I have to admit I was a little skeptical about the Spinning program when I first heard about it. I can understand the allure of riding with friends on the local roadways, but cycling in a packed exercise room? And going nowhere? Boring.

Of course, I was wrong. Granted, the scenery remains the same, but the ride changes constantly. The Spinning program keeps your mind engaged while vigorously challenging your body.

The Spinning program is an excellent adjunct to my road cycling because it accurately replicates the feel of my bike—from the fit, the resistance type of pedaling, and movement in and out of the saddle. I have recommended it to the elite-level cyclists that I work with on the U.S. National Team as an addition to their off-season riding; it offers them a total mind and body training program.

The lack of concerns about handling or road safety allows you to do mind work as well as physical work. The guided visualization and the music make it a very motivational, inspirational workout.

Participating in a Spinning ride while using a heart rate monitor has brought high-tech biofeedback training into the reach of all fitness enthusiasts. Together, the Spinning program and heart rate monitoring allow you to develop sophisticated training programs, which lead to increased levels of fitness.

The Biomechanics Behind the Spinning Program

The pattern of force applied throughout the complete pedal cycle begins at the top dead center (TDC). Your force output during cycling has been shown to change constantly during one revolution. Figure 1 is an example of changes in the various work forces as the crank rotates through the 360 degrees of the crank revolution for a cyclist riding while seated. The figure represents one complete leg cycle at 20 points (about 18 degrees apart) in the crank revolution. The cyclist is pedaling about 100 rpms with close to maximum power output for a steady-state ride of four minutes. The crank (dotted line) and the pedal (short bold line) are shown in correct relationship to each other during cycling. The angle of the pedal with respect to the arrow is called the anklining angle. The size of the force being applied to the pedal is shown by the size of the bold arrow and is proportional to the force being applied to the pedal.
Not surprisingly, most cyclists attain peak force at about 90 degrees, or with the pedal at 3 o’clock. However, significant downward force is still being applied at the bottom of the pedal stroke (180 degrees), which cyclists have referred to as trying to stretch the crankarm. Downward force decreases but is not totally eliminated during the upstroke, acting in opposition to the other leg.

The Science Behind the Effort

The forces you apply to the pedals are commonly used to characterize pedaling technique. These forces are typically measured with force-measuring pedals (with built in strain gauges) and described in component terms.

When viewing Figure 1, several interesting observations can be seen in the pedaling diagram. First, force on the pedals is rarely in a vertical (direct push downward to the ground) orientation. In the first 130 degrees of the pedal cycle (positions 0 to 7), the force is downward and backward. At position 4, the force is close to a 90 degree angle with the crank arm.

From this point forward, the angle of the crank and pedal decrease and the effectiveness of the force put into the pedal decreases. By the time the pedal reaches the bottom of the stroke, a fairly large force exists, but you can see from its orientation that it is not very effective, since it seems like the cyclist is trying to stretch the crankarm.

During the recovery phase of the pedal cycle (180 to 360 degrees) a force is still pushing down on the pedals. In particular, notice that during the recovery phase you apply hardly any pulling-up force to the pedals under the conditions studied. Pulling up on the pedals only occurs at very high resistance on the flywheel and at low pedaling rates. Pulling-up forces would be shown on the diagram as an arrow underneath the pedal and would point upward.
Remember, though, that both your legs are moving in a synchronous motion, but 180 degrees opposite each other. While the right leg is pushing down in the propulsion phase, the left leg will be in the recovery phase. While, as we have seen, there is a small downward force from one leg, this force is easily overcome by the other (propulsive) leg. During sprinting, climbing and starting on the bike, it is likely that the recovery forces would indicate that the rider would actually pull up on the pedals.

About the Author
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- Professor in the Department of Biology, University of Colorado
- Coach for the 1980 and 1984 U.S. Olympic Cycling Teams
- Coordinator of Project ’96 for the U.S. Cycling Team
- Columnist for Cycle Sport, Adventure Cycling and active.com
- Executive Editor, Performance Conditioning for Cycling
- Author of the following books: The Science of Cycling, Health and Physiology of Cycling, Serious Cycling
- Co-author of the following books: Physiology of Bicycling, Bicycling, Bicycle Injuries: Prevention and Management, The Medical and Scientific Aspects of Cycling, High Tech Cycling, Fitness Cycling
Muscle Groups Used in Cycling

* Drawing courtesy of Fred Koch
Muscle and Joints Actions During Pedal Stroke

PEDAL STROKE DIAGRAM

Which Muscle Does What

- **Gluteus Maximus**
  - Hip Extension

- **Hamstrings**
  - Knee Flexion

- **Psoas**
  - Hip Flexion

- **Quadriceps**
  - Knee Extension

- **Gastrocnemius/Soleus**
  - Ankle Plantar Flexion

- **Fibialis Anterior**
  - Ankle Dorsal Flexion
Suggested Reading

*The Cyclist’s Training Bible*, Joe Friel
A comprehensive guide book to help you create customized training plans based on scientific principles.

*The Way of the Peaceful Warrior*, Dan Millman
“A book that changes lives.” This book details the remarkable experiences that transformed the author’s perception and attitude about the world.

*In Fitness and Health*, Dr. Phil Maffetone
This book emphasizes the principles of aerobic training and balanced eating to improve metabolism and competitive performance.

*The ABCs of Burning Body Fat*, Dr. Phil Maffetone
A booklet for everyone who needs to burn more body fat.

*The Total Fitness Log*, Tony Svensson
A comprehensive training diary useful for recording training sessions in a variety of sports.

*Thinking Body, Dancing Mind*, Chung Lian Huang
A guide to building inner strength, concentration, and a mind-body balance.

*Flow in Sports*, Susan A. Jackson and Mihaly Csikszentmihalyi
Leading experts on “the flow state” explain the phenomenon as it occurs in sports. The nine fundamentals for creating favorable conditions for experiencing “flow” of mind and spirit are discussed.

The insights in these books have inspired many of the best Spinning instructors. Perhaps they will help you to “find the champion within.”

Many of these titles are available from Mad Dogg Athletics. Order online at www.spinning.com, or by calling 800.847.7746 (US) or 310.823.7008 (all other countries).