Name _____

History on Two Wheels

Bicycles have come a long way. Check out the bicycle time line below, then answer the questions that follow.

1817
The draisienne, or "walking machine," was invented. Riders moved it forward by pushing their feet against the ground and then coasting.

1863
The velocipede ("fast foot") was invented. It had pedals on the front wheel that helped riders travel faster than pushing the ground with their feet did.

1870
The high-wheeled bicycle was invented. To make it travel farther with each push of the foot, the front wheel was extremely large.

1884
The "safety bicycle" was invented. It had two tires of equal size and a chain to the rear wheel. It was safe because it balanced better than high-wheeled bikes did.

1888
Pneumatic (air-filled) tires were invented, giving bikes a smoother ride.

1940s
Built-in kick-stands were added to bikes to prop them up when not in use.

1960s
The 10-speed gearshift became common on bikes. Gears help riders save energy when traveling quickly or uphill.

1984
Gears were added to make bikes that have as many as 24 speeds.

2007
Fallbrook Technologies developed a new gearless bike transmission.

1. What year was the "walking machine" invented?
Ⓐ 1817 Ⓑ 1865 Ⓒ 1870

2. How do pneumatic tires give bikes a smooth ride?
Ⓐ They are big. Ⓑ They are filled with air. Ⓒ They are made of rubber.

3. Why did the bicycle invented in 1870 have a big front tire?
Ⓐ to make it go farther with each pedal push Ⓑ to help riders see in traffic Ⓒ to help riders travel on rough dirt roads

4. How do gears help bicyclists?
Ⓐ They make bikes safer. Ⓑ They help riders save energy. Ⓒ They help riders balance.

5. What made "safety bicycles" safe?
Ⓐ They traveled slowly. Ⓑ They were easy for automobile drivers to see. Ⓒ They were easy to balance.

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Senior Edition

New Vinci

An old idea leads bicycles down a new path.

WR WEEKLY READER PUBLISHING

Cover photo illustration: Megan Berkhobler; da Vinci head: Getty Images; bike: Ellsworth Handcrafted Bikes, Inc.; background: Institute for Cultural Exchange, Germany; 1817: SuperStock; 1870: Jupiter Images; 1884: Science Museum/Science & Society Picture Library; 1960: Jupiter Images; 2007: Fallbrook Technologies, Inc.

Smooth Shifting

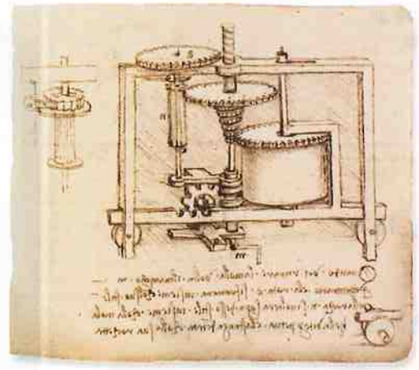
Old ideas help power the newest bicycles.

Leonardo da Vinci never rode a bike. Bicycles didn't exist when he lived (1452-1519). But designs by da Vinci did inspire one of today's cutting-edge bikes. Parts of the new bike follow sketches done by the artist and inventor in 1490.

What can today's bicycles gain from old da Vinci sketches? Bill Klehm says da Vinci's doodles were the inspiration to overcome some basic challenges of bike riding. "Have you ever had the chain fall off your bike?" Klehm asks. "Have you ever been stuck in the wrong gear and unable to climb a hill?"

Klehm is the president of Fallbrook Technologies. His company invented a new type of **transmission** for bikes. A transmission is a device that sends a vehicle's power to its wheels. The company named the new bike transmission NuVinci in honor of da Vinci.

What's unusual about the bike shown above? It has multiple speeds without multiple gears! Most bikes have gears that help them travel at different speeds. The new bike replaces gears with balls inside the back wheel. Depending on the position of the balls, more or less force is sent to the back wheel. The idea is based on a sketch by Leonardo da Vinci (right), in which a rounded gear transmits force by changing position. The small part of the gear requires more force to turn than the wide part.



da Vinci sketch: Institute for Cultural Exchange, Germany; gear: Fallbrook Technologies, Inc.; bike: Ellsworth Handcrafted Bikes, Inc.; ball diagrams: Fallbrook Technologies, Inc.

Geared Up

The transmission in a traditional bike is a system of **gears**. Gears are sets of wheels with interlocking spikes. A chain connects gears on the pedals to gears on the wheel.

When you shift the gears on your bike, you move the bike chain between gears of different sizes. A large gear on the pedals and a small gear on the wheel make the bike travel a long way with each turn of the pedal. However, going uphill is hard. Shifting to larger gears in back and smaller pedal gears makes pedaling easier, but the bike doesn't go as fast.

Early bikes had just one gear. Top bikes today let riders choose between 24 gears. Not bad, Klehm says—but there's room for improvement. Switching the chain between gears can make pedaling hard. Sometimes the chain falls off.

On the Ball

Fallbrook's new bike transmission, called a **continuously variable transmission** (CVT), doesn't have those problems. In fact, it doesn't have traditional gears at all. It uses a system of rotating balls. The balls transmit the power from the chain to the wheel. The position of the balls determines how much each turn of the pedal moves the wheel. Unlike shifting conventional gears, changing the position of the balls goes very smoothly. "There's no clicking between gears," Klehm explains.

So far, more than 15,000 bikes with the NuVinci have hit the streets. In 2008, Klehm said, the company expects to sell 80,000 more. Bike gears soon might go out of style, just as huge front tires did 120 years ago. If gears go, expect learning to use the new transmission to be simple. As Klehm says, "You adjust until it feels good … and you're where you need to be."

Bamboo Bike

In many parts of the world, millions of people rely on bikes for everyday transportation. Now a program called the Bamboo Bike Project is helping to build cheaper bikes for people in Africa. The new bikes are made from **bamboo**, a tall, sturdy plant in the grass family. Bamboo is a strong building material, and it's widely available. It grows wild in many parts of the world, including Africa.

Racers: Organic Athlete; workers: Craig Calfee

Workers build a bamboo bike (above). Some racers use bamboo bikes (left).

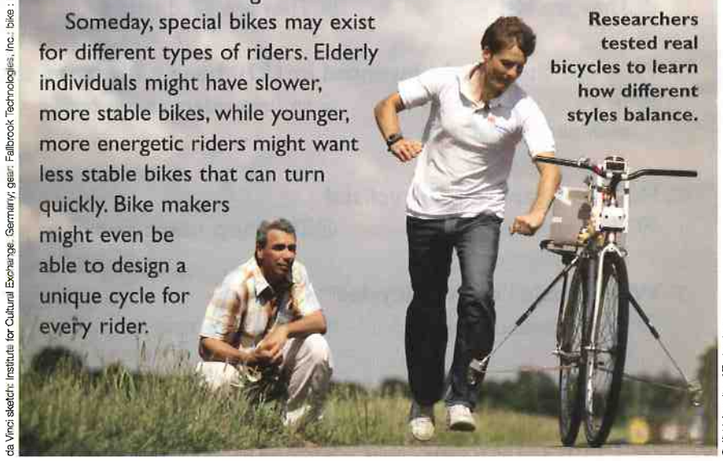
Craig Calfee, a bike designer in the United States, is involved with the project. His company, Calfee Design, already makes bamboo bikes for riders in the United States. The bamboo frames are stiff and light, so the bikes are great for racing.

Steady Pedals

Falling off your bike is never fun. Luckily, wiping out might be less likely in the near future. Scientists are closing in on a way to build more stable bicycles.

Arend Schwab at Delft University of Technology, in the Netherlands, and researchers from Britain and the United States recently created a computer model for studying bikes. The model tells them exactly how bikes will act under different conditions and at different speeds. The researchers hope that bicycle makers will use the model to design bikes with better balance.

Someday, special bikes may exist for different types of riders. Elderly individuals might have slower, more stable bikes, while younger, more energetic riders might want less stable bikes that can turn quickly. Bike makers might even be able to design a unique cycle for every rider.



Researchers tested real bicycles to learn how different styles balance.

Delft University of Technology