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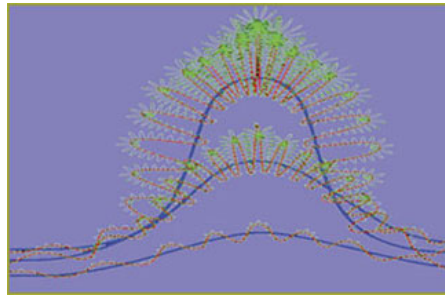
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## Making Waves: Tuning Biorhythms Through Cyclic Exercise

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By Roger Lewin, PhD | Contributing Writer - Vol. 7, No. 1. Spring, 2006

Everyone knows exercise is good medicine. Far fewer people understand how to optimize the health benefits of regular exercise. As with many other things, it is not a matter of blindly doing more, but of bringing physiological intelligence to the process.



According to Irving Dardik, MD, a former vascular surgeon and founding chairman of the US Olympic Sports Medicine Council, the optimal way to exercise is in brief alternating cycles of intense exertion and full rest. The idea is to create a wave of high and low heart rate bursts over the course of an exercise period. This is quite different from traditional exercise regimens based on sustained exertion.

The HeartWave, developed by former cardiovascular surgeon and exercise physiologist, Irving Dardik, MD, is a dynamic rather than static model of cardiovascular activity. This hypothetical HeartWave represents three sets of nested waves: the first, represented by the blue lines, indicates rising and falling heart rate at three levels of exertion intensity (low, moderate and high). Nested on the blue lines, the red waves indicate cycles of systole and diastole. The green waves represent biochemical oscillations within the heart muscle during the systolic-diastolic cycles. *Courtesy of Roger Lewin, PhD, and Irving Dardik, MD.*

In Dr. Dardik's approach, an individual exerts intensely for a total of just five minutes over a period of, say, 30 minutes. This will likely be good news for your exercise-averse patients who dread the mere thought of treadmilling or stair mastering for an hour.

Dardik's protocol is similar to what is known as interval training. But it is different in several ways. For one, the individual has target heart rates for each cycle, depending on overall health and fitness. Further, it places as much emphasis on recovery physiology as on exertion. Down-regulation of a revved up system is an active physiological process that also requires exercise. It is as important to overall health as the ability to rev up. Over the years, Dr. Dardik has not only applied his approach to improving athletic performance, he has also taught people with a range of chronic diseases to use cyclic training as a way of restoring health.

### Revvng Up and Cooling Down

A typical Dardik protocol involves one minute of high-intensity exercise on a stationary bike or trampoline, for example, followed by complete rest. During



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exertion, the heart rate is much higher than in traditional, sustained exercise. When the heart rate falls to near resting, the person does another exertion cycle, again followed by complete recovery. The cycles are done five times over a period of half an hour. During an exercise period, the heart rate rises and falls five times. Cycles are done three to four times a week.

One of the primary goals is to increase heart rate variability. Simply put, the greater the heart rate variability (HRV), the better someone's overall heart health; the more limited the HRV, the greater the cardiovascular risk.

A high-performance sprinter himself, Dr. Dardik's take on exercise evolved over several decades, catalyzed by several key observations. Early on, he noticed sprinters tended to be far healthier than distance runners. The latter are highly susceptible to infections, chronic diseases, heart problems and, of course bone and joint injuries.

His suspicion was further heightened in 1985 by the shocking death of his friend, Jack Kelly, a superb runner and Olympic oarsman. Mr. Kelly had just been elected President of the US Olympic Committee weeks before he died of heart failure after a run. Kelly died shortly after Jim Fixx, whose 1977 best-seller *The Complete Book of Running*, fueled America's fitness craze.

### The HeartWave

In most exercise-related deaths, heart failure comes *after* the individual stops activity, not during the exertion. This finding prompted Dr. Dardik to look seriously at how people exercised. "People have been running for thousands of years, and they didn't die like that. It must be something in the way people run now that causes heart failure after exertion." In looking at lifestyles of technologically primitive peoples, and wild animals such as cheetahs, he realized that alternating cycles of exertion and rest were the norm, extended exertions the exception.

Strapping on a heart monitor, he began to study his own heart during exercise. This led to a discovery he termed the HeartWave. When someone exercises, the heart rate climbs. When activity stops, it comes back down. The heart muscle itself is constantly in an alternating cycle of exertion (systole) and relaxation (diastole). Within the heart muscle, and in all tissues, there are waves of biochemical exertion and recovery.

"I saw it as waves within waves," Dr. Dardik says. He created a graphic representation of the nested orders of waves—biochemical cascades, alternating systole and diastole, and repeating periods of exertion and recovery over the course of the circadian cycles. The result is an example of fractal mathematics in action.

In 1977, Dardik was asked to head the US Olympic Committee's Sports Medicine Council, a position he held until 1985. He spent much time at the committee's Sports Training Center and Elite Athletes Project in Colorado, a meeting ground for top athletes and sports medicine pioneers. His work there led to the Rhythmic Interval Training Exercise (RITE) system, which forms the basis of his current approach.

### Restoring Rhythm

For many years, Dr. Dardik led a dual life: vascular surgeon by day (first at Montefiore Medical Center, Bronx, NY, and later at Englewood Hospital, NJ), sports physiologist by night. This led to an important realization: from the perspective of improving physiologic performance and engendering health, the sick patients he saw in surgery were not so different from his high-performance athletes. The physiology that optimizes athletic performance can also enable sick people to return to health. This idea changed his thinking about the underlying causes of illness. A prime cause, he believes, is a loss of connection with the basic rhythms of life.

Humans, like all organisms, evolved in a universe of rhythms: ultradian, circadian, lunar, and seasonal. Health, as Nobel Prize winning systems scientist Ilya Prigogine argued, depends on full expression of these rhythms in our behavior, in our physiology, in the oscillating biochemistry of our cells. When these rhythms are flattened, as they are in the non-stop 24/7 culture in which so many of us live, sub-optimal health or illness is the result.

People in simple foraging societies, who live in tune with the rhythms of nature, do not suffer the high incidence of type 2 diabetes, heart disease, cancer and other chronic diseases that characterize modern life. This is not, as some claim,

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because they don't live long enough to develop them. Many do. Further, young people in these societies do not show incipient signs of these diseases, as is the case in young people in Western societies.

To enhance health, we need to reconnect to the rhythms of nature. Going back to hunter-gatherer ways is not an option, of course. But Dr. Dardik found that by using exercise to shape healthy waves in our heart's activity, which cascade through all physiological systems, we reconnect with the natural rhythms in a fundamental way.

### From Core Concept to Clinical Trials

Though his exercise strategy emerged from work with Olympic level athletes, he began to apply what he learned to help people with advanced chronic diseases. He found he was able to attenuate a range of diseases, such as diabetes, multiple sclerosis, chronic fatigue, and heart disease, as well as psychiatric conditions such as anorexia and depression.

Irving Dardik is a very intuitive thinker. Initially his conviction that cyclic exercise would "cause health" as he puts it, was just that: intuition. Scientific support came later, first with publication of data from the Framingham Heart Study showing that reduced HRV is associated with aging and disease (Tsuji H, et al. *Circulation*. 1994; 90(2): 878-883). The corollary is that enhancing HRV will enhance health.

Working with Ary Goldberger, MD, a cardiologist at Harvard Medical School, Dr. Dardik showed that his cyclic exercise protocol increases HRV in a way that traditional aerobic exercise does not. It also enhances the complexity of dynamics of the heart's activity, which are associated with health, again in a way that traditional aerobic exercise does not.

"This is not something cosmetic, like putting a Jaguar body onto a Hyundai engine, hoping you now have a car that can perform better," says Dr. Goldberger. "This is something *fundamental*. When you see complex (heart) dynamics (in an individual on the protocol), it is not that the heart just *looks* more youthful; the person *is* more youthful, because these dynamics are coupled to the functionality of the system *at all levels*."

Prompted by early results, Dr. Goldberger undertook a preliminary trial involving 11 healthy female nurses at Hunterdon Medical Center, NJ, who went through the protocol for just eight weeks. Even this short program had significant impact: increased efficiency of oxygen metabolism (VO<sub>2</sub> max increased 15.5%); a 13% increase in ventilatory breakpoint (the point at which ventilation increases disproportionately to O<sub>2</sub> consumption); a 9% increase in HRV; and a 7.5% drop in diastolic blood pressure. Measures of immune function and stress also improved, as did measures of anxiety and positive affect. The women also reported that they slept better and had more energy (Goldsmith R, et al. *Am J Med and Sports*. 2002; 4: 135-141).

The efficacy of the Dardik protocol was further demonstrated at St Luke's Hospital, Kansas City, in a study involving 19 people with advanced Parkinson's disease. In every case, mobility and affect improved dramatically, much more so than is typical with exercise in Parkinson's patients. In addition, anti-inflammatory signaling molecules, such as IL-10 and adrenocorticotropin, were elevated (Cadet P. *Int J Molecular Medicine*. 2003; 12: 485-492). As in the first trial, HRV increased as well.

A third trial, at the Wistar Institute, Philadelphia, involved three groups of 18 HIV/AIDS patients: one group did the Dardik protocol; the second did traditional exercise; the third did no exercise at all. "We decided to focus primarily on quality of life measures," said Dr. Luis Montaner, who ran the trial. "That's not trivial, because anti-HIV drugs are quite toxic, and patients suffer a lot of detrimental effects, such as lack of energy, and depression."

"The results were impressive," said Dr. Montaner. "Those in the cyclic exercise group did better than people in the two control groups." When asked to rate, "How much I enjoy life," people in the cyclic exercise group moved from a baseline of "some of the time" to "most of the time," at the end of eight weeks. Responses to the statement, "My sleep was restless," moved from "most/some nights" to "some/rarely." They reported needing less effort for daily activities and felt happier. No such changes were seen in the other two groups. Dr. Montaner's trial has not yet been published.

### Major Advances, Major Setbacks

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Irv Dardik's personal and professional life has been almost a model of wave dynamics, a dizzying sine curve of profound achievements and desperate setbacks.

A championship sprinter in high school and college, he forsook an Olympic career to follow his brother, Herbert, to med school (Herbert Dardik is now Head of Vascular Surgery at Englewood Hospital, NJ). On graduating, Irv joined Herbert at Montefiore Medical Center, Bronx, for a surgery residency.

The Dardiks saw a lot of patients with vessel grafts. Many had problems several years out. The grafts, especially in the legs, would become clogged, leading to severe disability, even amputation. In 1971, while treating a woman with a clotted bovine graft, the younger Dardik became convinced there *had* to be a better way.

A burst of outside-the-box thinking led the Dardik brothers to pioneer the use of human umbilical cord veins for vessel grafting. Their studies, done on their own time outside Montefiore, led to a patent on the umbilical vessel biograft, now a mainstay of vascular surgery. The procedure benefited tens of thousands over the decades, and the Dardiks were ultimately awarded the American Medical Association's highest honor, the Hektoen Gold Medal.

The success of his surgical practice and the royalties flowing from the biograft enabled Irving Dardik to spend more time studying exercise physiology and wave dynamics. Eventually, he devoted full-time to practicing exercise as medicine. The ensuing years were marked by major ups and downs: excellent clinical results, but extreme financial difficulty; major conceptual advances but intense personal and family turmoil.

In 1991, *New York* magazine ran a cover feature on Dr. Dardik's success in treating everything from anorexia to MS solely with exercise. This catapulted him into the public eye—and into a vat of medicolegal trouble.

Prompted by what she'd read, Ellen Burstein, a consumer advocate and "fraud buster" for a Florida TV channel, called Dr. Dardik. She'd been diagnosed with MS in 1986, and was largely confined to a motorized wheelchair. Though she was skeptical, she wanted to try the Dardik approach, but was told she'd have to wait, as there was already a waiting list of 2,000 chronically ill people. Burstein insisted, offering a sum of \$100,000 to be treated immediately.

Dardik agreed to work with her, and initially, Ms. Burstein responded well. Within 6 months, she was walking again and able to get her exertion heart rate up to 160 bpm. Her hometown paper, the *Orlando Sentinel*, ran a profile headlined, "Back On Her Feet." Several months later, however, her condition declined, and she became convinced Dr. Dardik was a fraud.

Ms. Burstein hired a private detective, and tried to enlist others of Dr. Dardik's patients in a legal action. Ultimately she took her case to the New York State Board for Professional Medical Misconduct, which, in 1995, revoked his license, charging him with fraudulently practicing medicine, exercising undue influence, and exploiting patients by promising cures. This was despite the fact that Burstein had signed a contract stating that the Dardik program was experimental and couldn't guarantee cure.

Dr. Dardik believes the Board's action had more to do with bias against anything outside conventional medical thinking, than with principles of science or clinical practice. "Here I was saying that ... chronic disease can result from a flattening of the waves, with a cascade of ill effects ... (and) that people can take charge of their own health by restoring healthy waves through cyclic exercise. But in traditional (conventional) medicine, a person has a disease, and it is the role of the physician to cure that disease using the tools of traditional medicine. I was threatening their belief system."

He stands by the efficacy of his approach, but says he's always avoided the word *cure*. "I have seen so many sick people benefit from the program. I was then, and still am confident that the cause of chronic diseases is disrupted wave patterns, and that cyclic exercise can reverse these disorders. You can call what I do a cure. I prefer to call it reversing disease. What I do is help people connect with their bodies in a different way."

### **From Clinical Trials to Patient Care**

What does any of this have to do with primary care? Everything, says Robert Lindberg, MD, a primary care physician in Connecticut. "I have had some of my patients do the cycles for five years now," he says, "and I've seen some very positive health benefits. Many people with physical problems shy away from

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exercise. They think they can't do traditional sustained exertion. I show them in the office that they can get a good work out in just one minute." Dr. Lindberg said patients' heart rate data during exertion and recovery give insight into their overall health.

Dr. Dardik's most recent refinement is to tune exercise cycles to the lunar cycle. He reasons that because lunar rhythms are so important in the lives of other animals, they probably are for us, too. Here's how it works:

In the week before the New Moon, the lowest energy segment of the lunar cycle, exercise cycles are best done in the early morning, between 6 and 9 a.m. This is the lowest energy segment of the day, in terms of circadian rhythm. The cycles themselves are also very gentle, maybe just 3 or 4 moderate bursts of exertion and recovery, 3 times a week; these cycles are designed to kick start metabolism, to help people pull out of the early morning energy trough.

The week after the New Moon, a time of rising lunar energy, the cycles are done later, between 9 and noon, a time of rising energy in the circadian rhythm. The intensity is kicked up a notch. Again, the plan is for 3 or 4 bursts of exertion and recovery, 3 times a week.

Finally, in the week before the Full Moon, the time of maximum energy in the lunar cycle, exercise is done between 3 and 6 in the afternoon. The cycles are now done at maximum intensity, reaching the highest heart rate appropriate for the individual. The week following the Full Moon is a period of recovery, leading down toward the low-energy trough. After a week's rest, the cycling starts over again.

By mapping the intensity of the exercise cycles onto the lunar energy wave, this monthly protocol brings us as close to reconnecting to the rhythms of nature as we're likely to get without donning bearskins and flint tools and heading for the bush. The result is what was demonstrated in the clinical trials, and with scores of individuals with whom Dr. Dardik has worked privately: it causes health.

*Anthropologist Roger Lewin, PhD, is the best-selling author of many popular science books, including Bones of Contention, Principles of Human Evolution, Complexity: Life at the Edge of Chaos, and his award-winning collaborations with Richard Leakey, Origins and The Sixth Extinction. His most recent book is Making Waves: Irving Dardik and His Superwave Principle (Rodale), an in-depth exploration of the ideas presented in this article. It is available at [www.amazon.com](http://www.amazon.com) and quality bookstores nationwide.*

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