

## The Science of HeartMath

HeartMath is a technology whose effectiveness has been scientifically substantiated in a variety of research studies. The implications of this research are profound. People have long searched for a pill, drug or device that would give them better health or happiness. In the USA, 8 of the 10 top-selling prescription drugs are for stress-related problems, such as ulcers, hypertension, depression and anxiety. Science is proving that dependency on these drugs can lead to additional stress from side effects or addiction.

The HeartMath Research Center has found a critical link between emotions and the heart, as well as the immune and hormonal systems.

It's important to realize that the flourishing sales of these prescription drugs are dwarfed by astronomical sales of illegal drugs that millions take in the pursuit of feeling better—drugs like cocaine, heroin and crack. According to the Mayo Clinic, in the past decade cardiovascular fitness has become synonymous with good health. New research studies on the heart are being released at a rapid rate. The HeartMath Research Center is engaged in several areas of investigation showing how and why our mental and emotional attitudes have such profound effects on the rhythms of the heart. This research is proving what many of us already know intuitively—that our mental and emotional attitudes are directly related to our health and happiness.



### [Research Behind the Freeze-Framer](#)

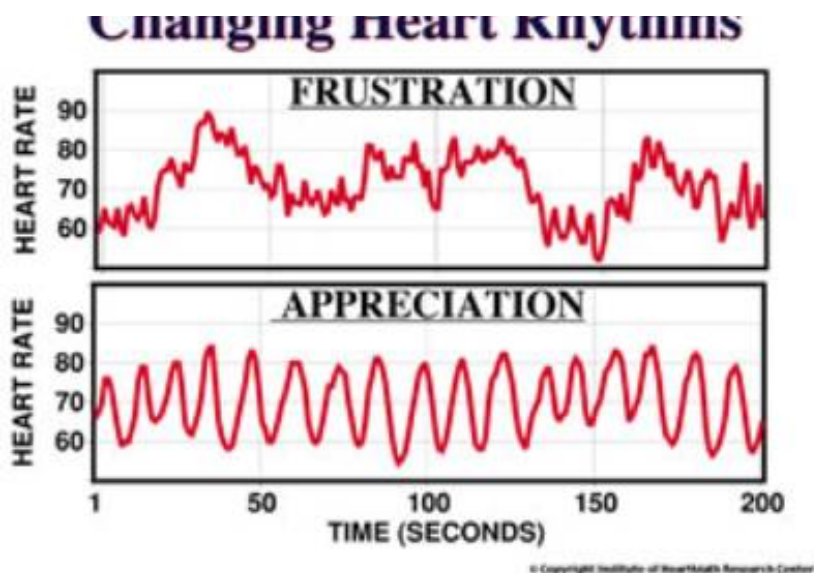
#### The Role of the Heart

In addition to being an efficient pump supplying blood to our entire body, the heart is also our main electrical power center. It generates 40 to 60 times more electrical amplitude than the brain. The heartbeat, which produces an electrical signal, can be measured at any point on the body. A doctor could place electrodes on your ear lobes, little toe or anywhere on your body and record your electrocardiogram (ECG) signal. Quite literally, the electrical signal from the heart permeates every cell and, in fact, studies at the HeartMath Research Center are showing that the quality of that signal can affect your cells.

#### Heart Rate Variability—A Key Measure of Mental and Emotional Balance

If you go to a doctor's office for a physical exam, you may be told your heart is beating at 70 beats per minute. This is an average figure because the time intervals between heartbeats are always changing, meaning your heart rate is always changing. Heart rate variability (HRV) is a measure of these beat-to-beat changes in heart rate as the heart speeds up and slows down in different patterns. These heart rate changes are influenced by

**Changing Heart Rhythms**



almost anything the brain and mind process, such as thoughts and sounds, but they are especially influenced by your emotions.

There is a two-way communication system between the heart and the brain that regulates heart rate and blood pressure and it is the interaction of signals flowing between the two that causes the heart rate to vary with each beat. Analysis of HRV is used by doctors to measure the balance between the sympathetic and parasympathetic nervous systems, two important branches of this communication system. Your thoughts, perceptions and emotional reactions are transmitted from the brain to the heart via these two branches of the autonomic nervous system and can be seen in the patterns of your heart rhythms. See Figure A.

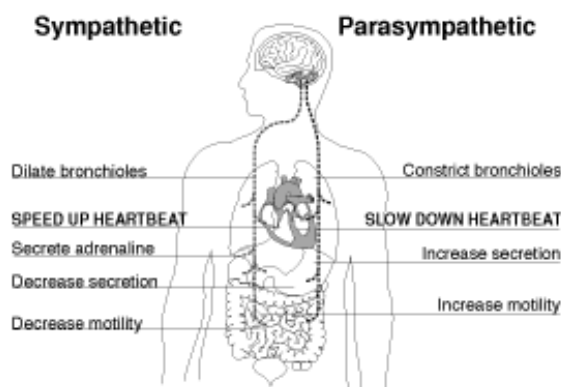


Figure A. Your Nervous System

Simplified diagram of the autonomic nervous system. The sympathetic branch increases heart rate and the secretion of adrenal hormones, etc., whereas the parasympathetic slows heart rate and has a relaxing, protective role. Proper function and balance between the two branches of the ANS is important for good health.

The graph in Figure B(1) shows the typical HRV pattern of someone feeling frustrated or edgy. When you feel edgy inside, you are likely to experience this type of heart rhythm. This excess wear and tear can create a chain reaction in your body. For example, when you're frustrated, your nervous system is out of balance, your blood vessels constrict, blood pressure rises and you waste a lot of energy. If this happens consistently, you can become hypertensive and greatly increase your risk of heart disease. Hypertensive individuals are two to three times more likely to develop coronary artery disease and four times more likely to suffer a stroke. As you've already read, it's estimated that one in four Americans, approximately 60 million people, are hypertensive.

Heart disease now accounts for slightly more than 40% of all deaths reported in the U.S.

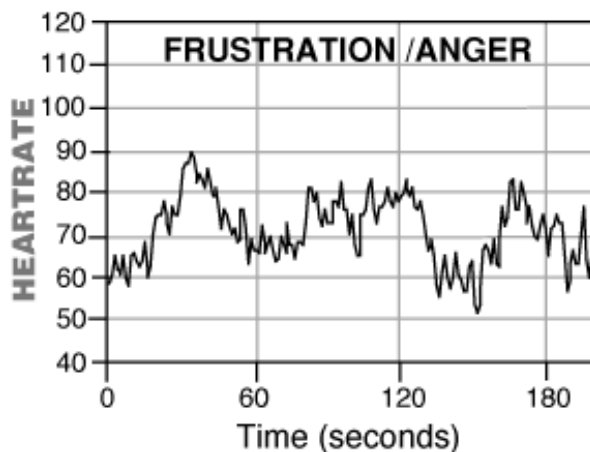


Figure B(1). Stress-Producing Heart Rhythm

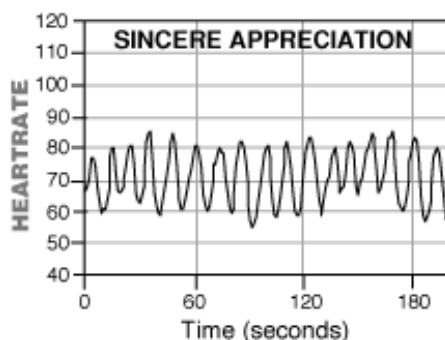


Figure B(2). Harmonious Heart Rhythm

Figure B illustrates the heart rate variability pattern of frustration or anger (top) which is characterized by its random, jerky pattern. Sincere, positive feeling states like appreciation (bottom) can result in highly ordered and coherent HRV patterns, generally associated with enhanced cardiovascular function.

On the other hand, feelings of sincere appreciation create the HRV pattern you see in Figure B(2), which is a smooth, even rhythm. This pattern is an example of cardiovascular efficiency. What's happening is that the two branches of the autonomic nervous system are "entraining" and working together at maximum efficiency instead of fighting each other. Think of entrainment as being "in sync." When your head and heart, thoughts and feelings, are working harmoniously together, you have more clarity and inner balance—and you feel better.

Another very important part of the heart/brain communication link are the nerves that carry information from the heart to the brain. (See Figure C below)

It is now known that the heart has a complex nervous system, which has been described as a "brain" of its own. Considered a single entity, the brain in the heart is an organized network of nerve cells and nerve plexi (centers) that send messages to each other using neurotransmitters and proteins. The heart has a complex circuitry that enables it to act independently, learn, remember, and as the saying goes, produce the feelings of the heart.

The information sent from the heart to the brain can have profound effects on the higher brain centers and influences perception, emotion and learning abilities. It even affects coordination and reaction speeds. IHM research shows that the Freeze-Frame process of focusing attention in the area of the heart while experiencing a positive feeling changes the patterns of information flowing along this pathway to a more coherent and harmonious pattern. This may explain the shift in perception experienced after Freeze-Framing. In addition to these perceptual shifts, many people have also been able to reduce their blood pressure and stress symptoms such as sleeplessness, indigestion and tension.

Heart rate variability is an excellent measure of nervous system balance, and research is showing that your perceptions and reactions affect your heart rhythms. Therefore, heart rate variability is an important indication of how well you are balancing your life.

## Heart to Brain Communication System

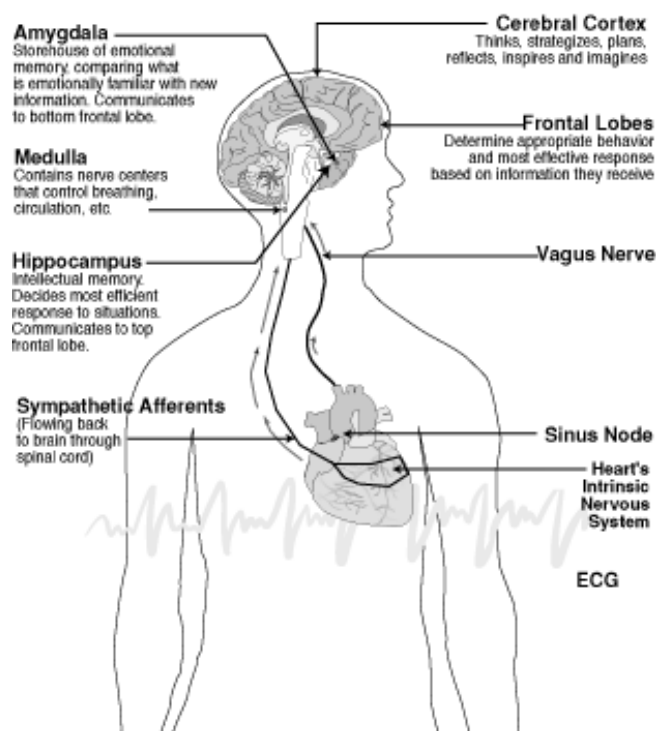


Figure C. Heart to Brain Communication System. The human body has hundreds of sensory systems which send information back to the brain. The heart communicates to the brain via two primary pathways.

As you become practiced in Freeze-Frame, you can balance your nervous system and change your heart rhythm patterns in the moment, as shown in Figure D.

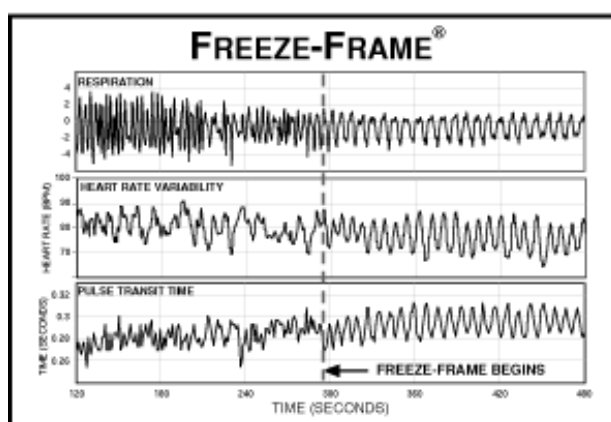


Figure D. Physiological Benefits of Freeze-Frame

These graphs show an individual's heart rate variability, pulse transit time and respiration patterns for 10 minutes. At the 300 second mark, the individual Freeze-Framed and all three systems came into entrainment, meaning the patterns are harmonious instead of scattered and out-of-sync.

## Electrocardiogram Analysis

Besides looking at heart rate variability patterns, doctors also analyze electrocardiograms (ECG) to determine the health of the physical heart. For some years, scientists have been able to see the effects of hostility and severe depression in the ECG. Only recently, through the use of ECG spectral analysis, have they been able to see the effects of even more subtle "negative" emotions, such as frustration, worry and anxiety, as well as the effects of "positive" emotions such as love, care, compassion and appreciation.

It is probably no coincidence that the electrical pattern of frustration in Figure E(1) looks about like it feels. When life is crashing down around you – your boss is yelling, pressure is mounting, the phone is ringing,

the copier is jammed and you're frustrated – your ECG spectrum is likely to look like Figure E(1). This is called an "incoherent spectrum" and you probably feel pretty incoherent when life is falling apart.

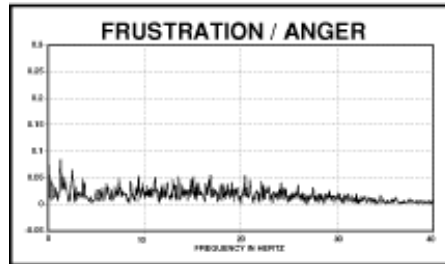


Figure E(1). ECG: Incoherent Spectrum

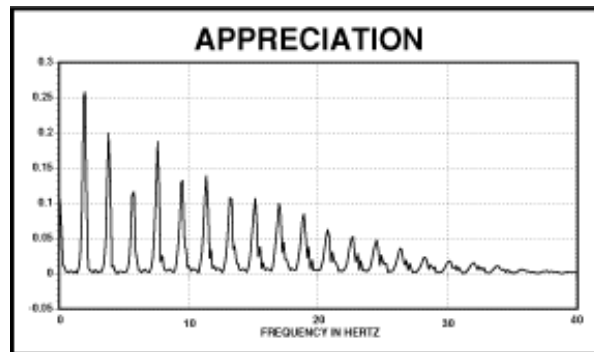


Figure E(2). ECG: Coherent Spectrum

Figure E(1) shows the spectrum analysis of eight seconds of electrocardiogram (ECG) data generated by the heart when a person experiences frustration or anger. This is called an incoherent spectrum because the frequencies are scattered and disordered. Figure E(2) shows the frequency analysis of the ECG during a period when the person is experiencing deep, sincere appreciation. This is called a coherent spectrum because the power is ordered and harmonious.

At other times, if your boss has just sincerely thanked you for a job well done, or you have a productive meeting with a co-worker, or when you love what you're doing and feel appreciation for life, your ECG spectrum probably looks more like the harmonious pattern of Figure E(2), called a "coherent spectrum." At these moments, life is going your way and you feel more coherent – you have more clarity and balance. Feelings of love, care or compassion can all lead to a more coherent ECG spectrum, similar to the graph of appreciation. On the other hand, research has found that feelings of anger, anxiety, irritation or resentment all produce incoherent spectra that look similar to the graph of frustration. Remember, this electrical energy is being radiated to every cell in your body.

## How Your Heart Affects Others

The electrical waves of the heart act like radio waves and are transmitted outside the human body as well as to every cell of your body. This may explain why you can sometimes walk into a room and tell if two people just had an argument, even though they are quietly standing there. You can "feel it in the air." The electrical frequencies radiated by the heart change dramatically when you are in different emotional states and can affect not only yourself but the people around you. In fact, the researchers at IHM have shown that the field radiated by your heart is literally picked up by the brains of people nearby! When two people are touching or even standing near each other, it is now possible to measure the heartbeat of one person being registered in the other person's brainwaves. (Fig. F) By learning to create internal entrainment and coherence through the Freeze-Frame process (taught in all HeartMath fundamental programs), you radiate a much more harmonious signal to your environment and the people around you.

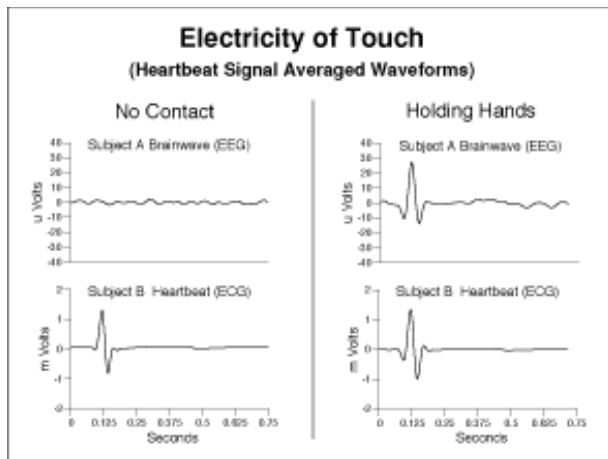


Figure F. Electricity of Touch

Signal averaging techniques were used to show that when two individuals touch, one person's electrocardiogram (ECG-heartbeat) signal is registered in the other person's electroencephalogram (EEG-brainwave) and elsewhere on the person's body.

### Beyond 2000: Freeze-Framing in Action

In late 1993, a videotape crew from the television program Beyond 2000 came to the Institute's research facility to do a feature on the music Heart Zones, which I designed scientifically to help people achieve increased mental and emotional balance and renewed vitality. The crew wanted to understand how the music was created, how to use it to get better results with Freeze-Frame and how we were able to prove its effectiveness in our laboratory research.

The host for the show decided to open the segment by being hooked up to all the physiological testing equipment in the lab – heart rate, ECG, EEG (brainwaves), blood pressure, respiration and more. Computers tracked all his physiological responses as he was videotaped. Unfortunately, he stumbled over his opening lines several times, forcing repeated "takes" and he became increasingly tense and nervous. The computers showed the results of his mounting tension. His blood pressure and heart rate had shot up to extremely high levels. The scientist monitoring the host's physiological responses suggested he try the Freeze-Frame technique he had learned earlier. As you can see in Figure G, within seconds his heart rate and blood pressure returned to normal and his respiration regained a smooth, even pattern. He then delivered his lines perfectly. The host and crew were delighted that they had real-time verification of Freeze-Frame's effectiveness captured on videotape.

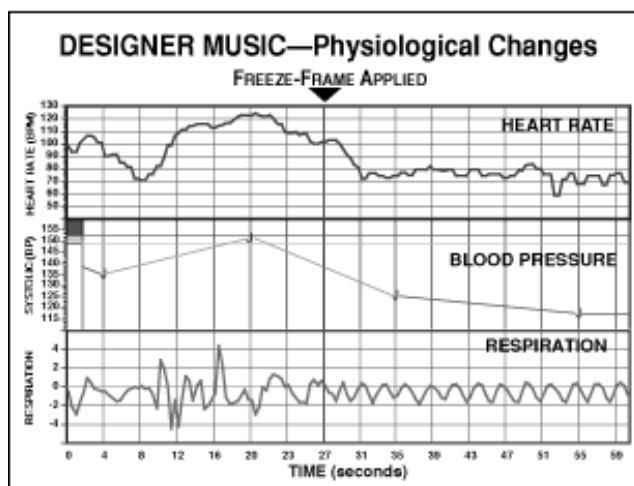


Figure G.

Chart shows the effect of Heart Zones and Freeze-Frame on an individual with little prior training. The individual was the host of the TV show Beyond 2000 featured on the Discovery Channel.

## Heart Hormones and the Immune System

Scientists are proving that repeated episodes of anger and frustration cause nervous system imbalances that are detrimental not only to the heart, but to the brain and the hormonal and immune systems. Have you ever had an argument with someone you loved and, the next day, replayed the situation over and over in your mind, cranking up negative emotions from the day before that made you feel terrible? Even recalling an upsetting episode can produce imbalances and stress. As mentioned earlier, the stress reaction creates specific hormonal imbalances and that these same hormonal imbalances have been shown to damage brain cells. They may even lead to Alzheimer's disease. It doesn't have to be that way once you understand what you are doing to yourself and how you can change it.

A study conducted at the HeartMath Research Center recently demonstrated that a group of normal, healthy people were able to increase the amount of the hormone DHEA available to the cells by up to 100% while decreasing their cortisol levels by 23%. DHEA is a very important hormone and is often referred to as the "anti-aging" hormone while cortisol is called the "stress hormone" because it is well known to increase when you are experiencing stress or feeling anxiety, helplessness or withdrawal. Cortisol is also the hormone that can damage the brain cells when its levels are kept too high from constant stress or worry. In the study, the increase in DHEA was significantly related to the subjects' increasing their feeling of warm-heartedness; the reduction in cortisol was related to their reductions in stress levels after practicing a HeartMath tool and listening to the music I wrote to facilitate the process. This stress-reducing music has been shown in other research studies to help boost immunity, reduce tension and improve mental clarity.

## The Immune System's First Line of Defense

IgA (immunoglobulin A) is an immune system antibody and one of the body's first lines of defense against colds, flu and infections of the respiratory and urinary tracts. IgA is found in our saliva, lungs, digestive and urinary systems. In a group study (twenty individuals) comparing the effects of anger versus care and compassion on average IgA levels, it was found that one five-minute episode of mentally and emotionally recalling an experience of anger caused an immediate short-term rise in IgA, followed by a depletion that was so severe it took the body more than six hours to restore normal production of IgA (see Figure I). What this study showed is that even a single episode of recalling an experience of anger and frustration can depress your immune system for almost an entire day.

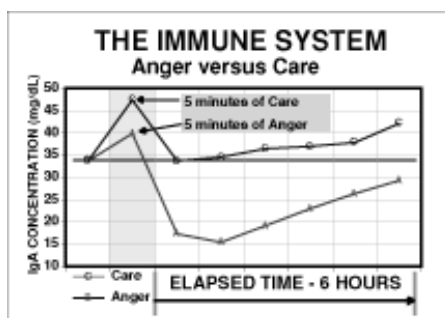


Figure H.

Figure H. This graph shows the impact of one 5-minute episode of recalled anger on the immune antibody IgA over a six-hour period. The initial slight increase in IgA was followed by a dramatic drop which persisted for six hours. When the subjects used the Freeze-Frame technique and focused on feeling sincere care for five minutes, there was a significant increase in IgA, which returned to baseline an hour later and then slowly increased throughout the rest of the day.

What are most people's days like? You wake up anxious because you didn't sleep well; you get frustrated with a co-worker who forgot to give you an important report; somebody gives you a strange look at the coffee machine and you feel a surge of irritation. Then you find voicemail messages that you're late responding to – it's a cascading series of events of anxiety, frustration and anger. The cumulative results of seemingly insignificant frustrations and anxieties have been shown to be even more detrimental to the immune system than the occasional large blowout of anger. Is it any wonder that health care costs are so high, eating up a huge percentage of corporate profits and expected to get worse?

This same IgA study also showed that one five-minute episode of mentally and emotionally experiencing the emotions of care and compassion caused a much larger, immediate rise in IgA – an average of 34% – followed by a return to normal (baseline). However, the IgA levels then gradually climbed above baseline throughout the next six hours. Learning to manage the moment and increase the ratio of your positive attitudes and feelings can improve your quality of life and well-being.

Other studies also show that feelings of happiness and joy increase white blood cell counts needed for healing and defend against invading pathogens, including cancer and virus-infected cells.

## **Freeze-Frame with HIV-positive/AIDS patients**

In a study using Freeze-Frame with HIV-positive and AIDS patients, researchers found dramatic improvements in anxiety levels and physical symptoms. Using the STAI (State Trait Anxiety Inventory) to measure psychological changes, participants who practiced Freeze-Frame for six months reduced their level of despair, anger, fear and guilt. At the beginning of the study, most of the participants had very high levels of anxiety. This was quite understandable considering the condition of their health and the general prognosis for people diagnosed HIV-positive. By the end of the six-month study, average anxiety levels had dropped by 20%, almost to that of the average healthy person, in spite of the fact that they still had a virus that is feared by society and could supposedly kill them at any time. They also reported more balance and harmonious flow throughout the day. More things seemed to go their way and they were able to increase the percentage of good days and get more done.

## **Affiliative Motive**

Another psychological measure is the "affiliative motive." Affiliation is a social motive characterized by the desire to establish warm and caring relationships with others. People with strong affiliative motive tend to be loving and caring individuals. It has been shown that loving and caring people have decreased levels of stress hormones, and higher IgA levels during times of stress than non-affiliative individuals. They get sick less often and are less vulnerable to disease. Loving and caring people also have increased norepinephrine, a chemical released from the nerves that has a wide variety of functions in balancing the nervous systems. Studies have shown that even if you aren't naturally affiliative, self-induced feelings of warmth and care towards others also increase IgA levels, resulting in an enhanced immune system.

## **Easy Access**

The Freeze-Frame technology focuses your attention in the area around the heart (where people subjectively feel love, care and appreciation). These feelings have been shown to help balance the nervous systems. When you Freeze-Frame, the heart rhythms become smooth and coherent and the signals that the heart sends to the brain through the nervous system affect the perceptual centers in the brain. This helps to give you a more balanced perspective of any situation.

Learning to manage the moment can literally change the quality of your life.

Freeze-Frame is a technology that gives you the conscious ability to self-manage your reactions, gain clarity and have more quality, fun and well-being in the moment. You gain the power to make better choices and decisions and not be victimized by your reactions to people, places and situations. Just as the detrimental effects of stress are cumulative, so are the beneficial effects of Freeze-Frame. Practice leads to increased mental and emotional buoyancy, cardiovascular efficiency and improved quality of life. Here's how it works inside our body:

"The background physiology and the scientific underpinning of this technique are absolutely sound, which is why we went ahead with pilot studies at Shell. I don't think the science is new, but getting it to work with individuals – and particularly technical people – is!"

Graham Bridgwood, M.D.,  
Chief Medical Officer, Shell International

## **The Cycle of Perception: Reprogramming Neural Circuitry**



Your perceptions underlie how you think and feel about the person or issue that you are dealing with. The resulting thoughts and emotions, but especially the emotions, cause numerous physiological changes in the body. These changes can be measured in the nervous system, hormonal system, heart and blood pressure. These changes, in turn, feed back and affect what is called the neural circuitry of the brain. The state of your neural circuitry, in turn, affects your perception. Your neural circuitry consists of neural pathways in the brain and body, pathways that are developed and reinforced to the degree that we use them. Whether you "learn" a healthy response or a stressful reaction, you are "hard-wiring" this pattern into your system through repetition.

Here's an illustration of how the cycle works. If you get frustrated because traffic was unusually heavy on the way to work, that feeling causes the sympathetic nervous system to increase your heart rate and instruct the adrenal glands to secrete adrenaline and other hormones into the blood stream. These changes then affect the neural circuits in the brain. You are then more sensitive to the next stressful situation and more likely to have a negative reaction. If you repeat this pattern, the neural pathways in the brain are reinforced and your emotional response becomes automatic so that you can get stuck in repeating, inefficient thought loops such as worry and anxiety. This then leads to a depletion of your energy and clouds your judgment. Freeze-Frame allows you to break the cycle, and with practice you can begin to retrain and reprogram the neural circuitry so that you are not the victim of your own thought loops and inappropriate self-defeating emotional reactions, but can build new intelligence into your system.

Details of the Institute of HeartMath system and research are at <http://www.heartmath.org/index.html> (non-profit) - and at the Institute's sister site (commercial) at <http://www.heartmath.com/index.html> from which the above article at [http://www.heartmath.com/freezeframer/science\\_of\\_freezeframer.html](http://www.heartmath.com/freezeframer/science_of_freezeframer.html) was accessed.

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