a radically different solution: the *laufmaschine* (running machine), a personalized vehicle soon to be known as a *draisine* or *velocipede* (from the Latin words meaning fast foot) (figure 1.1). It represented the first significant step toward the basic bicycle, a compact, pedal-powered vehicle.

Except for its iron tires, the machine was made almost entirely of wood and had but two miniature carriage wheels in a line, connected by a perch that supported a single cushioned seat. The rider sat nearly erect and propelled the machine by pushing off the ground with one foot, then the other, as if walking or running. A long pole pivoted at the foremost end of the frame, allowing the rider to turn the front wheel in the desired direction of travel. A small padded board was affixed waist high in front of the seat, on which the rider could rest the elbows or forearms, shifting pressure as needed to keep the vehicle from tipping to one side or the other.

## Emergence of the Basic Bicycle

For the next few decades, inventors continued to toy with velocipedes, generally reverting to four-wheeled platforms while proposing all sorts of propulsion schemes that employed either the legs or arms, or both (figure 1.2). Some, like Willard Sawyer of Dover, England, even enjoyed modest commercial success. Still, the



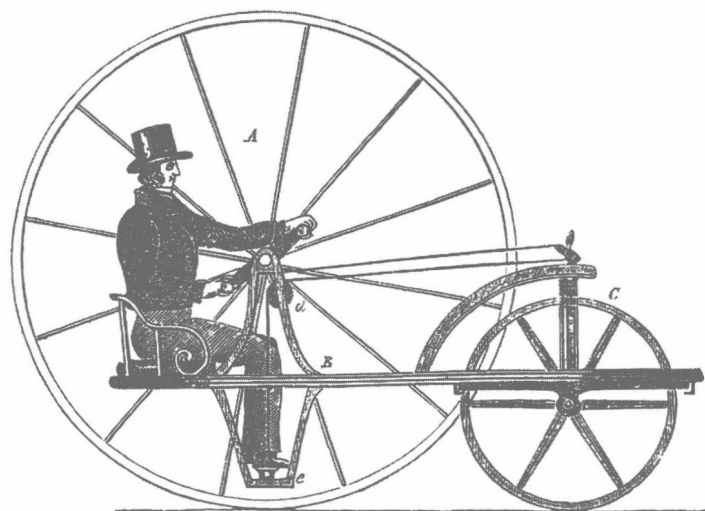
**Figure 1.1** The 1818 British patent of Denis Johnson, a coach builder in London, describes an improved kick-propelled two-wheeled velocipede.

Courtesy of the National Archives (Northeast Branch, New York)

public continued to regard the velocipede as a failure with, at best, dim prospects for improvement.

Finally, in the mid-1860s, the basic bicycle emerged in Paris. The brainchild of Pierre Lallement, a mechanic who specialized in baby carriages, it strongly resembled the hobby horse except for the pedals protruding from the front hub. The slender vehicle reprised Drais' delightfully compact profile. At the same time, it demonstrated the surprising principle that a vehicle with but two wheels in a line could be indefinitely balanced and propelled by means of a mechanical drive—rather than by human propulsion alone. This removed the principal objection to the draisine and opened a promising path for development.

Lallement himself, meanwhile, had emigrated to Connecticut with the makings of an improved bicycle in tow (figure 1.3). In the spring of 1866, he tooled around New



**Figure 1.2** One of the many unsuccessful attempts to build a practical human-powered vehicle after the demise of the draisine and before the introduction of the basic bicycle.

Courtesy of the Boston Public Library

Haven, to the amazement of a journalist who reported the next day: “An enterprising individual propelled himself about the Green last evening on a curious frame sustained by two wheels, one before the other, and driven by foot cranks” (as recounted in “Pierre Lallement and His Bicycle,” *Wheelmen Illustrated*, Oct. 1883). Lallement’s antics attracted an investor, James Carroll, and the two were soon awarded an American patent, the world’s first published document describing the basic bicycle.

They failed, nevertheless, to enlist a manufacturer and a dejected Lallement returned to Paris. To his great surprise, however, he found that the Michaux bicycle had become a great hit there in his absence. The novelty also caught the attention of foreign visitors, including Americans who began to take an interest in the machine.

## Bicycles in America

The “boneshaker” (so nicknamed because the wooden wheels were very tough on riders) unleashed a frenzy of experimentation and fired the public’s imagination. “Never before in the history of manufacturers in this country,” marveled the *New York Times* in early 1869, “has there arisen such a demand for an article.”

In the interim, however, the crude bicycle spawned the majestic high-wheeler. Developed primarily in France and England, the new design retained the boneshaker’s simple but effective direct drive. Its enlarged front wheel, meanwhile, gave a better gear. Its vastly improved construction, employing wire wheels, ball bearings, and tubular frames, halved the weight of the typical bicycle and gave a much better ride. The new vehicle could now travel a hundred miles in a single day, even over poor dirt roads.

By the mid-1870s, the new style of bicycle had gained a significant following among prosperous young Englishmen who relished camaraderie and adventure on the open road. By the end of that decade, exploiting the Lallement patent, the



**Figure 1.3** Pierre Lallement poses on a velocipede in Paris in 1869 or 1870. After returning to France he sold his patent and used the funds to start a short-lived bicycle business.

Courtesy of the Library of Congress

Boston businessman Albert A. Pope reigned over a robust American cycle industry. For all its appeal, however, the high bicycle was intimidating to untold numbers of would-be cyclists. It often catapulted the rider over the handlebars, at times causing serious injury and even death. The industry came under increased pressure to offer safer alternatives (figure 1.4).

Although several other designs, including tricycles, gained a small following in the 1880s, it was the Rover that would set the fashion for the world by the end of that decade. Developed by J.K. Starley of Coventry, England, the so-called safety bicycle featured wheels of equal size, the rear one powered by a chain and sprocket. By the early 1890s, with the introduction of inflatable tires, the upstart bicycle, eerily reminiscent of the old boneshaker, had driven the high-wheelers off the road while attracting legions of new riders, including women.

A great boom exploded as millions the world over took to the feather-light wheel, weighing a scant 25 pounds. Gushed one American in the August 1895 issue of *The Cosmopolitan*, "It is well nigh impossible to calculate the far-reaching effects of [the bicycle's] influence." For starters, the low-mount safety bicycle encouraged an increasingly sedentary population to exercise outdoors. The bicycle also had an enormous impact on women and the rigid Victorian dress code. "Since women have taken up the bicycle," noted one feminist, "it has become more and more apparent that its use demands a radical change in costume" (*The Cosmopolitan*, August 1895). Some even began to use the bicycle for everyday transportation.



**Figure 1.4** An American Star being driven down the Capitol steps in the late 1880s to show its superior stability relative to the high-wheeler. For a brief time, Star became a favorite among American cycle tourists and racers.

Courtesy of the Library of Congress

Still, the bicycle did not truly complete its transition from a rich man's toy to a poor man's carriage until the early part of the 20th century. Before the boom, the first safety bicycles had cost about \$150—at a time when the average worker made only about \$12 a week. And despite its popularity, it remained a costly investment throughout the boom. But shortly thereafter, reliable bicycles were selling for only around \$25, primarily through department stores and mail-order houses.

## Bicycling Around the World

Throughout the 1920s and 1930s, utilitarian and recreational cycling thrived in Europe. The touring bicycle, developed primarily in France and England, used light-weight frames, aluminum alloy parts, and hub or derailleur gears. Cycle camping

became popular among the middle class, while a growing network of youth hostels, born in Germany, offered cycle tourists cheap accommodations.

In developing countries like India and China, demand for utilitarian bicycles soared. In the car-crazy United States, meanwhile, the bicycle had become primarily a child's vehicle, laden with automotive-style gadgets. However, in the midst of the Great Depression, the country suddenly experienced a brisk recreational revival, taking a cue from Hollywood actors like Joan Crawford who had discovered the joys of cycling. The bicycles, patterned after children's models, were nonetheless heavy, weighing a good 50 pounds or more.

During World War II, the bicycle played an even larger role in everyday life in Europe. Even fuel-pinched Americans turned to the two-wheeler for basic transportation. Although reliance on the bicycle would wane at the conclusion of the conflict, recreational interest enjoyed another revival, thanks in large part to the flood of GIs who returned from Europe with a greater appreciation for lightweight bicycles with three-speed hub gears.

In the late 1960s, following a juvenile fad for the low-riding, fast-moving Schwinn Sting-Ray, American adults began to acquire a taste for even lighter and more versatile bicycles with derailleurs, known as 10-speeds. A second boom occurred. Suppliers in Europe, Asia, and America worked frantically to meet the overwhelming demand, selling some 40 million bicycles between 1972 and 1974. Although sales eventually tapered off, cycling had reestablished itself on both sides of the Atlantic as a popular adult pastime.

Since then, the versatile mountain bike, with fat tires and multiple gears, has given cycling a wonderful boost. In the late 1970s, a group of young men and women based in Marin County, California, began to modify old bicycles for off-road use. By the 1980s, manufacturers had recognized a market for rugged yet comfortable bicycles that could go just about anywhere. The robust design of the mountain bike, conducive to city riding, has also been a boon to utilitarian cyclists, spawning the wildly popular hybrid bicycle. Hybrids have wider tires and an upright position, like mountain bikes, and include the larger wheel size of road bikes. Their versatility allows riders to use them on road, trails, and some off-road situations.

## Bicycling Today

Today, the bicycle continues to provide cheap and clean transportation. Of course, it is still widely used throughout the developing world, even as many countries strive to increase domestic automobile production and sales. In developed countries, the bicycle is increasingly favored as a "green" machine that can help reduce obesity and traffic congestion. Many cities now offer extensive bicycle lanes and even sophisticated rental networks. Many firms encourage bicycle commuting to improve the health of their employees.

Recreational cycling is also on the rise: Consumers enjoy a greater variety of cycles than ever before at all price points. Many consider RAGBRAI (which stands for Register's Annual Great Bicycle Ride Across Iowa) the start of cross-state tours. From its inception in 1973, there are now more than 20,000 participants in the week-long ride, each of whom pay only \$140. On the other end of the spectrum, Cycle Oregon is a plush, tightly organized ride that limits itself to 2,000 riders. This allows them to treat each rider like royalty, serving excellent food, microbrews, and much more. The joy of Cycle Oregon will set you back \$850, and it sells out within a week of the

## **BICYCLE FRIENDLY AMERICA**



The League of American Bicyclists' Bicycle Friendly America program teaches, rewards, and encourages bicycling in America. The program recognizes businesses, communities, and states for promoting and supporting cycling. Awards given are bronze, silver, gold, and platinum—all are coveted designations. Visit [www.bikeleague.org](http://www.bikeleague.org) to find out more.

### **Bicycle Friendly Businesses**

The Bicycle Friendly Business (BFB) program recognizes employers' efforts to encourage a more bicycle-friendly atmosphere for employees and customers. The program honors innovative bike-friendly efforts and provides technical assistance and information to help companies and organizations become even better for bicyclists.

### **Bicycle Friendly Communities**

The **Bicycle Friendly Community** (BFC) application is an in-depth audit of the engineering, education, encouragement, enforcement, and evaluation efforts in a municipality. This comprehensive inquiry is designed to yield a holistic picture of a community's work to promote bicycling. The application is free, and assistance is available from league staff members.

### **Bicycle Friendly States**

The Bicycle Friendly State program is a two-part recognition program that ranks and recognizes states that actively support bicycling. First, states are ranked annually based on their level of bike-friendliness. Secondly, states that wish to apply for a Bicycle Friendly State award designation can receive further recognition and promotion of their efforts as well as feedback, technical assistance, training, and further encouragement to improve their bicycling legislation, projects, and programs.

opening. Scores of organizations host annual rides to raise money for charities and cycling clubs abound. The Multiple Sclerosis Society hosts rides across the United States that raise millions of dollars, as do the American Diabetes Association, Bike and Build, the Lance Armstrong Foundation, and many more. These rides are fun and raise hundreds of millions of dollars for charity.

Since bicycling was first included in the U.S. transportation bill in 1991, federal, state, and local funding for bicycling has blossomed. In the decades since, communities have paved old railroad lines to become trails, added bike lanes to miles of streets, and developed single-track trails for mountain bicyclists.

Where will the bicycle go from here? Some believe it is due for a major overhaul, given the superior speed of low-slung aerodynamic models known as recumbents, where riders are seated and their legs are straight out in front of them. Others predict the most popular bicycle of the future will have an electric motor, ready

to kick in whenever the riders' will to pedal wanes. A 2010 article in the *New York Times* notes that there are currently an estimated 120 million electric bicycles on the streets of China, up from a few thousand in the 1990s (Goodman 2010). Regardless of what lies ahead, the bicycle's rich and colorful history projects a future as bright and energetic as its past.

## BENEFITS OF BICYCLING

The bicycle is a simple two-wheeled machine that uses human power for propulsion. But riding this machine is one of the great and simple joys of life. It grants a sense of delight and accomplishment no matter your age or ability—from a 3-year-old on training wheels to an 85-year-old riding 50 miles in a day. The wind in your face and the freedom with which you flow over the earth can refresh the soul. Your heart pounds, and your muscles push you faster and faster up a hill. Then, as you stop pedaling and coast down the other side, a grin magically spreads across your face.

Of course, the benefits of bicycling include more than freedom and independence. Cycling helps you save money on fuel, get into better shape, and remain healthier longer. Bicycling is a fitness activity that the entire family can enjoy together. Bicycles are used for recreation, transportation, sport, and work. In fact, more people around the world use the bicycle as a means of transportation than any other vehicle (Did You Know? n.d.). Starting at below \$100, the bicycle is a form of transportation virtually everyone can afford and a way of life that no one should pass up.

### Lose Weight, Gain Fitness

The bicycle offers an enormous range of practical benefits for individuals, families, and society as a whole. Bicycling is one of the best activities for the cardiovascular system, and cycling is very effective for reducing weight and keeping it off. A 150-pound cyclist burns 410 calories in 1 hour while pedaling at a moderate pace of 12 miles per hour—burning the number of calories nearly equivalent to a plate of pasta with Alfredo sauce. A 200-pound cyclist burns 708 calories in 1 hour while pedaling at 12 miles an hour—burning calories equivalent to that of a lean steak with a baked potato and serving of broccoli (NutriStrategy 2005).

### Get Mentally Healthy

Bicycling is good not only for the body but also for the mind. In addition to breathing fresh air and exercising, the cyclist is his own vehicle, using self-power instead of machine power to get from point A to point B. This is a remarkably good feeling—to ride by the bus parked in traffic, glide past the cars stopped on the road as you coast by on a trail, or arrive at work powered by nothing but your own legs. These achievements help frame each day as successful from the beginning. Bicycling also relaxes you, giving you time to think as you ride, reducing your stress levels, and increasing your self-esteem and self-confidence as you improve.

### Bike to School

Bicycling remains a popular activity among children and a way to stay active and healthy for all ages, but it has declined as a functional mode of transport. According



## ***Kid's-Eye View***

### **The Benefits of Bicycling**

**K**ids are battling obesity at even higher rates than adults in the United States; daily activity is an important prescription to change this. How do you know if your child is ready to ride a bicycle? Here are some tips:

- Once a child can hold up his head and wear a helmet, he can be a passenger on a bike.
- Until about age five, kids should ride in a child seat, or better yet, a trailer.
- Kids need basic motor skills to operate a bike.

If kids are ready, be sure to teach them about riding safely:

- Explain to kids how traffic works; they have only been passengers.
- Teach them about yielding, passing, predicting, and obeying traffic laws.
- Bicycle riders have to obey the same rules as cars and buses.

to the National Household Travel Survey, funded by the Federal Highway Administration, in the 1960s more than 40 percent of children bicycled and walked to school (sometimes “uphill both ways in the snow”!). Today, only 12 percent of children bike or walk to school. At the same time, a survey done by the Centers for Disease Control and Prevention (n.d.) shows children are fighting obesity and diseases at unprecedented rates. About 32 percent of American children and adolescents today—25 million kids—are obese or overweight, according to the survey, and diseases such as type 2 diabetes (known previously as adult-onset diabetes) and asthma are becoming more common. A return to biking to school could help combat some of these serious conditions and diseases. The national legislation creating the Safe Routes to School was passed in 2005 and allocated \$612 million to programs that encourage children to walk and bike to school.

## **Start Your Day Right by Commuting**

According to the 2009 Nationwide Personal Transportation Survey, 28 percent of all trips in the United States are a mile or less, and 40 percent of all trips are two miles or less. Though these distances can easily be traveled by bike, more than 72 percent of trips within three miles of home are made by personal motor vehicle. These statistics could radically change if more people chose to bicycle to work (figure 1.5).

People who commute to work by bike, rather than car, avoid stress-inducing traffic jams, tollbooth lines, and battles for parking spots. They arrive at work feeling energized instead of enervated. They are ready to work, not frustrated