Kinetic Water Research Symposium

By
William Davis

THE KINETIC (tm) WATER RESERCH PROGRAM (1983-1986)

PREFACE

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Three years of chemical investigation and scientific research into the anamolous phenomena of Kinetic Water have provided some rather vivid observations as well as stimulating ideas for theoretical speculation.

The following experimental observations and research data are initial examinations and preliminary reports that pose more questions than reveal specific answers.

These findings report the initial and preliminary assessments. The four (4) Technical Reports and Afterthought are written as perplexing observations which lend themselves for future research and further speculation.

The purpose for making these initial findings public is not to shout: Discovery! Rather the intent is to solicit open scientific comment and increased systematic inquiry into very fascinating phenomena.

Practically speaking, THE KINETIC(tm) WATER RESEARCH PROGRAM is seeking to expand the experimental scope of these initial laboratory inquiries. The PROGRAM is seeking to broaden the level and increase intensity of research. We ask for your comments, criticisms, and suggestions as well as we are requesting proposals for further basic and applied faculty and undergraduate research and continuing education.

Water is the vital element of life and a most perplexing "stuff of life." The following reports and preliminary findings may add a new dimension and perspective to this most common of substances.

Willie C Davis

William Davis, Ph.D.
Principle Investigator
Department of Chemistry
St. Philip's College/ACCD
San Antonio, Texas 78203
(512)531-3566

Lanier Byrd

Lanier Byrd, M.S.
Director of Research Program
Chairman of Natural Sciences
Director of Research Program
Chairman of Natural Sciences
St. Philip's College/ACCD
San Antonio, Texas 78203
(512)531-3545

Jonathan P. De Vierville, M.S.
Principle Promoter and Project
Liaison

Burton Crow, Ph.D.
Director of Continuing Education
Sponsor

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INITIAL PHYSICAL AND BIOLOGICAL STUDIES OF KINETIC(tm) WATER

(Technical Report #1)

This study (Technical Report #1) reports the results of several experiments that explore the possibility of certain physical and biological properties of Kinetic(tm) Water that are measurable and different than those of deionized water. This work was originally simulated by the hypothesis that the molecular structure of Kinetic(tm) Water is different. The molecular structure of Kinetic(tm) Water is different with a smaller aggregation of water molecules. The impression was that these aggregations are the result of a loss in hydrogen bonding.

The initial experiments indicated that surface tension, boiling point, transport rate and diffusion rate of Kinetic(tm) Water were at variance with the similar physical properties of deionized water. Further experiments were designed to replicate and expand the earlier study by providing a wider scaling of method.

SURFACE TENSION

The initial method was that of Du Nouy Torsion Balance procedure. A light ring of wire, 4.00 cm in circumference, was suspended at one end of a light horizontal rod. The other end of a rod is attached perpendicularly to a fine horizontal steel wire which is fixed at one end and attached to a knob at the other end. As the knob was turned, the end of the rod tended to move upward. Such a Torsion balance is capable of measuring a force of 0.1 dyn and with a fine quartz fiber, is able and sensitive enough to measure forces as low as the weight of a 0.001 microgram object (approximately 10-6 dyn).

The coefficient of surface tension was also determined by the rise in a capillary tube. Because the adhesive forces are so much greater than the internal cohesive forces, the resultant inward force is practically perpendicular to the surface of the glass. The water adjusts itself until its surface is perpendicular to the resultant force. Near the glass, the resulting forces in a water molecule are directed inward, toward the glass, and hence the liquid rises until the surface is perpendicular to the force.

The data for the surface tension is summarized in TABLE I. One can see that the surface tension on the Kinetic(tm) Water is slightly lower than the control (deionized water). The individual values show a high degree of positive skewness and for these measurements the standard deviation was employed to test for differences.

Comparison of the averages of the heights of the suds formation showed that various water showed differences, and was increased when compared with deionized water. So the observed height suds formation of Kinetic(tm) Water is consistent with the loss of hydrogen bonding in the water.

The high surface tension of water, as a result of hydrogen bonding, makes it possible for water to travel in the narrow vessels in an organism. It is felt to be an ideal medium for transporting ions and molecules needed for animal, plant, and bacterial metabolism. Thus it would seem that Kinetic(tm) Water would support the growth of plants and animals. As can be noted from TABLE V, Kinetic(tm) Water inhibits the growth of Eschericia Coli, but it enhances the growth of certain molds.

BOILING POINT DETERMINATION

As is known, the temperature at which the vapor pressure of a liquid just equals the external pressure is defined as the boiling point of the liquid.

A simple, micro boiling point apparatus was used to determine the boiling points. Readings were recorded at the moment the bubbling ceased entirely and the liquid began to rise into a capillary tube. The results are summarized in TABLE II.

TABLE I

Inter Face (Water-Air)	C°	Coefficient of Surface Tension (in dyn/cm)	
		X	SD
I. D-Water (SPC)	20° ± 1	77.3	1.2
II. D-Water (C)	20° ± 1	73.5	2.2
III. K-Water (3rd Run)	20° ± 1	69.2	1.4

The height of sud formation on stirring of water with detergent for 30 minutes expressed in cm.

	X	SD
I. D-Water (SPC)	9	2
II. D-Water (C)	13	1.7
III. K-Water (3-nm)	21	6

TABLE II

Since we are dealing with Boiling Point (BP) the temperatures are presented as the difference between control and kinetic H_2O.

Trial	C° X	SD
I. D-Water K-Water	5.2	3.9
II. D-Water K-Water	3.8	1.8
III. D-Water K-Water	2.7	1.2
IV. D-Water K-Water	4.1	2.4
V. D-Water K-Water	4.2	3.1

THE TRANSPORT AND DIFFUSION RATE

The diffusion coefficient is the quantity of substance diffusing per unit of time through a unit area. The diffusion coefficients were measured by the method which makes use of the sharp boundary which is formed between solution and solvent. The solute is spotted on chromatographic strips which are suspended in the solvent (water).

After an adequate elapse of the time the quantity and rate of migration is determined. The results are summarized in TABLE III.

DISTRIBUTION OF A LIQUID BETWEEN TWO PHASES

When two mutually insoluable liquids are mixed, they are distributed in each other with different equilibrium concentrations in the two phases. In our experiments the liquid Butanol was distributed depending markedly on the polarity of water. Deionized water appears to have its water molecules more tightly bonded than Kinetic Water but Kinetic Water has more hydrogen bonding sites available to bond with Butanol molecules. The polarity is due to the formation of hydrogen bonds. To date only the times required for the clearing and separation of the immiscible liquids are summarized in TABLE IV.

TABLE III

Diffusion and Transportation Rate. (Given the Rf. values. Rf = distance travelled by the compound divided by the distance travelled or migrated by the solvent front.)

	Rf.	Values
	X	SD
Substance		
$KMNO_4$		
1. D-Water	0.72	.09
2. K-Water	0.89	.05
Diazepam		
1. D-Water	0.79	.07
2. K-Water	0.91	.11

TABLE IV

Distribution studies with Butanol and water. Expressed as rate of clearing.

	Time cm/s
Butanol and D-Water	25
Butanol and K-Water	83

Kinetic(tm) Water shows a greater diffusion and transportation rate than deionized water. Though the differences are not a significant rate with a non-polar compound, there is a consistent trend in rate data. This variable did not yield consistent trends in the same direction as the surface tension boiling point data. If one assumes that Kinetic(tm) Water has a small aggregation due to a loss in hydrogen bonding then there should be decreased capillary action resulting in a slower diffusion rate.

As can be noted from TABLE IV, the data is in agreement with the surface tension and boiling point data. Since the partitioning of alcohol in Kinetic(tm) Water is dependent upon the hydrogen bonding between the hydroxyl group and the water molecule, the distribution of the alcohol in Kinetic(tm) Water should be less but the values showed very little significant variances. These observations were not entirely consistent with the fact that surface tension decreases.

TABLE V

BIOCHEMICAL INHIBITION OF THE GROWTH OF ESCHERICHIA COLI

Organism	% Inhibition		% Enhancement	
E. Coli	25°c	37°c	25°c	37°c
I. D-Water	-	-	-	-
II. K-Water	46	52	N/A	N/A
ASP Niger Mold				
I. D-Water	-	-	-	-
II. K-Water	N/A	N/A	-	20%

As can be noted from TABLE II, an overall comparison of surface tension values and the boiling-point differences values are in agreement with the possibility that Kinetic(tm) Water has smaller aggregation than deionized water. The boiling-point differences are borne out when individual samples are compared. The control waters are significantly different from each value of the Kinetic(tm) Water.

The most conservative interpretation of the data in TABLE III would lead us to conclude that the Kinetic(tm) Water should have less capillary action. The inhibition of Escherichia Coli growth is not consistent with the known properties of water.

DISCUSSION

Water is both a valuable and versatile compound. Not the least of important properties is its high degree of hydrogen bonding, a consequence of the polarity of water molecules. The freezing point, boiling point, heat of vaporization, and heat of fusion are all high relative to those of the hydrides of other similar compounds. The intermolecular hydrogen bonding between molecules results in large aggregation of water molecules. The high surface tension of water, a result of the strong attraction of water molecules for each other through hydrogen bonding, help water to rise in the narrow vessel in plant stems and roots by capillary action. The high surface tension also helps to hold water in the small spaces between soil particles. Because water is an excellent solvent, it is an ideal medium for transporting the ions and molecules needed for plant and animal metabolism. Ions do not readily recombine in dilute water solution because water molecules that surround them cut down the attractive force between them.

Although structure of liquid water is still not completely understood, it appears that clusters of hydrogen bonded water molecules exist throughout the liquid. Some uncombined water molecules are probably present as well. One theory of the structure of liquid water suggests that the clusters continually vary in size and shape because they pick up uncombined molecules and lose molecules that become uncombined. As the temperature is raised, hydrogen bonds are disrupted, and the larger clusters are broken down into smaller ones. Thus it may be reasoned that in the process of preparing Kinetic(tm) Water adequate Kinetic energy is supplied to break the hydrogen bonds. The disassociation of the water molecules from the cluster may be responsible for the vapor pressure. Further, x-ray diffraction studies have shown that hydrogen bonding greatly affects the structure of ice, which is described as an open structure because of the significant fraction that is unoccupied. This structure of ice is a direct consequence of the fact that each hydrogen atom is hydrogen bonded to an oxygen atom of an adjacent molecule. In addition it is known that the structure of liquid water is less open than the structure of ice because when ice melts the total number of hydrogen bonds decrease; unlike most other substances, water increases in density on going from solid to liquid because of a partial breakdown of the hydrogen bonded structure resulting in small aggregation of water molecules. It has been postulated that there is at least a twenty percent (20%) breakdown in hydrogen bonding in water as the energy content increases. It is not unreasonable to postulate that with the process of making Kinetic(tm) Water that adequate energy is available for the breaking of hydrogen bonds.

CLEARING RATER, VISCOSITIES, SOLUBILITIES

(Technical Report #2)

The reasons for the selection of these parameters for investigation are two-fold: 1) they are amenable and can be studied within the confines of a community college setting; 2) these variables have industrial, educational, and pharmaceutical and ecological significances. Many common phenomenon depend on these variables.

We have focused our planning and work on exploring variables which would better meet the educational needs of the student, college, and the community. The initial experiment lists the following priorities of current investigators:

1. Initiation of student-oriented research programs
2. A collection of physical and biological data for scientific, industrial, and community information

This ranking clearly places the practical concerns for student research and training experience as a priority. The basic needs for collecting scientific useful data is a result of the educational process.

This report (Technical Report #2) centers around a product of the Biophysics Corporation named Kinetic(tm) Water. Kinetic(tm) Water consists of hydrogen and oxygen which exhibits properties at variance with ordinary deionized (purified) water and this difference results in significant changes in physical properties. The tentative conclusions are that there is less hydrogen bonding; that is to say there are less holes as relative to the Hole Theory of Water.

Since the physical structure of ordinary liquid water is not well established, and this does not provide much in the way of a structural reference point, the determination of the specific physical structure of Kinetic(tm) Water is not possible at this time. It should be noted, however, that many theories and hypothesis abound, none of which are complete in their explanations of the proven physical properties of water. This is a complicating factor relative to a reference point for the research presented in this report. The study of Kinetic(tm) Water may provide a key to eventually elucidate the certain secrets of ordinary water structure. The efforts to determine the unique properties of Kinetic(tm) Water is informative.

This report contains information on the recently developed immiscible fluid clearing time of separation tests which offer a simple repeatable and visual demonstration of a difference between Kinetic(tm) Water and deionized water. The procedure is based upon petitioning two immiscible solvents containing dyes for visualization. The solvents are similar in physical structure; each capable of forming hydrogen bonds with each other. The rate of cleaning is directly related to the ability to form hydrogen bonds.

TABLE VI

COMPARISON OF CERTAIN PHYSICAL PROPERTIES OF WATER AT 20°c

Interface-Air			ABp		Surface Tension		Clearing Rate		Within Run Precision
			X	SD	X	SD	X	SD	
1.	D-Water	3rd Run	6.4	± 2.6	78	± 1.3	65	± 2.2	N=40
	K-Water	" "	"		68	± 1.1	41	± 1.1	"
2.	D-Water	6th Run	7.4	± 0.9	75.6	± 1.2	68	± 1.4	N=10
	K-Water	" "	"		65	± 1.7	40	± 0.8	"
3.	D-Water	12th Run	6.3	± 0.5	79.2	± 2.1	67	± 2.4	N=5
	K-Water	" "	"		63	± 1.4	39	± 1.6	"
4.	D-Water	18th Run	10.5	± 1.3	78.2	± 0.9	67	± 2.0	N=20
	K-Water	" "	"		59.1	± 1.3	22	± 2.7	"
5.	D-Water	" "	13.5	± 2.8	77	± 1.5	65	± 1.1	N=5
	K-Water	" "	"		60	- 1.6	21	± 1.2	"

Between - Run Precision (N=20)

The viscosities of most liquids decrease with temperature according to the Hole Theory. There are vacancies in a liquid, and molecules are continually moving into these vacancies so that the vacancies move around. This process permits how, but it requires energy because there is an activation energy which a molecule has to have to move into a vacancy. The activation energy is more readily available at higher temperatures and so the liquid can flow more easily at higher temperatures. The viscosities of several liquids at different temperatures are shown in TABLE VII. Kinetic(tm) Water seems to have few holes and fewer or weaker hydrogen bonds.

In the time that has followed our initial report (Technical Report #1) much evidence has been accumulated in favor of a decreased level of hydrogen bonding in Kinetic(tm) Water. The lattice structure attributed to ice, places atoms on lines joining pairs of oxygen atoms. Similar evidence exists for alcohol. We have also studied and also lined up a quantity of evidence from solubility relationships. The data in TABLE VII serves to illustrate the point. Solubility requires strong attraction between the solute and solvent molecules. The two most likely sources of such attraction are the mutual electro-static attraction of molecular dipoles and chemical coordinator forces such are involved in the formation of hydrogen bonds. If the first four (4) liquids in TABLE VII are considered, it is evident that the solubility depends primarily on diople attraction and the nitrobenzene, with its high dipole moment, should be the most soluble in D-Water. However, it is known, it is only three (3) times as soluble as non-polar benzene, whereas phenol, with low dipole moment, is 136 times as soluble.

Since the non-polar parts of these four (4) molecules must be nearly identicle, it seems reasonable to ascribe the higher solubilities of aniline and phenol to hydrogen bond formation involving the oxygen atom of water as donor, and the hydrogen atoms attached respectively to the nitrogen and oxygen of water as donor, and the hydrogen attached respectively to the nitrogen and oxygen of aniline and phenol as acceptors. It is to be pointed out that hydrogen bond formation offers a satisfactory explanation for similar trends found when deviations from Raoult's Law or deviation linearity of molar polarization - concentration relationships in solution are considered. It is known that the relative viscosities of other compounds reflect association due to hydrogen bonding. It is to be noted that Kinetic(tm) Water shows a slight variance in trends due to the lower degree of hydrogen bonding.

FUTURE STUDIES

Future conclusive evidence of the decrease in hydrogen bonding awaits x-ray studies, electron diffraction investigations, spectroscopic studies in the visible and infrared regions of the spectrum, including the Raman spectra. Much of this evidence can be more effectively discussed under the heading of chelate rings, but one may discuss a portion of the infrared spectroscopic work at this time. Infrared absorption spectra are due in part to the vibration of atoms in molecules. It has been found by comparing the spectra of similar molecules that definite linkages have characteristic vibration frequencies which are usually altered a little by substitution. One would

TABLE VII

VISCOSITY OF LIQUIDS IN ATMOSPHERE

Liquids	25°	50°		
D-Water	0.000896	0.000549		
K-Water (18 Run)	0.000990	0.000651		
Ethanol	0.00109	0.000598		
Benzene	0.00061	0.00044		
Mean	0.000896	0.000549	Within run precision (N=20)	
	0.000990	0.000651	Between run precision (N=20)	
SD	0.00010	0.00019	4.81	3.91
CV%	4.6	4.4		

expect, however, that if a hydrogen atom attached, for example, to an oxygen atom in alcohol and became a hydrogen bond, its vibration frequency would become significantly detered, thus giving evidence of its altered state of existence. I feel as if such, indeed, will be the case in Kinetic(tm) Water, the loss of hydrogen bonding would shift the O-H band of water to higher frequencies. Probably it will happen that the O-H Band occurs in a region of the spectrum in which many liquid also absorb.

One is now in a position to examine evidence bearing on the factors that regulate the stability of the hydrogen bonds. Infrared spectroscopy furnishes the best evidence. The visual approach, as we have already seen, is to observe the influence of the bonding on the group that donates the proton. The bonding weakens the blinding forces of this group and hence shifts its vibrational band to lower frequencies. The strength of the bond can be estimated from the magnitude of the shift. In pursuing this question it will be well to remember that the stability of a hydrogen bond will depend jointly on the proton - donor power of one group and the proton - acceptor power (buscity) of another group.

The evidence reviewed by the author seems to indicate strongly that hydrogen bonding is not to be ascribed to resonance but must be the result of electrostatic attraction. The way this occurs is through a number of dipoles associated by an end-to-end (linear) alignment. It can be rationalized that increasing the bond moments, it would be expected to increase the amount of association and thus change certain physical properties as boiling point, diffusion rate, and change surface tension. If we now turn to experiments in support of such a prediction as a result of "shake test" and spectroscopic study of hydrogen bonding between different alcohols and deionized and Kinetic(tm) Water, we find little, if any correlation between the strengths of the hydrogen bonds and the dipole moments of the water. These findings seem to indicate that a loss in hydrogen bonding rather than steric hindrance is the general explanation of the non-association of strongly dipolar molecules such as Kinetic(tm) Water. Although Kinetic(tm) Water could not form hydrogen bonds, it might be expected to associate strongly dipole attraction with alcohol if, indeed, dipole attraction is solely responsible for the association with more weakly dipolar substance. The above considerations make it clear that there are grave concerns with the Electrostatic Theory of hydrogen bonding since certainly all of the bonding in Kinetic(tm) Water cannot be lost. Indeed, one need not search far to find further difficulties. If we tentatively accept the Electrostatic Theory, then we would presume that the proton-acceptor properties of oxygen in the water molecule would increase with the intensity of the net negative charge of oxygen. This, in turn, should depend on two factors: 1) the polarity or ionic character of the O-H bond, and 2) the diameter of the oxygen atom. This is because the net charge collected at the negative end of the dipole would become more concentrated as the surface tension of a cluster of atoms becomes greater.

One final question deserves consideration before we close our discussion. Why, if hydrogen bonding is merely the result of electrostatic interactions, is it that the bonds are not easily broken? Why is the loss of hydrogen bonding not additive? We have previously remarked that the strength of an electrostatic field at the surface of an atom depends on the ionic character of the bond and on the interval of time used to disrupt the bond. It may well be that the excessively high concentration of positive charge around the uniquely small hydrogen atom is necessary for appreciable bond "strength". Such charge concentration is indeed a factor in hydrogen bonding and indicated by that fact the Kinetic(tm) Water has vastly smaller proton acceptor powers than deionized water, even though the two waters have equal electron negatives according to Pauling's table.

TABLE VIII

SOLUBILITY OF LIQUIDS IN WATER AT 25°

	Solubility %		Dipole Moment $X10^{18}$
	$D\text{-}H_2O$	$K\text{-}H_2O$	
1. Benzene	0.06	0.10	-
2. Nitrobenzene	0.20	0.37	4.19
3. Aniline	3.94	2.42	1.50
4. Phenol	7.9	5.3	1.80
5. D-Water	-	-	1.85
6. K-Water	-	-	-

MOLECULAR STRUCTURE OF KINETIC WATER

(Technical Report #3)

This report includes a description of four activities separately described. These are as follows: 1) viscosity studies; 2) infrared studies and interpretation; 3) free radicals studies and interpretation; 4) diffusion studies.

The study reported here is one of several that were designed to explore the molecular structure of Kinetic Water. The work was originally stimulated by reports (Davis et at private communication from the staff of Biophysics Foundation) of certain anomalous physical and biological properties of Kinetic Water. The impression is that the deviations are results of the loss of hydrogen bonding in the water. The initial experiments indicate that the boiling point and surface tension values are lower than those of deionized water. The Kinetic Water also exhibits bactiostatic properties against the certain bacteria as E. coli.

The present experiment was designed to replicate and expand the earlier studies by providing a wider scaling of physical variables and a broader theoretical interpretation of the results.

VISCOSITY AS RELATED TO KINETIC WATER

The viscosity of a liquid or solution is its resistance to flow. To stir glycerin more energy is needed than to stir water. Glycerin is hence said to be more viscous than water, and similarly water is more viscous than ether. Collodion solution of jellies are very viscous.

It is obvious that liquid whose molecules tend to associate in larger aggregations are more viscous, such as liquids with polar molecules, i.e. glycerin, glycol and water, as well as liquids composed of large molecules, such as long chain molecules of oleic. All these liquids also have a high boiling point. As is known, the molecules of water, according to Debye, are dipoles, i.e. the distribution of the positive and negative charges in the molecule of water is asymmetric. The positive end of the water molecule attracts the negative end of another water molecule, and loose aggregates and chains are formed. This phenomenon of mutual interaction and association in water is decreased in Kinetic Water. The latter shows weak chemical bonds between hydrogen atoms or protons and a strongly electronegative atom, oxygen. Since the other H also may form bonds with oxygen atoms of adjacent molecules, the actual structure may be more complicated than that of deionized water. However, recent data seem to indicate that attractive forces in lower-hydrogen-bonding-Kinetic Water are weak, and hence the viscosities and boiling points are lower. The viscosity of a viscous, polar solvent will be further increased if a polar solute is dissolved in it; this increase will be very high if long, fibrous polar molecules are introduced. However, liquid of lower viscosity (i.e. ether, hexane and possibly Kinetic Water) also show an enhanced viscosity after dissolving a fibrous colloid.

As is well established, the viscosity of a liquid or solution can be measured precisely either by moving a solid body through the liquid or by allowing the liquid itself to flow through a capillary. The second method is simpler, and is the most commonly used device in colloid chemistry. The viscometer is a U-shaped tube which includes a capillary. The viscosity is determined by measuring the flow time of a definite volume of a liquid through this capillary.

For instance, the flowing time of 5.0 mL of a solution is compared with the flowing time of 5.0 mL water. The relative viscosity is the ratio of the flowing time of the solution to the flowing time through in t_1 seconds, and 5 mL of water in t seconds, the relative viscosity, $\underline{N}$ rel, of the solution is given by

$$\underline{N}\,\mathrm{rel} = \frac{t_1}{t}$$

Since temperature has a pronounced influence on viscosity, all measurements are carried out in a thermostate at constant temperature. In exact calculations the density of the solutions must must be considered.

Another common term is specific viscosity; this is the rise in viscosity of the solvent produced by the dissolved substance. The specific viscosity $\underline{N}$ sp = $\underline{N}$ rel -1, or

$$\underline{N}\,\mathrm{sp} = \frac{t_1 - t}{t}$$

In our studies the indicated sols are made up in deionized water and are compared with those prepared in Kinetic Water. The results are reported in TABLE IX. Several readings of the flow time were obtained, and the averages were then calculated in the usual way. Thus the value of the t is obtained. Measuring in the same way the flow time of the colloids, are obtained t_1. From these figures the relative and specific viscosities were calculated.

Ferric hydroxide evidently has the lowest viscosity, and approximately the same figures can be obtained for sols of silver sulfide. As expected the hydrophobic sols have a very low viscosity in both water. The $\underline{t}$ values were approximately the same for both waters. The viscosities of the three hydrophilic colloids differ appreciably and there were significant differences between the flow rates in the waters (deionized and kinetic water). It is especially to be noted that albumin and glycogen have much lower viscosity than gelatin. It is felt that the reason lies in the differences in particle shape. Albumin and glycogen are spherocolloid, but gelatin has fibrous particles. Moreover differences in the viscosities of spherocolloids are readily explained. The particles of all inorganic colloids are very compact. It is known that colloids of ferric hydroxide, despite their polar groups, are not significantly hydrated. On the other hand, the globular molecules as glycogen are more hydrated and the solutions

TABLE IX

The viscosity of certain colloids in deionized water at 25°C t = 81 sec.

	Ferric hydroxide sol 0.5%	Albumin 0.5% - 1%		Glycogen 5% - 1.0%		Gelatin 0.5% 1.0%	
t_1	81.7	84.4	87.6	85.5,	88.1	115.7,	175.6
$\underline{N}$ rel	1.070	1.090	1.102	1.095,	1.098	1.48,	1.968
$\underline{N}$ sp	0.025	0.040	0.062	0.050,	0.091	0.481,	0.999
Kinetic Water							
t_1	80.9	79.1	80.1	83.1,	85.1	107.9,	146.7
$\underline{N}$ rel	0.982	1.010	1.091	1.045,	1.070	1.21,	1.761
$\underline{N}$ sp	0.012	0.031	0.042	0.030,	0.043	0.381,	0.720

have higher viscosities because they are loosely built. The differences between the waters are not so easily explained. It seems as if the facts indicate that the chief reason for the lower viscosities of a colloid is due less to the shape of the molecules than the lack of solvation or hydrogen bonds interaction of solvent.

Many investigators have shown that the relative viscosities of different forms or shapes reflect association due to hydrogen bonding.

DIFFUSION AND DIALYSIS

It is remarkably difficult to perform accurate diffusion experiments in solutions. This was noted by many authors who proposed to observe diffusion not in liquid but instead in soft jellies.

By means of the following simple experiements it is easy to distinguish the rate of diffusion of colored micromolecular solutions of the two different waters. A two percent gelatin sol, prepared by dissolving gelatin in hot deionized water, was distributed among several test tubes; each one half full. The tubes were left for one hour at room temperature without stirring. During this time the gelatin sol sets to a jelly. The tubes are separated into two groups. One group is used for colored solutions in deionized water and the other in Kinetic Water. The colored solutions were prepared with Diazepam and salt solutions of copper sulphate, cobaltous chloride or nickel nitrate. Onto these several jellies are poured some of the colored salt and drug solutions. After two days the various tubes were compared, and it was observed that while the colored salt solutions had penetrated deeply into the jelly, the colored salt-drug solutions in Kinetic traveled 10 cm further. This diffusion is related to ultrafiltration and to dialysis: here the larger water aggregates in deionized water is separated from the smaller water aggregates in Kinetic Water by a permeable membrane through which the penetration of a substance is observed. The membrane is a gel with tiny pores that only micromolecular substances can pass it. If a substance dialysis, i.e. penetrates without impedance through the membrane into a pure solvent, its particles must be composed of less than a 100 molecules. Certainly the aggregates in Kinetic Water are smaller than those in deionized water.

A PORTION OF INFRARED SPECTROSCOPIC WORK

Infrared absorption apectra are due in part to the vibrations of atoms in molecules. It has been found by comparing the spectra of similar molecules that definite linkages have characteristic vibration frequencies which are usually altered compartatively little by substitution. One would expect, however, that, if a hydrogen atom attached, for example, to an oxygen atom in alcohol became a hydrogen bond, its vibration frequency would become significantly altered, thus giving evidence of this altered state. Such has indeed been found to be the case, the formation of hydrogen bonds shifting the O--H band of water of alcohol to lower frequencies. It happens, however, that the O--H band is shifted to lower frequencies in Kinetic Water but not to the same extent. Whether or not the difference is significant await further studies.

STUDIES OF FREE RADICALS

Our first experimental trials were directed toward the goal of determining whether the methods of preparation of Kinetic Water results in disassociation of the water molecules to form ions as:

$$H_2O \text{ --- } H^+ + OH^-$$

This type of disassociation seem unlikely since the conductivity of Kinetic Water shows no increase over deionized water. It is more likely that if a disassociation occurs it is a homolytic one involving free radicals which are electrically neutral.

$$H\text{-}O\text{-}H \text{ --- } HO^{\cdot} + {}^{\cdot}OH$$

or

$${}^{\cdot}O \text{ -- } O^{\cdot} \text{ and } H^{\cdot} + H^{\cdot}$$

All free radicals are characterized by the presence of an "odd electron." It is known that atoms containing an odd number of electrons should possess a magnetic moment. Each electron, owing to its spin energy, confers on the atom a definite magnetic moment. When the atom contains an odd number of electrons, one must remain unpaired (the odd electron) and its magnetic moment is uncompensated. This gives a magnetic moment to the atom or molecule in question. Thus all free radicals are paramagnetic. Another property common to all free radicals which have been isolated is color, which some investigators also attributed to the odd electron.

However, Kinetic Water is neither paramagnetic or colored. This may be explained by the fact that when free radicals of short life are produced in solution, let us say by thermal decomposition, they are so thoroughly encased by the solvent that either they will recombine with each other quickly after deactivating collisions with the solvent molecules, or they will decompose, or they will react with the solvent molecules. In practice it is found that the reaction with the solvent is the path usually followed. Reaction with some other solute is possible but unlikely in Kinetic Water.

The picture just given of a free radical enclosed in a "cage" of solvent molecules is an essential part to the principle of primary recombination. The principle of Kinetic significance is not entirely random, but there is a tendency for the fragments produced by the disassociation of a molecule to be more closely clustered than would correspond to random distribution. "Thus in addition to the 'normal' probability of 'primary recombination' of two particles which have been parts of the same molecule before disassociation."

When an electron-pairing type of reaction results in the production of a stable free radical, it is, of course, not difficult to demonstrate the presence of the free radical and hence the type of rupture. But when the free radical has only a transient existence in the course of a reaction, it is frequently no small task to establish the activation mechanism.

A unique characteristic of reactions of this kind is that they may give rise to "chain reactions." Thus if $^{\cdot}OH$ is highly reactive, which is usually the case, it will attack another molecule, producing thereby another free radical or an atom containing an unpaired electron. This in turn will attack another molecule, and so on, setting up a reaction chain which will be terminated when two particles having unpaired electrons meet and combine.

CONCLUSION

The experimental observations accord well with the hypothesis that the anomalous behavior of Kinetic Water is due to the loss of hydrogen bonding.

The experimental data is in no way exhaustive. Much more work is needed before conclusive statements can be made. One final question deserves consideration before we close the report. Why, if free radicals are formed during preparation, do we not find moments, paramagnetism, or color in Kinetic Water, despite the large amount of accumulated evidence showing that pyrolysis of hydrogen bonds involves the primary production of free radicals? We anxiously anticipate designing experiments bearing on this question.

PLANT GROWTH & LIPOPROTEINS

(Technical Report #4)

The study reported is one of several that were designed to explore one possibility that Kinetic(tm) water shows anamalous biological and physical properties when compared to deionized water (d). The work was originally stimulated by reports (Technical Report #1) of lower boiling points and surface tension. Biologically the K-water retards the growth of the bacteria E. Coli. The impression is that these anamolies are due to the breaking of hydrogen bonding.

The initial experiment (Davis et al) with infrared absorption spectra showed that the hydrogen bonds were definitely decreased in K-water. It has been found by comparing the spectra of similar molecules that definite linkages in K-water have characteristic vibration frequencies which are altered significantly by the physical method of treatment. [One would expect, however, that a hydrogen atom attached to an oxygen atom is hydrogen bonded. Its vibration frequency is altered, thus giving evidence of its altered state of existence. Such has indeed been found to be the case in D-water, the hydrogen bonds shifts the O-H band to lower frequencies. It happens, however, that the O-H band of K-water is shifted but not to the same extent as the D-water. Since the band was not altered appreciable in K-water one must conclude that there are fewer hydrogen bonds.]

The interpretation of pyrolytic reactions as breaking hydrogen bonds is richly substantiated by a variety of experimental evidence. The well investigated decompositions of organic molecules to give stable free radicals such as HO, are pyrolytic in the broad sense although they occur at room temperature or below. A unique characteristic of reactions of this kind is that may give rise to "chain reactions". Thus if ·OH is highly reactive, which is usually the case, it will attack another molecule, producing thereby free radicals or an atom containing an unpaired electron. This in turn will attach another molecule, and so on, setting up a reaction chain which will be terminated when two particles having unpaired electron meet and combine. When free radicals of short life are produced in solution, let us say by heat and physical decomposition they are so thoroughly encased by the solvent that either they will recombine with each other quickly after deactivating collisions with solvent molecules, or they will decompose, or they will react with the solvent molecules. In practice it is found that the reaction with the solvent is the path usually followed. Reaction with some other solute is possible but unlikely in dilute solutions.

The picture just alluded to of a free radical enclosed in a "cage" of solvent molecules is an essential part of our hypothesis for the physical preparation of Kinetic Water. The Kinetic significance of the hypothesis lies in the fact that the distribution of free radicals or atoms (·OH, .OO·, H·), let us say a strongly treated solution is not entirely random, but there is a tendency for the water fragments produced by the disassociation of a molecule to be more closely clustered than would be correspond to random distribution, thus in addition to the normal probability of recombination of two particles which have been parts of the same molecule ph 5/22

before disassociation. When a physical decomposition reaction results in the production of a stable free radical, it is, of course, not difficult to demonstrate the presence of free radical and hence the type of rupture. But when the free radical has only a transient existence, as shown by heat given off during the preparation of K-water, it is frequently no small task to establish the activation mechanism of preparation.

Now we are in a position to study a further possible mechanism. Investigation in the field of singlet oxygen production have reliably demonstrated that, when a molecule absorbs a quantum of energy from ultraviolet portions of the spectrum, the absorption results in a transition of a valency electron from one quantum orbit to another. This in turn results in either in the creation of more highly energized valence link, corresponding to a potential energy curve on a higher level than the ground state, or in complete disassociation. If this is not achieved it may, nevertheless, happen that a chemical change such rearrangement will take place. An example is the rearrangement of free radical oxygen into signlet oxygen under the possible influence of heat energy that no disassociation accompanies this change is inferred from the absence of products such as would surely result from the interaction of the solvent with any free radicals produced by the photodecomposition of drastic physical treatment.

The fact that the absorption of one quantum of energy may result in the reaction of dozens or even hundreds of molecules as the result of a chain reaction is surely too well known to the reader merit description. There is originally some doubt as to whether the chains are "energy chain" in which any sufficiently energy-rich particle-possibly oxygen-may pass the activation energy on to another, or "material chains" in which only particles having certain chemical peculiarities are capable of continuing the chain much evidence has accumulated to show that most chain reactions, at any rate, involve material chains and that the commonest required "singlet peculiarity" is a valence shell containing an odd electron. The demonstration of this truth is particularly convincing in case of chain reaction causing roots of plants to grow. This growing activity could involve diatomic molecules which have become activated by heat absorption in that portion of their spectrum which demonstrably corresponds to disassociation into atoms.

Whether or not free radicals are precusor to singlet oxygen or co-existent with the latter is yet to be experimentally proven. Yet the effects of electronically excited species of oxygen and free radical oxygen are well known. The first suggestion that excited species are responsible for a photodynamic action-the destruction of cells and tissues in the presence of light. It is now known that singlet oxygen survived long enough to react chemically, being responsible for a wide variety of oxidative effects in nature.

EFFECTS UPON ROOT GROWTH OF CERTAIN PLANTS

Two preliminary investigations were conducted to test the enhanced absorption rate of "Kinetic Water".

Pilot Study

This study was begun on October 3, 1986. Two onions were placed in either 20 ML of Kinetic Water or deionized water. The results are presented in Table X.

Replication studies

The replications was begun on October 24, 1986. This was a systematic experiment. For example of onion, carrots, lettuce were incubated in Kinetic Water and compared with deionized water. The results are shown cm of growth.

Most of our recent studies have two major aims: assessment of the effects of K-Water on the blood vessels of rats and diffusion rates of K-Water into plant tissue under given conditions.

Concerning the first aim, rats with high levels of low density lipoproteins were given K-Water and compared with D-Water. It is known that low density lipoproteins with high cholesterol content are associated with atherosglerosis. As can be seen from TABLE XI the rats on K-Water showed a lower level of low density lipoproteins. The significance of this observation is yet to be determined. Statistical treatment of the data is still lacking. No global prediction model, accounting for the quantity of water ingested, ingestion rate age at risk is yet available. Predictions are general based on the hypothesis that K-Water or D-Water is constantly ingested over the trial period.

Preliminary studies with onion shows that K-Water diffuses as a gaster rate than D-Water. As a result roots are stimulated to grow.

Suffice it to say that further investigation is needed in both areas before statistical data can be presented.

TABLE X

				DAY			
0	1	2	3	4	5	6	7
Bean	3.5	2.0	4.0	10.0	5.0	15.0	6.0
Onion root	30.0	12.5	10.0	9.5	4.0	5.5	7.5
Averaging 1 cm/day							

TABLE XI

LOW DENSITY LIPOPROTEINS

Blood Vessel (mg%)	Liver (mg%)
870 ± 344	0.700 ± 0.690
685 ± 670	0.100 ± 0.114
1290 ± 917	0.042 ± 0.020
722 ± 592	0.023 ± 0.010

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St. Philip's College
2111 Nevada
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UPSTREAM, DOWNSTREAM

A BIO-REGIONAL WATER SEMINAR

March 8 & 9 AT ST. PHILIP'S COLLEGE

Coventured by

Department of Social Science
Office of Continuing Education
Bioregional Research Group
San Antonio Media Center

THE TEXAS NATURE CONSERVANCY

UpStream, Downstream
A Bioregional Water Seminar
St. Philip's College March 8 & 9, 1985
Watson Auditorium

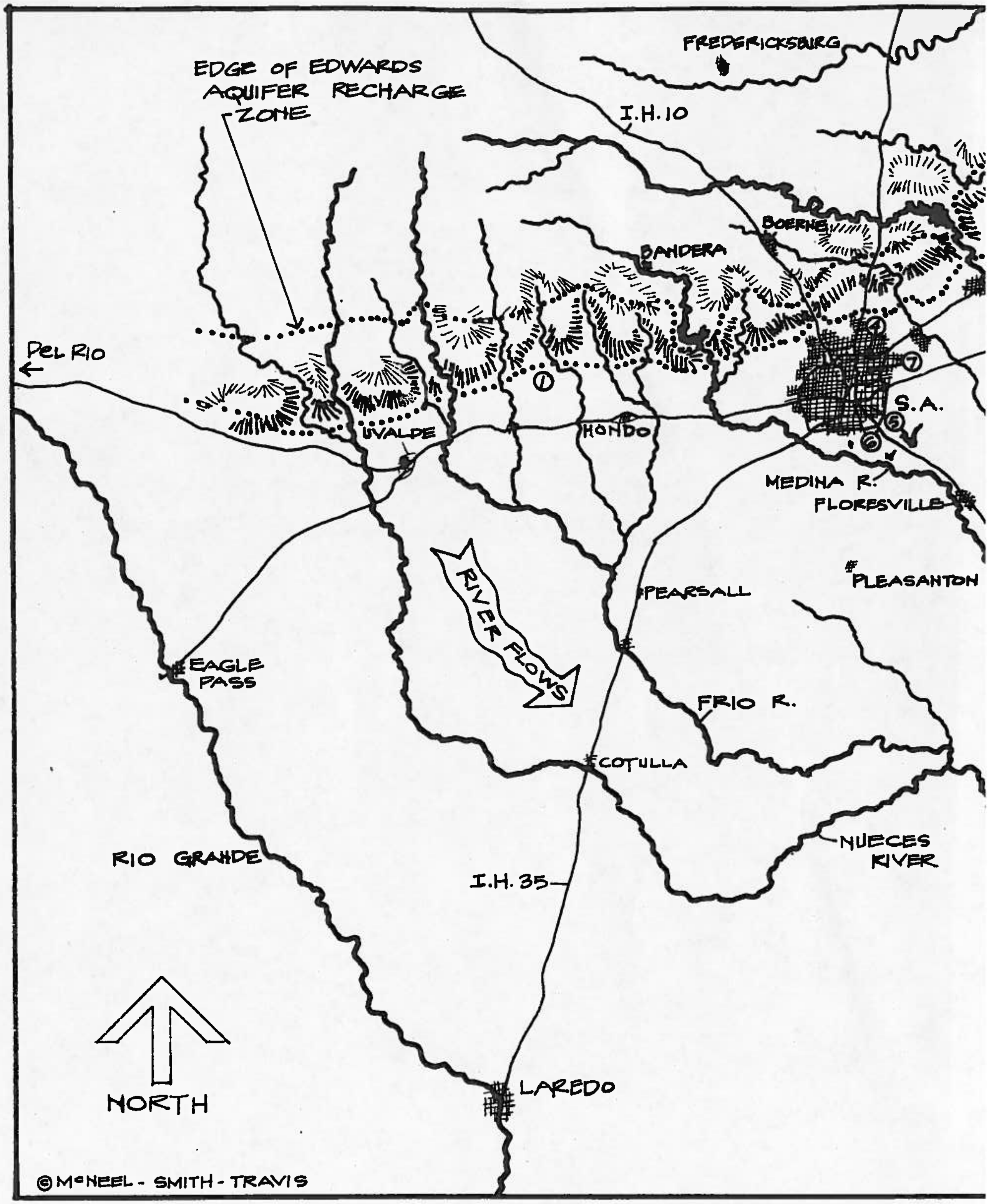
Friday, March 8

1:30 p.m.	Gather at Watson Auditorium, St. Philip's College, for van trip to Honey Creek
2:30 p.m.	Arrive at Honey Creek Preserve
7:00 p.m.	Welcoming Reception at Watson Auditorium Performance & Sonic Installation: George & Katherine Cisneros
7:45 p.m.	"Knowing Home" - Pre-historic and Historical Confluence of Land and People: Dr. Weldon Hammond, hydrogeologist, UTSA Dr. Tom Hester, archeologist, UTSA Del Weniger, Biology Department, Our Lady of the Lake University, and author of "The Explorers Texas"

Saturday, March 9

8:30 a.m.	Coffee
9:00 a.m.	"Critters in the Water": Rex Wahl, Texas Heritage Program, Texas Nature Conservancy Luke Thompson, Texas Land Steward, Texas Nature Conservancy
9:45-10:30 a.m.	"Water as a Health Source" - slide presentation on The Hot Wells Project: J. Paul de Vierville, CSW-ACP Continuing Education, St. Philip's College
10:30-11:00 a.m.	Coffee
11:00 a.m.	"The Politics of Water" - What sort of plan will it take to deal with the inevitable power plays of the future? Bob Ashcroft, Ralph Bender and Associates Fred Pfeiffer, San Antonio River Authority Tom Fox, Edwards Underground Water District
12:30 p.m.	Luncheon and Research Report "What is Kinetic (TM) Water?" Preliminary Research Project Report: Dr. William Davis, Chemistry Department Principle Investigator, St. Philip's College J. Paul de Vierville, CSW-ACP Director of Water Research Project

Continued Inside



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Saturday, March 9 (cont.)

1:30 p.m. "The Future of Our Bioregion" - Is water a limit to growth? Are we too reliant on the Aquifer? Can we save the Edwards Aquifer?

Matt Martinez, vice president,
Morton Southwest
Kathy Powell, Urban Studies,
Trinity University
Del Weniger, Biology Department,
Our Lady of the Lake University
And, recent candidates for the
Edwards Underground Water District

to bet
region

to bri
water -

San Antonio
Bioregion

San Antonio and its inter-related neighb
ing cities are experiencing steady populati
growth and investment by various busines
interests inside and outside the region. Th
facts will demand a series of decisions
regarding the use of resources, taxation,
regulation, social services and many other
activities necessary to insure a high quali
of life for all people in the region.

In order that sound decisions can be ma
a comprehensive understanding of the
Bioregion that surrounds San Antonio is
needed.

A Bioregion is a division of space which
characterized by similar climate, culture,
vegetation, plant and animal life. The San
Antonio bioregion is generally defined by
ridgelines of watersheds of principal rivers
Watersheds were selected as a means of
delineation since they have a profound eff
upon plant and animal life and human set
tlement patterns.

Water was very likely a key factor in th
location of Indian camp grounds and was
critical to the establishment of the missior
with their ingenious system of acequias
(diversion ditches) and resultant Labores (i
rigated farmland).

The rivers that delineate and those that
traverse the bioregion emanate from a com
mon area northwest of San Antonio in the
Hill Country, then diverge and rejoin at co
fluence points forming an ellipsoidal
configuration

Purposes of This Seminar

understand the history of this
its watershed

to encourage dialogue and research am
water users, purveyors and planners

ogether diverse viewpoints about
past, present and future

to stimulate public education and
awareness of the problems of water qua
and quantity