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SUPERIOR COURT OF THE STATE OF CALIFORNIA

IN AND FOR THE COUNTY OF SAN DIEGO

Elizabeth Crane, an Individual, on behalf of Herself and All Others Similarly Situated, and on behalf of the General Public, Plaintiff, vs. BIO-HYDRATION RESEARCH LAB, INC. and DOES 1 through 100, inclusive, Defendants.	CASE NO. GIC 822855 **CLASS ACTION** Hon. J. Richard Haden Dept. 72 **DECLARATION OF PROFESSOR ANDREW C. KUMMEL IN SUPPORT OF PLAINTIFF'S OPPOSITION TO DEFENDANT'S SPECIAL MOTION TO STRIKE** Date: March 5, 2004 Time: 9:00 a.m.

I, Andrew C. Kummel, declare as follows:

1. I am a Professor of Chemistry at the University of California at San Diego. I hold a Ph.D. in chemistry, and my specialties include physical and materials chemistry. I am considered an internationally recognized expert in the fields of chemical physics, physical chemistry, and materials chemistry. To be promoted to my current position of full Professor, my scientific work was reviewed twice by 12-15 outside experts and judged to be of international stature.

2. I have published approximately 70 papers in the most prestigious international journals of physical chemistry including the *Journal of Chemical Physics*, *Journal of Physical Chemistry*, *Physical Review Letters*, and *Science*. Each of my papers has been reviewed by 1-2 experts plus the editors.

3. Other scientists consider my scientific judgment to be accurate, as documented by my being a frequent referee for the top international journals in my field including the *Journal of Chemical Physics*, the *Journal of Physical Chemistry*, *Surface Science*, *Physical Review B*, *Physical Review Letters*, *Science*, and *The Journal of the American Vacuum Society*. I also regularly review grant proposals for the National Science Foundation (NSF) as well as private grant agencies.

4. I am the current recipient of several major research grants including ones from the Division of Mathematical and Physical Sciences of the National Science Foundation, the Division of Materials Science of the National Science Foundation, the Air Force Office of Scientific Research (AFOSR), the Semiconductor Research Corporation (SRC), and the Motorola Corporation. In the past, I also had funding from other agencies including the Defense Research Projects Administration (DARPA), the American Chemical Society (ACS), and the Packard Foundation. I have received peer-reviewed funding for 14 years. Each grant is reviewed by at least 3-5 experts who judge my previous published work, my knowledge of the field, and my ability to design creative realistic experiments. My current research funding exceeds $400,000/yr.

5. The science by my research group has been recognized by scientists all over the world, as demonstrated by the fact that my students and I are invited several times per year to present our results as international meetings including those of the American Vacuum Society, the American Chemical Society, The Gordon Research Conferences, The Institute of Electrical and Electronics Engineers (IEEE), the Chemistry and Physics of Semiconductor Interfaces. My students and I have won several prizes for our work including the Packard Fellowship.

6. Many of the claims made by Bio-Hydration Research Labs, Inc. ("Bio-Hydration") about Penta water are not only wrong but absurd because they violate the scientific community's current understanding of the structure and dynamics of water. This is not just personal opinion, but also the

reaction by the scientific community to the claims made by Bio-Hydration. As documented on my Report attached hereto as Exhibit A, several of the claims made by Bio-Hydration on its website about Penta water are completely false. It is impossible to create a stable form of liquid water composed of small clusters.

7. For example, on its website, Bio-Hydration claims to have created a new "stable" form of water, which they call "Penta water." It claims to have restructured water into smaller stable clusters. This is absurd for the reasons summarized below, and detailed in my attached Report.

8. The Bio-Hydration website states that liquid water is composed of clusters. This is a major premise of all its claims. However, liquid water is not composed of clusters. Rather, liquid water is a hydrogen bonded network of water molecules.

9. The Bio-Hydration website claims it has created a new form of water which is stable for many days. This is completely inconsistent with all studies upon the lifetimes of various liquid water structures, and Bio-Hydration never performed the proper studies to prove their claims.

10. The Bio-Hydration website shows a structure for Penta water in which five water molecules are arranged in a circle with the oxygens clustered together. This is absurd because each of the oxygens has a negative charge and hence repel one another.

11. The Penta patent, attached as Exhibit A to the Declaration of William Holloway in Support of Bio-Hydration's Motion to Strike ("Holloway Declaration"), claims that Penta water has a boiling point between 93 and 100 C because the water is in smaller clusters. This is outright wrong, for the reasons set forth in my attached Report. Indeed, one of the main claims in the patent – that Penta water has an allegedly unique cluster structure – can be disproven in a few hours even by an amateur scientist.

12. The studies cited by Bio-Hydration in its motion to strike as main proof for the formation and stability of Penta water are unreliable, defective, and insignificant.

13. Bio-Hydration's website and moving papers also cite to a paper by a Russian group ("Study of Cluster Molecular Structures in Various Types of Liquid Waters Using Spontaneous Raman Spectroscopy" by A.F. Bunkin *et al.*) on the Raman spectrum of Penta water versus various controls.

Holloway Declaration, Exhibit C. The Russian paper is supposed to serve as primary proof that Penta water has a different structure than regular pure water. However, the paper is defective and unreliable for several reasons set forth in my attached Report, and summarized below.

14. The Russian paper claims that the vibrational structure of Penta water differs from that of other waters by 10 K (10 Kelvins). Even if this were true, it would only be a 3% effect and be meaningless. However, I doubt even this tiny effect is real. Even if the effect were real, it does not even come close to proving that Penta water contains stable clusters.

15. Moreover, that Russian paper was published in a local journal that is not internationally refereed. One of the many defects in the paper is that, of the 15 references cited by the authors, 13 are papers written by the same authors (*i.e.* self-citations). I have never read a legitimate scientific paper in which 86% of the citations are self-citations. Raman spectroscopy measures the vibrational frequency of molecules. Furthermore, that Russian study contains numerous critical scientific flaws, as detailed in my attached Report. Had I been a referee evaluating the paper, I would have rejected it.

16. The Bio-Hydration website claims that Penta water is transported across cell membranes more effectively due to the smaller water cluster size. Bio-Hydration claims that small water clusters allegedly in Penta water can diffuse through aquaporins more rapidly than large clusters in regular water. As detailed in my Report, this is a complete misreading of papers by Nobel prize winners who discovered the structure of aquaporins, which papers clearly state that water is only transported through aquaporins one molecule at a time.

17. The conspicuous absence of Bio-Hydration's claims from mainstream scientific journals demonstrates the speciousness of Bio-Hydration's claims. Normally, when a startup biotech company has a major scientific breakthrough, it publishes its results in the most prestigious journals such as *Science*, *Nature*, or *JAMA (Journal of the American Medical Association)*. BioHydation Labs claims they have a new form of water which is stable for many days. If this were true and could be proven, the results would have been published in *Science*, *Nature*, or *Physical Review Letters*. Instead, the work was published in an obscure Russian journal which is not internationally peer reviewed. This indicates that Bio-Hydration did not want close scrutiny of its research.

18. Moreover, when a biotech or drug company wants a study performed, they hire the most respected international scientists at the best universities. These scientists typically would have long publication records in international journal and the universities would be in the top 50 in worldwide ranking. Instead, Bio-Hydration cited (and presumably hired) scientists from a country in which the scientists are desperate for funds. The Russian scientists did not seem to think very highly of their own research. Bunkin and Pershin occasionally publish their conference presentations in an international journal, *SPIE-Int. Soc. Opt. Eng. Proceedings of Spie - the International Society for Optical Engineering*, and they occasionally publish research paper in an international journal, *Journal of Raman Spectroscopy*. The fact they declined to publish their Penta water study in either of these journals indicates that the authors, who are cited and presumably hired by Penta, either thought the results were not reliable or that the results were not significant. For their hydration and athletic performance studies, they did not even try to publish them in a local peer review journal; this would be consistent with Bio-Hydration's knowledge that its studies are not worthy of close scrutiny by experts.

19. If Bio-Hydration had been able to create a new stable form of water, its scientists would be invited to talk at all the important meetings on the structure and chemistry of water and ice. Looking over the programs for the ACS and Gordon conference on water and ice, there were no talks by Bio-Hydration. This indicates that the scientific community judges the results by Bio-Hydration to be absurd. Conference organizers actively seeks controversial speakers as shown by the numerous conferences and symposia on cold fusion before 99.99% of the scientific community was convinced it was completely wrong. If there was any possibility than even a small fraction of the scientific community though that Bio-Hydration had created a new form of water, the scientists from Bio-Hydration would have been invited to talk at the international meetings. I note that nearly all small biotechnology companies proudly publicize when their scientists present their studies at well known scientific meetings.

20. Retired Professor Stephen Lower of Simon Fraser University in Canada has a website explaining various false claims by water companies. He refers to all the claims by numerous companies to restructure liquid water into stable clusters as "pseudoscience" and he specifically refers to Penta

water as a "worthless product." My attached Report contains one of his quotes about Penta water.

21. To summarize, the basic premise of all of Bio-Hydration's claims is that it has a process that restructures liquid water into stable small clusters and that these clusters are more readily transported into cells. This is completely false. Bio-Hydration claims are an amusing use of legitimate scientific terminology taken completely out of context to create a new fiction. Bio-Hydration's claims on the formation of a new stable structure of liquid water are simply junk science.

Dated: February 23, 2004

Andrew C. Kummel
Professor of Chemistry and Biochemistry
University of California, San Diego

REPORT ON CLAIMS BY BIO-HYDRATION RESEARCH LABORATORIES REGARDING PENTA WATER

By Professor Andrew C. Kummel
University of California at San Diego
February 22, 2004

This report will document that several of the claims made by Bio-Hydration Research Labs, Inc. ("Bio-Hydration") on its website about Penta water are completely false. It is impossible to create a stable form of liquid water composed of small clusters.

Part I: CREDENTIALS OF ANDREW C. KUMMEL

I am a Professor of Chemistry at UCSD, and hold a Ph.D. in chemistry. My specialties include physical and materials chemistry. I am considered to be an internationally recognized expert in the fields of chemical physics, physical chemistry, and materials chemistry.

1. I have published approximately 70 papers in the most prestigious international journals of physical chemistry including the *Journal of Chemical Physics*, *The Journal of Physical Chemistry*, *Physical Review Letters*, and *Science*. Each of my papers has been reviewed by 1-2 experts plus the editors.

2. Other scientists consider my scientific judgment to be accurate as documented by my being a frequent referee for the top international journals in my field including the *Journal of Chemical Physics*, *The Journal of Physical Chemistry*, *Surface Science*, *Physical Review B*, *Physical Review Letters*, *Science*, and *The Journal of the American Vacuum Society*. I also regularly review grant proposals for the National Science Foundation (NSF) as well as private grant agencies.

3. Further proof of my scientific reputation is my being the current recipient of several major research grants including ones from the Division of Mathematical and Physical Sciences of the National Science Foundation, the Division of Materials Science of the National Science Foundation, the Air Force Office of Scientific Research (AFOSR), the Semiconductor Research Corporation (SRC), and the Motorola Corporation. In the past, I also had funding from other agencies including the Defense Research Projects Administration (DARPA), the American Chemical Society (ACS), and the Packard Foundation. I have received peer-reviewed funding for 14 years. Each grant is reviewed by at least 3-5 experts who judge my previous published work, my knowledge of the field, and my ability to design creative realistic experiments. My current research funding exceeds $400,000/yr.

4. The science by my research group has been recognized by scientists all over the world as documented by me and my students being invited several times per year to present our results as international meetings including those of the American Chemical Society, the American Vacuum Society, the Gordon Research Conferences, the Institute of Electrical and Electronics Engineers (IEEE), and the Chemistry and Physics of Semiconductor Interfaces. My students and I have won several prizes for our work including the Packard Fellowship.

5. Currently, I am a full professor of chemistry at the University of California at San Diego. To be promoted to this position, my scientific work was reviewed twice by 12-15 outside experts and judged to be of international stature.

Part II: DISPUTE OF BIO-HYDRATION'S CLAIMS

(1) On its website, Bio-Hydration claims to have created a new stable form of water, which it calls "Penta water." Bio-Hydration claims that it has restructured water into smaller stable clusters. This is clearly absurd for the following reasons.

(a) The Bio-Hydration website states that liquid water is composed of clusters; this is a major premise of all their claims. Liquid water is not composed of clusters; instead, liquid is a hydrogen bonded network of water molecules.

A comprehensive molecular theory for water was put forth by Frank. H. Stillinger (Princeton University) in the journal *Science* in 1980, and has stood up to scientific review for more than twenty years. Stillinger's article, "Water Revisited," 209 *Science* 4455 at 451 (July 25, 1980), is attached to this Report as Exhibit 1. This *Science* paper has been cited 464 times in the scientific literature, indicating that this model for water is highly respected in the scientific community. Stillinger states that liquid water is a constantly changing random network of water molecules.

"Summary: Liquid water consists of a macroscopically connected random network of hydrogen bonds, with frequent strained and broken bonds, that is continually undergoing topological reformation. Anomalous properties of water arise from the competition between relatively bulky ways of connecting molecules into local patterns characterized by string bonds and nearly tetrahedral angles and more compact arrangements characterized by more strain and bond breakage. However, these alternatives constitute virtually a continuum, of architectural possibilities rather than a discreet pair of options ... Upon the melting of pure ice, the tetrahedral network remains largely intact and, rigidity is replaced by fluidity, and crystalline periodicity gives way to spatial homogeneity. Molecules are much freer to diffuse about and change their orientation."

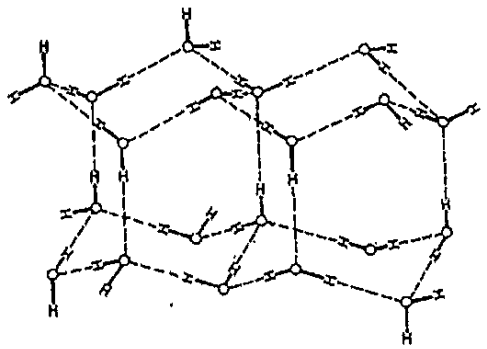


Figure 1: This is a model of solid ice. Note the model should continue infinitely in all directions. Each water molecule has one oxygen atom, "O", and two hydrogen atoms, "H". The atoms within a molecule are joined by very strong "covalent bonds" shown by the solid lines. Conversely, the forces between the molecules are weak "hydrogen bonds" shown by the dashed lines. Note: The oxygens have negative charge and the hydrogen have positive charge; the hydrogen bonds link these opposite partial charges.

Solid ice consists of water molecules, with each hydrogen atom bonded to its four nearest neighbors in a perfectly regular tetrahedral arrangement. Water molecules consist of one oxygen with a partial negative charge and two hydrogens with a partial positive charge. In solid ice, each molecule is arranged so that the negatively charged oxygen is closest to two positively charged hydrogens in two neighboring molecules and each positive charged hydrogen is closest to one negatively charged oxygen in a neighboring molecule. The basic motif is matching positive and negative partial charges in neighboring molecules. This is similar to simple bar magnets always lining up antiparallel. The matching of the negative charges on the oxygens with the positive charges on the hydrogen is denoted as "hydrogen bonding". The perfect tetrahedral arrangement of nearest neighboring water molecules results in the water molecules forming six sided rings as shown in Figure 1. Hence, the infinite network of hydrogen bonded water molecules can be described as consisting of clusters of 6 water molecules, but there are no discrete clusters. Instead all of the six sided rings are joined together in an infinite array. An analogy would be that if there was a giant solid bolder, one could use a pick to break of a small sample rock. Even though the small rock is a perfect sample, this does not mean the boulder is composed of a large number of discrete rocks. The only time that water exists as stable discrete clusters is in the gas phase close to the condensation temperature.

When solid water melts, the tetrahedral arrangement of water molecules becomes distorted. The average number of hydrogen bonds formed by each water molecule increases, but there is a distribution. Liquid water is greatly disordered. To represent this disorder, scientists use models of water which appear as large clusters with five and six membered rings of water molecules. However, these models are not meant to imply that liquid water consists of clusters. All the clusters are part of an infinite network in the same manner that the rock was a piece of the large boulder, but the boulder does not consist of discrete rocks.

(b) Bio-Hydration's website claims it has created a new form of water that is stable for many days. This is completely inconsistent with all studies upon the lifetimes of various liquid water structures, and Bio-Hydration never performed the proper studies to prove its claims.

The concept of long lived clusters or any other non-equilibrium structure of liquid water is critically flawed. Bio-Hydration claims that Penta water clusters are stable at room temperature for 6-9 months (or 16 billion seconds, 1.6×10^7 seconds). This would indicate that the hydrogen bond lifetime was stable for 6-9 months.

The transient nature of any hydrogen bond in liquid water has been shown by infrared spectroscopy, Raman spectroscopy, inelastic neutron scattering and molecular dynamics simulations to be on the order of 10 picoseconds (0.000000000001 seconds, or 1×10^{-12} seconds). A picosecond is one trillionth of a second. If the Penta water process were able to produce small discrete clusters of water, they would be stable for approximately 10 picoseconds after which the hydrogen bonds would freely dissociate and reform the random distorted tetrahedral network of standard pure liquid water. The disagreement between Penta's claims and the experimental work listed above is a staggering difference of 19 orders of magnitude (factors of 10). All the experimentally measured values for the H-bond lifetime agree within the same order of

magnitude; roughly 10 picoseconds. Any party claiming the H-bond lifetime is 19 orders of magnitude (100,000,000,000,000,000 – one quadrillion times!) different is obviously incorrect. Furthermore, if Bio-Hydration wanted to prove its claim, it would need to perform the standard measurements for the structure of liquid water using neutron scattering.

(c) The Bio-Hydration website and truck show a structure for Penta water in which five water molecules are arranged in a circle with the oxygens clustered together. This is clearly absurd because each of the oxygens has a negative charge and hence repel one another.

As previously stated, pure water consists of water molecules in which each water molecule is hydrogen bonded to approximately four nearest neighbors in a distorted tetrahedral arrangement. Each water molecule consists of one oxygen with a partial negative charge and two hydrogens with a partial positive charge. Each water molecule is arranged so that the negatively charged oxygen is closest to approximately two positively charged hydrogens in two neighboring molecules and each positive charged hydrogen is closest to approximately one negatively charged oxygen in a neighboring molecule. The basic motif is matching positive and negative partial charges in neighboring molecules. This is similar to simple bar magnetic always lining up antiparallel.

The Bio-Hydration website and truck show a structure for Penta water in which five water molecules are arranged in a circle with the negatively charged oxygens clustered together. This is clearly absurd because each of the oxygens has a negative charge and hence repel one another. It is analogous to how the positive poles of magnets repel each other. In order to get the oxygen ends of 5 water molecules to cluster together, one needs a positive ion. However, Penta water is high purity water with nearly zero dissolved ions. Even if there were some dissolved ions, the results of Omta and coworkers show that dissolved ion do not breakdown or enhance the hydrogen bonding network of liquid water.

(d) The main public proof for the formation and stability of Penta water is a Russian paper whose claimed results are insignificant and which was never published in an internationally refereed journal.

The Penta website shows a paper by a Russian group ("Study of Cluster Molecular Structures in Various Types of Liquid Waters Using Spontaneous Raman Spectroscopy" by A.F Bunkin et al) on the Raman spectrum of Penta water versus various controls. The paper claims that the vibrational structure of Penta water differs from that of other waters by 10 K (10 Kelvins). Even if this were true, it would only be a 3% effect and be meaningless. However, I doubt even this tiny effect is real. Even if the effect were real, it does not even come close to proving that Penta water contains stable clusters.

This paper is published in a local journal that is not internationally refereed. (a) Even at first glance the paper seems suspicious. Of the 15 references cited by the authors, 13 are papers written by the same authors (*i.e.* self-citations). I have never read a legitimate scientific paper in which 86% of the citations are self-citations. (b) The authors state in the first sentence that "Water molecules form clusters in both water and water solutions." As previously explained, this is false because liquid water forms a hydrogen bonded network without discrete stable clusters. (c) The authors state that any changes in vibrational structure could be ascribed to just

a change in the density of hydrogen bonds instead of proving the existence of stable clusters in liquid water. "Cluster structure can be defined as an average cluster size or concentration of hydrogen bonds per unit volume."

The Russian paper is supposed to be the primary proof that Penta water has a different structure that regular pure water. Raman spectroscopy measures the vibrational frequency of molecules. The Russian study had several critical flaws. (1) Water molecules have a high frequency vibrations due to their strong covalent oxygen-hydrogen bonds, and they have low frequency vibrations due to their weak hydrogen bonds. Strangely, the Russians choose to probe the influence of the weak hydrogen bonds on the high frequency vibrations. This is not a very sensitive technique. (2) The Russian scientists used a very high power laser (80mJ/pulse). This can heat the sample, rendering any small differences in measured vibrational frequency to be meaningless. (3) The experimental apparatus is not standard for measuring spontaneous Raman scattering as defined in the most famous handbook of laser spectroscopy entitled: Laser Spectroscopy by Wolfgang Demtroder (1998). Demtroder describes the standard experimental setup with the laser beam interacting with the sample material in an internally reflective capillary tube of length between 10-30 meters. This long path length allows for significant enhancement of the spontaneous Raman intensities. The Russian experimental apparatus does not employ the capillary technique. Rather, they use a sample cell, where the path lengths probably do not exceed 1 meter. The authors admit that uncertainty in their experiment is introduced by poor signal-to-noise ratio. (4) The authors probably did not have a temperature controlled sample since they did not state they had an apparatus to control the temperature of their samples.

The poor technique used by the Russians can directly be seen in the noisy inconsistent data. Figure 2 shows the Raman spectrum using an unfocused and a focused laser. The data for the focused laser is more intense, but the peak is not smooth and is poorly fit by the Gaussian envelop. Note also the strange asymmetric noise at the top of the peak. The width of the peak is about 22 nm so determining the peak position to better than 1 nm would be challenging even with very low noise data. Considering the noise in the data in Fig 2 and the strange peak shape, it seem unreasonable to claim that the Russian group can determine the peak position to better than a few nm,. Instead, the Russian authors claim to determine the peak position with an accuracy of 0.1 nm (note 0.1 nm = 1Å); this is not reasonable with their data. On this basis alone, I would have rejected the paper had I been a referee.

The authors report the data with both an unfocused and focused laser beam. The unfocused laser beam probably has the advantage that it does not heat the water samples as much. For the unfocused beam, the Russian group found that the peak position of unoxygenated Penta water was the same (i.e. less than one standard deviation) as unprocessed water. When they repeated the experiment with the focused laser beam, they claim there was a 0.5 nm shift in the peak position. This alone would lead one to conclude that their technique was not reliable to detect small changes (< 2nm) in peak position. For the oxygenated Penta water with the unfocused beam they claim to observe a 0.8 nm shift in speak position while with the focused beam the shift was only 0.5 nm relative to unprocessed water. As previously stated, I would conclude that the differences are too small to reliably measure. Instead, the Russian group concluded that they observed a 10 C shift in vibration temperature for the oxygenated Penta water relative to unprocessed water. Even if this result was real, one needs to convert to an absolute temperature scale to judge the size of the effect. Room temperature is 298 K (K = Kelvins); a 10 C shift is

also a 10K shift. Thus the alleged change in vibrational temperature is only 3%. This is insignificant.

(e) The Penta patent claims that Penta water has a boiling point between 93 and 100 C because the water is in smaller clusters. This is clearly wrong.

The only known ways to lower the boiling point of water are to mix water with a lower boiling point liquid or to boil water at high altitude (*i.e.* in Denver) or on a day with very low barometric pressure. Using just a kitchen thermometer with +/-1 C accuracy, we have boiled several samples of Penta water at sea level and found the boiling points to be identical to those of tap water, Arrowhead Distilled Water, and Crystal Geyser Spring Water. We found that Essentia purified water with added electrolytes had a 1 C greater boiling point, but that is expected for any water solution with a high concentration of dissolved ions. I am sure that anyone can repeat this test and will see the claim that Penta water has a unique low boiling point is false. Clearly, one of the main claims in the patent that Penta water has an allegedly unique cluster structure can be disproven in a few hours even by an amateur scientist.

(2) Diffusion of Water Through Aquaporins:

The Bio-Hydration website claims that Penta water is transported across cell membranes more effectively due to the small water cluster size. Bio-Hydration claims that small water clusters allegedly in Penta water can diffuse through aquaporins more rapidly than large clusters in regular water.

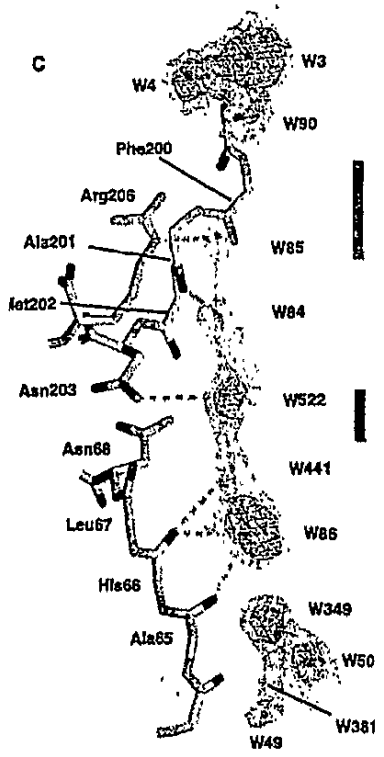
Aquaporins are membrane-bound proteins that facilitate the transmission of water across the lipid bi-layer membranes in eukaryotic cells. Because of the hydrophobic core of the lipid bi-layer structure, water does not freely diffuse across this barrier; hence, aquaporins are membrane bound proteins that facilitate the transmission of water across this interface. The structure and mechanism of aquaporins have been studied extensively, and the 2003 Nobel Prize in chemistry was given to Peter Agre of Johns Hopkins University for determining the structure and function of the aquaporins.

Agre and coworkers showed that the function of aquaporin was to transmit water molecules through an interior channel in the protein. The structure of this protein was determined by x-ray crystallography. This x-ray data along with molecular dynamics calculations showed that water molecules are transmitted in a single file line through the pore. Figure 1 shows the experimentally determined protein structure with bound water molecules in the channel. It is seen that the channel is only wide enough to accommodate a single water molecule, but the channel is quite long and can facilitate a chain of water molecules. (296 *SCIENCE VOLT* 527 (April 19, 2002), "Control of the Selectivity of the Aquaporin Water Channel Family by Global Orientational Tuning," Emad Tajkhorshid, Peter Nollert, Morten Ø. Jensen, Larry J. W. Miercke, Joseph O'Connell, Robert M. Stroud, and Klaus Schulten) (attached to this Report as Exhibit 2).

In simple terms, water molecules are transported from outside the cell water one-by-one and are guided through the channel by electrostatic interactions. The train of water molecules in the protein at any given time may number as many as seven. This is inconsistent with Penta's description of water transport into cells. The Penta website claims that because Penta water is in small clusters, it can more easily be transported through aquaporins in cells. This is a complete

misreading of the papers by Nobel prize winners who discovered the structure of aquaporins, which papers clearly state that water is only transported through aquaporins one molecule at a time.

Figure 2: Observed location of water molecules in the water bound channel with an overlaid electron density map. The protein channel the array of interconnected sticks on the left. Note only one side of the channel is shown. The real channel has a cylinder shape so the interconnect sticks depicting the protein would surround the water passing through. The water molecules are the items on right inside the mesh. Each water molecule appears inside of a dense mesh and is labeled. The water on top (W3, W4, W90) and below (W349, W50,W381, W49) is outside the channel. The water instead the channel is labeled W85, W84, W522, W411, W86. Note each of the water molecules inside the channel is a discrete molecule and not part of a cluster.



Part III: Reaction of the Scientific Community to Bio-Hydration's Claims

In my opinion, many of the claims made by Bio-Hydration about Penta water are not only wrong but absurd because they violate our current understanding of the structure and dynamics of water. This is not just personal opinion, but the reaction by the scientific community to the claims made by Bio-Hydration.

(1) When a startup biotech companies has a major scientific breakthrough, it publishes the results in the most prestigious journal such as *Science*, *Nature*, or *JAMA (Journal of the American Medical Association)*. BioHydration claims it created a new form of water that is stable for many days. If this were true and could be proven, the result would have been published in *Science*, *Nature*, or *Physical Review Letters*. Instead, the work was published in an obscure Russian journal which is not internationally peer reviewed. This indicates that Bio-Hydration did not want close scrutiny of its research.

(2) When a biotech or drug company wants a study performed, it hires the most respected international scientists at the best universities. These scientists typically would have long publication records in international journal and the universities would be in the top 50 in worldwide ranking. Instead, Bio-Hydration cited (and presumably hired) scientists from a country in which the scientists are desperate for funds. The Russian scientists did not seem to think very highly of their own research. Bunkin and Pershin occasionally publish their conference presentations in an international journal, *SPIE-Int. Soc. Opt. Eng. Proceedings of Spie - the International Society for Optical Engineering*, and they occasionally publish research papers in an international journal, *Journal of Raman Spectroscopy*. The fact they declined to publish their Penta water study in either of these formats indicates they the authors who are cited and presumably hired by Penta either thought the results were not reliable or that the results were not significant. For their hydration and athletic performance studies, they did not even try to publish them in a local peer review journal; this would be consistent with Bio-Hydration knowing that its studies were not worthy of close scrutiny by experts.

(3) If Bio-Hydration had been able to create a new stable form of water, its scientists would be invited to talk at all the important meetings on the structure and chemistry of water and ice. Looking over the programs for the ACS and Gordon conference on water and ice, there were no talks by Bio-Hydration. This indicates that the scientific community judges the results by Bio-Hydration to be absurd. Conference organizers actively seek controversial speakers as shown by the numerous conferences and symposia on cold fusion before 99.99% of the scientific community was convinced it was completely wrong. If there was any possibility than even a small fraction of the scientific community though that Bio-Hydration had created a new form of water, the scientists from Bio-Hydration would have been invited to talk at the international meetings. I note that nearly all small biotechnology companies proudly publicize when their scientists present their studies at well known scientific meetings.

(4) Bio-Hydration has been openly challenged by an illusionist known for identifying scientific frauds, James Randi, on his website (http://www.randi.org/jr/08-24-01.html). A printout of Randi's website is attached to this Report as Exhibit 3. Although James Randi is not a PhD scientist, he has a good understanding of basic scientific principles, and he has great talent for explaining scientific in the vernacular. James Randi has offered a $ 1 million prize if a proper scientific study could prove that Penta water more rapidly hydrates humans. Bio-Hydration has declined to compete for the $ 1 million. James Randi has posted the following on his website and as far as I know has not even been sued for product defamation by Bio-Hydration. I have included this quote because it explains the absurdity of Bio-Hydration's claims in blunt, non-technical terms. The middle italicized paragraph is James Randi quoting the Bio-Hydration website.

> (RANDI): Just so that you can see how pseudoscience and ignorance have taken over the Internet merchandising business, I suggest that you visit www.hydrateforlife.com and try to follow the totally false and misleading pitch that the vendors make for this product, magically-prepared "Penta" water that will "hydrate" your body miraculously. A grade-school education will equip you to recognize the falsity of this claim, but it's obvious that the purveyors are cashing in on ignorance and carelessness. Just read this as an example of pure techno-claptrap:
>
> *(Bio-Hydration): Normally, the water you drink is in large clusters of H20 [sic] molecules. That's because its [sic] been affected by air, heat, and modern civilization.*

Penta™ is water that, through physics, has been reduced to its purest state in nature — smaller clusters of H2O [sic] molecules. These smaller clusters move through your body more quickly than other water, penetrating your cell membranes more easily. This means Penta™ is absorbed into your system faster and more completely. When you drink Penta™, you're drinking the essence of water. You get hydrated faster, more efficiently, and more completely than with any other water on earth.

(RANDI) Folks, water is water. It's burned hydrogen, no more, no less. The molecules of H_2O — *not* "H2O" as these quacks write — do not "cluster," under *any* influence of the dreadful "air, heat, and modern civilization" that you're cautioned to fear. True, water exhibits surface tension, and the molecules do "line up" to an extent, though almost any foreign substance in there disturbs this effect — soap/detergent "wets" it readily. But water molecules in "clusters"? No way! The illustrations you see here are totally wrong and fictitious. There's no such thing as "essence of water," by any stretch of scientific reasoning, or imagination. This is total, unmitigated nonsense, a pack of lies designed to swindle and cheat, to steal money, and to rob the consumer. And "through physics" has *nothing* to do with it.

(5) Retired Professor Stephen Lower of Simon Fraser University in Canada has a website explaining various false claims by water companies. He refers to all the claims by numerous companies to restructure liquid water into stable clusters as "pseudoscience" and he specifically refers to Penta water as a "worthless product." Below is a quote from his website (http://www.chem1.com/CQ/clusqk.html).

> "This manufacturer uses ultrasound to break up larger "clusters" into smaller ones, and unlike most, offers numerous references to "research studies," mostly in obscure Russian journals or lacking proper citation and have nothing to do with the kinds of fictitious "clusters" this outfit is flogging. What they don't say, of course, is that millions of years of evolution have made artificial methods of enhancing "cellular hydration" unnecessary, as described here. ..."

SUMMARY:

The basic premise of all of Bio-Hydration's claims is that it created a process that restructures liquid water into stable small clusters and that these clusters are more readily transported into cells. This is completely false. You cannot change the equilibrium structure of water. Water is a hydrogen bonded network, not a collection of clusters. Any changes to the structure of water are gone after a fraction of a second. As explained above, one can chip off a small rock from a large boulder to get an accurate sample of the boulder, but that does not mean that a boulder is composed of a collection of rocks. Bio-Hydration's claims are an amusing use of legitimate scientific terminology taken completely out of context to create a new fiction. Bio-Hydration's claims regarding the formation of a new stable structure of liquid water are junk science, and silly at best.

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