

# MODULATION OF DNA CONFORMATION BY HEART-FOCUSED INTENTION

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## Introduction

Cell biologist Dr. Glen Rein had conceived of the idea that DNA would make a good target for testing healers' ability to affect biological systems, since well established quantitative measures of DNA's conformational state existed and it potentially offered a more stable and reliable system than cell or bacterial cultures. He had tested this model system with several healers by having them hold test tubes containing DNA while they attempted to create a healing environment, and had obtained some positive indicators that the conformational state of DNA changed when exposed to these environments. In late 1991, Dr. Rein accepted a position at the HeartMath Research Center with the intention of continuing these experiments in addition to a series of cell culture studies. We conducted a number of different experiments with DNA over the next year and a half. The first six months were primarily spent performing a series of control studies to insure the stability of the measurement system and refining the protocols. Doc Childre then added the element of intentionality to the protocols, which proved to be a key factor.

Some of the key results of this series of studies were presented at research conferences and published in several conference proceedings.<sup>1-4</sup> We have since received so many requests for the results of this research that we are now making a summary of our findings available in this brief report.

## Background

### *Heart rhythm patterns and emotions*

The rhythmic beating of the heart at rest is not monotonously regular, but rather varies dynamically from moment to moment. Heart rate variability (HRV), derived from the electrocardiogram (ECG), is a measure of these naturally occurring beat-to-beat changes in heart rate, which has proven to be particularly valuable in studying

the physiology of emotions. The analysis of HRV, or *heart rhythms*, provides a powerful, noninvasive measure of neurocardiac function that reflects heart-brain interactions and autonomic nervous system dynamics, which are particularly sensitive to changes in emotional states. Our research, along with that of others, suggests that there is an important link between emotions and changes in the patterns of both efferent (descending) and afferent (ascending) autonomic activity. These changes in autonomic activity are associated with dramatic changes in the pattern of the heart's rhythm. Specifically, we have found that during the experience of negative emotions such as anger, frustration, or anxiety, heart rhythms become more erratic and disordered, indicating less synchronization in the reciprocal action that ensues between the parasympathetic and sympathetic branches of the autonomic nervous system (ANS). In contrast, sustained positive emotions, such as appreciation, love, or compassion, are associated with highly ordered or coherent patterns in the heart rhythms, reflecting greater synchronization between the two branches of the ANS.<sup>5</sup>

### *Heart coherence*

Based on these findings, we introduced the term *coherence* to describe distinct modes of physiological functioning associated with the experience of sustained heartfelt positive emotions. These coherent functional modes encompass a number of related physiological phenomena associated with more ordered and harmonious interactions among the body's systems, including the development of a more ordered (coherent) heart rhythm pattern.<sup>5</sup> Two distinct types of coherence associated with positive emotions have been identified (described in detail elsewhere<sup>6, 7</sup>), one of which is characterized by a sine wave-like HRV pattern and the other by a transient low HRV state. Hereafter, we will use the term *heart coherence* to refer collectively to both these coherent

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modes. Our research has also enabled the development of heart-based tools and techniques that promote positive emotions and increase heart coherence.<sup>5, 8, 9</sup>

### *The heart's electromagnetic field*

The electromagnetic field generated by the heart is the most powerful rhythmic electromagnetic field produced by the body. The heart's field permeates every cell and may act as a synchronizing signal for all the cells in the body in a manner analogous to information carried by radio waves. The rhythmically pulsing waves of electromagnetic energy generated by the heart create fields within fields and give rise to interference patterns when they interact with magnetically polarizable tissues and substances. We have previously shown that cells studied *in vitro* are responsive to the heart's field. Further studies conducted in our laboratory have indicated that the heart's electromagnetic field can be detected by other individuals and can produce physiologically relevant effects in a person five feet away.<sup>10</sup>

There is a direct correlation between the patterns in the heart rate variability rhythm and the frequency spectrum patterns of the ECG or magnetocardiogram (MCG), indicating that psychophysiological information can be encoded into the electromagnetic fields produced by the heart. Our data show that the heart's electromagnetic field becomes more organized during positive emotional (heart coherent) states, potentially increasing its capacity to impact surrounding endogenous tissues or exogenous systems.<sup>10</sup>

### *The theory of heart intelligence*

The theory of heart intelligence proposed by Doc Childre postulates that an energetic connection or coupling of information via resonance mechanisms occurs between higher dimensional structures maintained in the quantum vacuum (which are organized in a holographic-like fashion) and the physical DNA in our cells. These higher dimensional structures are proposed to communicate information to the DNA, guiding cell organization and differentiation and setting the boundaries for the individual organism's ability to vary in its physical, mental, and emotional domains. At the level of our physical bodies, the DNA molecule in each cell acts as an "antenna" and demodulator that is tuned to the organizing field. At the macroscopic level, the individual DNA molecules are linked through an "energetic connection" in the form of conventional magnetic fields, which are organized in overlapping patches of cells. As a result, there are networks of groups of cells that form an energetic system. In this model the electromagnetic field

produced by the heart acts to bind and synchronize the cells in the body and functions effectively as a modulated carrier wave that organizes the higher-level regulatory functions of the body's energetic system. The heart thus provides the encompassing energetic field that binds the whole system together. This theory also proposes that the heart serves as a key access point through which information originating in the higher dimensional structures is coupled into the physical human system, and that states of heart coherence generated through experiencing heartfelt positive emotions increase this coupling.

The experiments described in this report were some of our first steps in testing this hypothesis. Our premise was that by increasing coupling to the higher dimensional structures, which in common language are often referred to as the higher self or spirit, a top-down process could be initiated which would in turn facilitate an intentional change in the conformational state of a DNA molecule. The theory of heart intelligence predicts that individuals who are able to maintain states of heart coherence have increased coupling to the higher dimensional structures and would thus be more able to produce changes in the DNA.

## **Methods**

In the main study reported on here, the experimental group consisted of ten individuals who were trained and experienced in HeartMath's heart-focused coherence-building techniques. These participants self-generated focused feelings of love and appreciation while holding the intention to cause a sample of DNA to either wind or unwind. Eighteen individuals with no training in HeartMath techniques served as controls. Some of the control participants were students from the University of California at Santa Cruz and others were individuals recruited from the local community. Participants were paid fifty dollars for their participation.

ECG measurements were recorded and analyzed for coherence. The HeartMath-trained participants each performed a trial in three different conditions: (1) while in a heart-focused state (generating feelings of love and appreciation) and holding the intention to cause a specific change in the DNA; (2) while in a heart-focused state with no intention to change the DNA; and (3) in their normal state but with the intention to cause a specific change in the DNA. Control group participants performed a trial in only one condition: a heart-focused state with the intention to cause a change in the DNA.

The DNA samples consisted of identical aliquots (labeled in a double-blind fashion) of human placental DNA (Sigma Chemical Co.) suspended in deionized

water (20 µg/ml). At the beginning of each experiment, the DNA samples were heat-treated (80° C for 2 minutes) to partially denature (unwind) the DNA. All samples were stored at 4° C in a separate building before and after each experimental run. For each trial, the conformation of DNA was measured before and after exposure to the subject's intention using a Hewlett Packard ultraviolet (UV) absorption spectrophotometer. The winding and unwinding (conformational state) of DNA is measured by changes in the absorption of UV light at 260 nm. Results were calculated as a percent change relative to the initial value at the start of a given trial. In addition, to control for any potential influence of environmental fluctuations, for each trial performed on a target DNA sample, pre and post measurements were also conducted for a control DNA sample (aliquoted from the same stock solution but not exposed to human intention or heart focus).

Each sample of DNA was contained in small sealed test tube, which was placed in a beaker to eliminate any direct contact with the test tube containing the DNA solution. Target samples were given to all individuals approximately one minute after physiological recordings had begun. The subjects held the beaker containing the test tube for two minutes, during which time the ECG was continuously recorded. HeartMath-trained participants were instructed as to which protocol they were to follow (intention to wind or unwind/no intention, etc.) When the protocol called for the participants to hold an intention, the direction (wind or unwind) was randomized. The control subjects were instructed to generate feelings of love and appreciation and asked to hold an intention to either wind or unwind the DNA.

In addition to the main protocol described above, several variations of the basic experiment were performed. These included a series of trials to determine whether DNA could be intentionally influenced over greater distances. In these long-distance (nonlocal) experiments, the subject attempting to influence the DNA was located 0.5 miles away from the laboratory where the DNA was being tested. The experiments were done blind in that the experimenter testing the DNA was unaware in a given trial of whether or not the subject was intentionally attempting to influence the DNA or the specific nature of the intention.

## Results

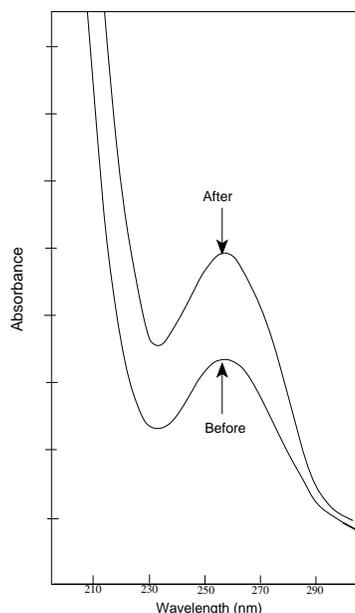
In the trials in which individuals practiced in HeartMath techniques were instructed to generate feelings of love and appreciation while holding a specific intention to cause a change in the DNA (either wind or unwind), there was an increase in heart coherence (with the specific type

of coherence varying among different participants). There was also a significant change in the conformation of the DNA (mean change 10.27%,  $p < 0.01$ ). In some cases, changes in DNA conformation of up to 25% were observed, indicating a very robust effect. In contrast, the control group showed no significant increase in heart coherence and produced no significant change in the DNA (mean change 1.09%; data not shown). In general, the individuals who generated the highest heart coherence ratios produced the most marked effects on the conformational changes of the DNA. When HeartMath-trained participants maintained a heart coherent state but did not hold an intention to cause a change in the DNA, the results were similar to those of the control group, even though the control group held the intention to cause a change in the DNA. Similarly, when the HeartMath-trained participants held the intention to change the DNA but maintained a normal psychophysiological state (without heart focus), they did not exhibit increased coherence and did not produce a significant change in the DNA. However, there was a directional trend in the DNA data for this condition that was not observed when participants did not have the intention to cause a change.

The UV spectra shown in Figure 1 indicate a very large increase in absorption (increased denaturation) of a DNA sample after an individual generating a particularly high coherence ratio intended to unwind the DNA. These changes were threefold larger than those that could be produced by maximal thermal and/or mechanical perturbation, well known to denature DNA. The effects observed here appear to go well beyond simply causing the DNA to completely denature (*i.e.*, complete separation of the two strands).

Figure 2 shows the result of two separate trials in which a participant intended to cause a winding of the DNA while in each of the two types of heart coherence modes. State 1 is now termed *physiological coherence* ("entrainment" in earlier publications) while State 2 is now called the *Point Zero mode* or low HRV state ("internal coherence" in earlier publications).<sup>6,7,11</sup> The results of both trials are consistent with the subject's intention to wind the DNA. These results indicate that in this experiment the two different heart coherence modes influenced the winding of the DNA to different extents, with the Point Zero mode producing a larger effect.

It was also of interest to determine if a particular intention could be directed to a specific DNA sample. Thus, an additional trial was performed with Doc Childre, an individual who had shown consistent ability to generate extended periods of heart coherence. In this experiment, three test tubes containing identical aliquots of DNA were placed together in the same beaker to deter-



**Figure 1.** Ultraviolet (UV) absorption spectra of a DNA sample before and after being exposed to the intention of an individual generating heart coherence. In this trial, the participant was holding the intention for the DNA to further unwind. The increase in absorption at 260 nm in the “After” spectrum relative to the “Before” spectrum indicates that further denaturation (unwinding) of the DNA did occur. The substantial change in DNA conformation observed in this trial was three times larger than that which could be produced by maximal thermal and/or mechanical perturbation in the lab, suggesting that physical/chemical alterations in the DNA bases may have also occurred.

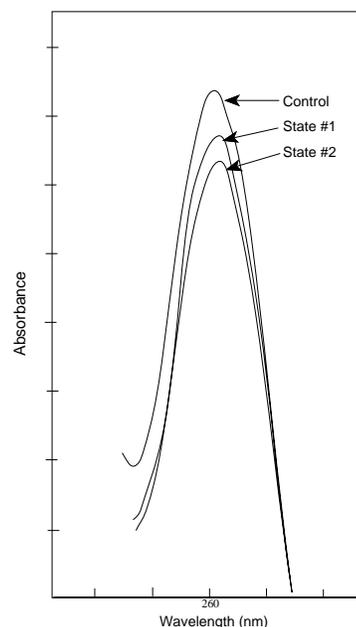
mine if two of the samples could be affected to different degrees while not influencing the third sample. The intention was to simultaneously denature (unwind) two of the samples to different extents while leaving the third sample unchanged. The results shown in Figure 3 indicate that two of the DNA samples were indeed changed to different degrees while the third sample was unaffected relative to a control sample. This ability to simultaneously direct specific intentions to different DNA molecules suggests that the information communicated between the individual and the DNA is very specific and is not simply an amorphous energy field.

One of the control group participants recruited from the local community entered the research facility in a generally upset and frustrated mood and exhibited little control over his emotions. This individual showed an unusually chaotic heart rhythm pattern, further confirming his negative emotional state. He was not able to focus and the idea of self-generating a positive feeling was an unfamiliar concept to him. He did, however, agree to hold the beaker containing the DNA sample. Although he was not able to maintain a focused intention, his energy did

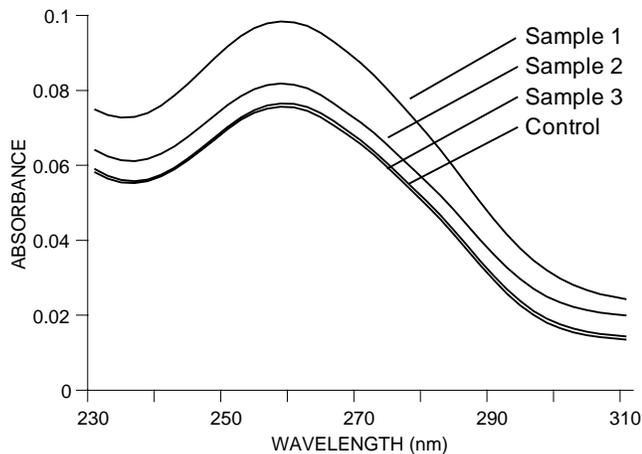
cause a change in the conformation of DNA sample. The spectra in Figure 4 show the unusual effect he had on the DNA. The “After” spectrum indicates not only an increased winding of the DNA but also a shift in the peak of the absorption curve. This is a very unusual effect, which indicates that an alteration in the physical/chemical structure of one or more of the bases in the DNA molecule may have occurred.

### Nonlocal studies

The results shown so far could conceivably be mediated by the electromagnetic field radiated by the heart. This hypothesis is supported by studies showing that DNA is sensitive to externally applied electromagnetic fields.<sup>12</sup> However, a number of nonlocal studies in which people hold an intention to affect a biological system over longer distances have also revealed dramatic effects. In these studies the distance between the targets and the people holding the intention are well beyond the range at which conventional electromagnetic fields could

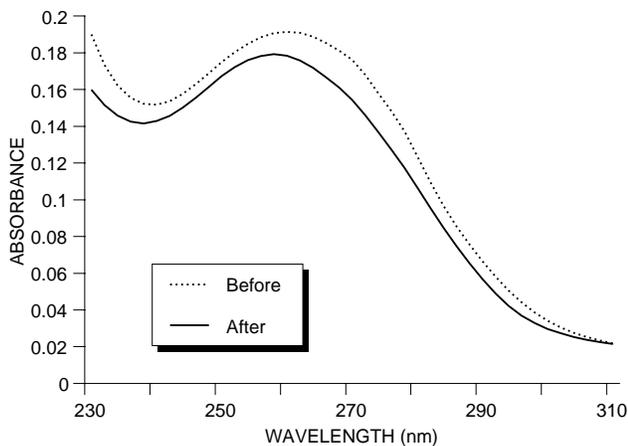


**Figure 2.** DNA UV absorption spectra obtained in two separate trials in which a participant was in each of the two types of heart coherence modes while holding the intention to cause further winding (renaturation) of the DNA. State 1 in this experiment corresponds to the physiological coherence mode while State 2 denotes the Point Zero mode. The decreased absorption at 260 nm relative to the control spectrum (without exposure to heart coherence or intention) indicate that both heart coherence modes coupled with focused intention did produce increased winding of the DNA. In this experiment, the Point Zero mode was associated with the ability to produce greater changes in DNA conformation.



**Figure 3.** In this experiment, three DNA samples were held at the same time by an individual generating heart coherence, with the intention of simultaneously unwinding two of the samples to different extents while leaving one of the samples unchanged. The resulting spectra indicate that Sample 2 indeed underwent a smaller conformational change than Sample 1, while Sample 3 remained indistinguishable from the control.

conceivably mediate the effect. Figure 5 shows an example from a series of experiments in which the individual maintaining heart coherence and intending to change the DNA was 0.5 miles from the DNA sample. In this example, the intention was to increase the winding of the DNA. In other such nonlocal experiments the intention to unwind the DNA caused a corresponding increase in the absorption peak at 260 nm (data not shown). Results from a series of five nonlocal trials demonstrated a significant change in DNA conformation (mean change 2.76%,  $p < 0.01$ ).

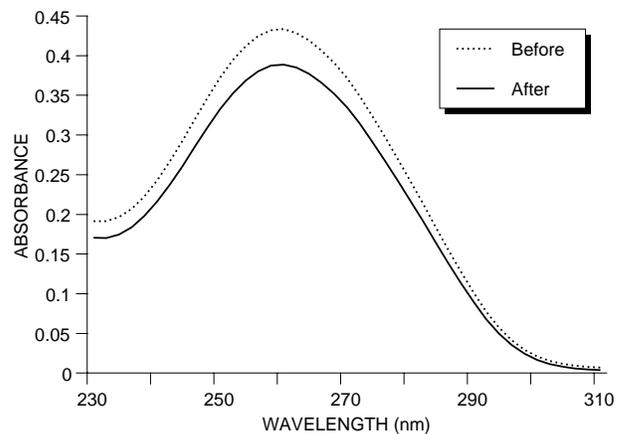


**Figure 4.** Unusual shift in the UV absorption spectrum of DNA after being exposed to high-intensity frustration.

## Discussion

UV spectroscopy gives information about the chemical interactions between DNA strands, the resonance energy transfer along individual strands, and the interaction between the strands and their environment (water). The conformational changes of DNA observed in this study were complex and suggest that all three sites of action were affected.

The results provide experimental evidence to support the hypothesis that aspects of the DNA molecule can be altered through intentionality. To our knowledge, this study was the first to correlate specific electrophysiological modes with the ability to cause changes in a biological target (DNA) external from the body. The data indicate that when individuals are in a heart-focused, loving state



**Figure 5.** UV absorption spectra of DNA illustrating the ability of an individual to affect the DNA nonlocally. In this experiment, the participant generating heart coherence and intending to increase the winding of the DNA was located one-half mile away from the DNA sample. The decrease in absorption at 260 nm observed in the “After” spectrum relative to the “Before” spectrum indicates that increased winding of the DNA did occur.

and in a more coherent mode of physiological functioning, they have a greater ability to alter the conformation of DNA.

Individuals capable of generating high ratios of heart coherence were able to alter DNA conformation according to their intention. Intending to denature (unwind) or renature (wind) the DNA had corresponding effects on the UV spectra. Control group participants showed low ratios of heart coherence and were unable to intentionally alter the conformation of DNA. It is important to note that both the intention to cause a change and heart coherence were important variables in the outcomes of the experiments.

These findings, coupled with the observations that the DNA could also be influenced nonlocally and that three samples could be simultaneously affected in different ways, seem only to be comprehensible within a quantum physics framework. These data support the hypothesis that an energetic connection exists between structures in the quantum vacuum and corresponding structures on the physical plane, and that this connection can be influenced by human intentionality. The experimental data are also consistent with the concept that states of heart coherence facilitate greater coupling between an individual and higher dimensional (spirit-level) structures, thereby enabling human intention to interact with these structures and initiate a top-down process whereby energetic information in the quantum vacuum can be modulated and influence physical systems.

In Childre's model briefly summarized earlier, within living systems the DNA molecule is proposed to act as an "antenna" and demodulator that is tuned to a nonlocal field existing outside of space-time, thus functioning as a conduit through which higher dimensional epigenetic information is transduced at the level of the physical organism. Since DNA is thus predicted to be particularly sensitive to this flow of information, we reasoned that it should make a good model system to explore the effects of human intentionality. By using an *in vitro* DNA target in this study, we eliminated any potential neuronal or biochemical influences that could occur *in vivo*, thus demonstrating a direct energetic interaction. While the DNA utilized in this experiment was derived from an exogenous source, it is likely that an individual's own DNA would be more "tuned" or resonant, and therefore even more responsive, to that person's intentions. Thus, though clearly in need of further testing, it is conceivable that individuals could influence their own DNA through a top-down process such as that described above, potentially producing effects of even greater magnitude than those observed in this study. The denaturation and renaturation of DNA studied in this investigation are biologically relevant processes involved in a number of vital cellular functions, including DNA replication and repair as well as transcription, a process which results in the generation of proteins and enzymes that in turn regulate many aspects of cellular physiology. Thus, the data presented here support the concept that cell-level processes can be influenced by human intention, mediated via energetic interactions.

Also intriguing is the finding that heart coherence, generated through heart-focused positive emotions, appears to be necessary for this type of interaction to produce significant effects. It is possible that this finding may hold a key to better understanding the observed

contribution of positive feelings and attitudes to health and healing, as well as other related, well acknowledged but poorly understood phenomena such as the placebo effect, spontaneous remission in cancer, the health rewards of a strong faith, and the positive effects of prayer. The data reported in this study support the concept that energetic mechanisms may play a significant part in mediating such effects. Finally, should the model proposed here be confirmed by further research, understandings gained through this process could potentially aid us in learning how to consciously affect aspects of our physiology and health through heart-focused intention. It is our belief that learning how to interact with, and effect change in, the energetic patterns associated with biological structures and systems may form the basis for a new mode of treating diseases and disorders that are largely unresponsive to existing medical treatments. New understandings gleaned from research in this area could also aid people in enhancing their health and well-being, and that of their environment, on a day-to-day basis.

## References

1. Rein G, McCraty R. Modulation of DNA by coherent heart frequencies. In: *Proceedings of the Third Annual Conference of the International Society for the Study of Subtle Energy and Energy Medicine*, Monterey, California, 1993: 58-62.
2. Rein G, McCraty R. Local and nonlocal effects of coherent heart frequencies on conformational changes of DNA. In: *Proceedings of the Joint USP/IAAPR Psychotronics Conference*, Milwaukee, Wisconsin, 1993.
3. Rein G, McCraty R. Structural changes in water and DNA associated with new physiologically measurable states. *Journal of Scientific Exploration* 1994;8(3):438-439.
4. Rein G, McCraty R. DNA as a detector of subtle energies. In: *Proceedings of the Fourth Annual Conference of the International Society for the Study of Subtle Energy and Energy Medicine*, Boulder, Colorado, 1994: 61-64.
5. McCraty R, Childre D. *The appreciative heart: The psychophysiology of positive emotions and optimal functioning*. Boulder Creek, CA: HeartMath Research Center, Institute of HeartMath, Publication No. 02-026, 2002.
6. McCraty R, Atkinson M, Tiller WA. New electrophysiological correlates associated with intentional heart focus. *Subtle Energies* 1993;4(3):251-268.
7. Tiller WA, McCraty R, Atkinson M. Cardiac coherence: A new, noninvasive measure of autonomic nervous system order. *Alternative Therapies in Health and Medicine* 1996;2(1):52-65.
8. Childre D, Martin H. *The HeartMath Solution*. San Francisco: HarperSanFrancisco, 1999.
9. Childre D, Rozman D. *Overcoming Emotional Chaos: Eliminate Anxiety, Lift Depression and Create Security in Your Life*. San Diego: Jodere Group, 2002.
10. McCraty R. *The energetic heart: Bioelectromagnetic interactions within and between people*. Boulder Creek, CA: HeartMath Research Center, Institute of HeartMath, Publication No. 02-035, 2002.
11. McCraty R, Atkinson M. *Psychophysiological coherence*. Boulder Creek, CA: HeartMath Research Center, Institute of HeartMath, Publication No. 03-016, 2003.
12. Sakamoto M, Fujikado T, Hayakawa R, Wada Y. Low frequency dielectric relaxation and light scattering under AC electric field of DNA solutions. *Biophysical Chemistry* 1980;11(3-4):309-316.