Hydrogen bonding, water monopoles and electron charge splitting

Running title: On the principles of biophysics X: Epilogue

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Abstract:

Water is a mixture of $^+\text{H}_2\text{O}_{\text{ice}}$ ice dipoles and the $\text{He}^{\frac{1}{2}+}_g,\text{OHe}^{\frac{1}{2}-}_g$ gas buffer monopoles. Ice/gas transition is due to hydrogen bonding. The isentropic reversible sublimation between the ice demagnetization and gas remagnetization state generates a constant influx of 15mCoulomb $\text{H}_2\text{O}_{\text{gas/mole}}$ in water, causing the super fluidity of water. Transition is described by an RC-circuit with time constant of 1sec. Volume information between the ice and gas state is exchanged as electrical information of 30mCoulomb($\text{He}^{\frac{1}{2}+}_g,\text{OHe}^{\frac{1}{2}-}_g$)/mole $\text{H}_2\text{O}_{\text{ice/sec}}$ across the ice/gas interface $i_g$ at the edge of water. Information is exchange at the speed of light and invariant with the distance $\Delta x$ between $^+\text{H}_2\text{O}_{\text{ice}}$ and $i_g$. Ion transport proteins and messenger molecules exploit the water volume turnover property by sending net salt or proteins across membranes, using the outer lipid membrane or the cytosolic (circular or double helix) genome as substitute for $i_g$, respectively.

Introduction:

A $^+\text{H}_2\text{O}$ dipole cannot move in water because its dipole charge $e^-$ in Coulomb cannot be dislocated as capacitance (C) and current (C/sec), simultaneously. By itself the dipole is therefore a motionless $^+\text{H}_2\text{O}_{\text{ice}}$ ice molecule. Moving requires conversion of the electro magnetic $^+\text{H}_2\text{O}_{\text{ice}}$ dipole into the gas monopoles $\text{He}^{\frac{1}{2}+}_g$ and $\text{OHe}^{\frac{1}{2}-}_g$, which are able to move as free electrical capacitance or gas through the gas space between the ice molecules. Here is shown that sets of $3^+\text{H}_2\text{O}_{\text{ice}}$ dipoles in the bulk of water are able to send a split primary charge $e^{\frac{1}{2}+},e^{\frac{1}{2}-}$ as serial volume information (Ce'/sec, not the electron) to the gas/ice interface $i_g$ at the edge of water, which allows the $3^\text{nd}$ ice molecule to be stored and demagnetized as gas $\text{He}^{\frac{1}{2}+}_g$ and $\text{OHe}^{\frac{1}{2}-}_g$ monopole buffer capacitances in $i_g$. Subsequently these monopoles get distributed as the remagnetizing gas buffer currents $\text{He}^{\frac{1}{2}+}_g$ and $\text{OHe}^{\frac{1}{2}-}_g$ (phase-shifting) across the bulk of water before they short-circuit each and return to the ice dipole state. Hydrogen bonding of protons over a distance of $18.10^{12}$mtr (fig.1) is causing the reversible adiabatic sublimation steps. Water is a mixture of ice and gas and the reversible re- and demagnetization in a monopole/dipole RC-circuit causes the super fluid conductivity of water. Biological entities exploit the net water admittance of membranes to transport net proteins, fluid or salt across a membrane, or to store net biological information in $i_g^{1,3}$. It is suggested that the DNA system evolved as storage medium of information from the surround, introducing time and reproducibility in biological specimen.
Results: *Hydrogen bonding*. Proton $H^+$ and hydroxyl $OH^-$ ions are electrical monopoles moving free of resistance (otherwise they cannot exist) between water molecules as gas and free electrical potential (Volt). Evidently the monopoles also can move as electrical current because pH-potentiometry allows them to be measured as such. The sample current of a pH-meter measures the potential of a proton current ($H^+/\text{mtr.sec, Ampere}$) in water to be deposited as ice ($10^{-2} \text{H}_2\text{O}_\text{ice}/\text{cm}^2$) on a cathode, by replacing a number ($n$) of $H_2O_{\text{ice}}/\text{cm}^2$ capacitances on that cathode being sent as $H_2O_g$ current to the anode. The electrical equivalent of this process is a RC-circuit, $Q/\text{sec}=C.V \text{Volt}$ (Eq.1). The potential $E_{H^+}$ of the circuit is determined by the sublimation of gas into solid with known gas constant, $R_{\text{gas}}=8.314 \text{Joule/mole}$. Entering that value in Eq.2 shows that $E_{H^+}$ is a function of $H^+_g$-displacement, $\delta H^+_g$, in water (Eq.2a). It can be shown that this proton mobility is caused hydrogen bonding. The proton shift per $H_2O$ is $18.10^{-12} \text{mtr}$ (textbook, fig.1a) and we suppose that the bonding equivalent in a molecule is $1.66*10^{-19} \text{C/sec} (1e-/sec primary charge)$. Then 1mole$H^+_g$ in one 1ltr$H_2O_g$ potentially can generate $10^5C(e)\text{mtr}$ when bonding is high in solutions with pH1 and pH14, in the presence of 1mole $H^+$ or 1mole $OH^-$ buffer ions, respectively (shown by Eq.5). Bonding should be low, $10^2C(e)\text{mtr}$ per $10^{-7} \text{moleH}_2\text{O}_g$, at pH7, which is also shown by Eq.5 (fig.3), and this latter bonding can be proven. Eq.6 shows that indeed $10^2$ molecules per 1/3mole $H_2O_{\text{ice}}$ generate $10^2$ $C$/per $10^{-7} \text{moleH}_2\text{O}_g$. The ratio is known as Faraday's constant (Eq.7), being the current that is needed to deposit one mole of a monovalent ion in solution on an electrode. Hence, an electrical potential informs about net volume changes that are associated with bonding ($\delta H$) of water when it sublimates from ice to gas across a gas/ice interface $i_g$ (for example the electrode used above) and vice versa. It does not inform about net charge displacement across $i_g$ because that, by definition, should be zero ($2^\text{nd}$ law of electricity) across any interface. For example, a pH measurement informs that the potential of 1mole$H^+_{\text{ice}}$ to displace 1/3mole$H_2O_{\text{ice}}$ ($n=3$ in Eq.2a) on the cathode is 27.7mV, and not 26.7mV, the value of a hypothetical Nernst diffusion potential (Eq.4). It is concluded that water is a mixture of ice and gas and 3 mole $H_2O$ is converted per second in 1ltr water.
Monopoles and electron splitting  The $^1$H$_2$O$_{\text{ice}}$ dipole is a magnetic dipole, due to asymmetrical electron ($e^-$) charge distribution. Moving does not require electron splitting per se but at least the magnetizing charge of the electron (C/sec) should be split for moving. Therefore sets of 3mole $^1$H$_2$O$_{\text{ice}}$ dipoles send 3 serial capacitive demagnetization water currents to $i_{g_b}$ per second (fig.2). The first 2 molecules create a vacuum ($-\delta H$) by hydrogen bonding, squeezing out the 3rd molecule into $i_{g_i}$. The 3rd molecule sublimates in $i_{g_i}$ as $\text{He}^{+}\frac{1}{2}$ and $\text{OH}e^{-}\frac{1}{2}$ monopole capacitance (fig.2a). Imaginary electrons are wrapped up in the buffer ions because the electrical equivalent of $\delta H$ is $1e^-$ (Eq.6). It means that the buffer ions are running in an electrical circuit at the speed of light. Instant capacitance of 30mC/mole $^1$H$_2$O$_{\text{ice}}$ is generated per second (Eq.3, fig.2), and this capacitance represents the dipole demagnetising volume decrease of 1ltrH$_2$O/sec. Following a capacitance to current phase-shift this monopole capacitance is distributed as $10^7$mole/ltr.sec remagnetising ($\text{He}^{+}\frac{1}{2}$ and ($\text{OH}e^{-}\frac{1}{2}$) monopole buffer currents (Eq.'s 1, 8), establishing the pH7 value of water. The combined electrical equivalent water volume of the buffer ions is 15mC/moleH$_2$O$_{\text{gas}}$ (Fig.2b), which returns to ice when water gets frozen (fig.3a). The continuous conversion from gas to solid and vice versa of given ice molecules anywhere in water is invariant with the distance $\Delta x$ to $i_{g_i}$, because ice is not compressible (fig.2b). An RC-circuit with capacitors only describes the continuous inward flux of buffer monopoles (fig.2b), showing that only water is able to pass a membrane and that electrolytes can be transported only with water across a membrane at essentially 0Volt$^{1,3}$. The net turnover (admittance) of water is 15mC/mole/sec (0.833mole/ltr, Eq.'s 9,10). The value is also known as the $\frac{1}{2}$H$_2$O/O$^-$ redox potential of water (textbook). The $3.10^{-2}C(\text{He})^{+\frac{1}{2}}$, $\text{OH}e^{-}\frac{1}{2}$-g/cm$^2$.sec fluid capacitance furthermore is generated per cm$^2$ over a distance of 1mtr, the volume of 1/10th of a liter. Thus the monopoles generate 0.833Joule 'redox potential' (Eq.'s 10,11) in the volume of 0.1ltr. The gas constant of 1ltr water is therefore 8.333Joule/mole (Eq.6).

![Image](Fig.4) a Ice and gas share the volume of one ltr. Freezing causes 0.15C gas to disappear, which is converted to 0.075C ice. The concomitant relative volume increase at 0°C is 0.925/0.85 or 1.088 (textbook) b Net admittance of 0.83mole NaCl (15mC/mole ice) can pass a membrane under essentially 0Volt condition$^{1,3}$. This admittance can be influenced by field potentials of 1 and 100 Hz$^2$. Signal transduction is invariant with the distance $\Delta x$ across a cell because it is passing through a no compressible ice pathway c Short-circuiting of amino acid OH$^-$ and H$^+$ terminals yields net electron Ce$^-$ information (not the electron) which is passed as magnetic water dipole flux to the genome. The information overwrites the existing dielectrical information in the vacuum of the genome. d All information in the universe, including biological information, passes the dielectrical vacuum of a capacitor getting an extra dimension of time.
Discussion:

Water is a mixture of gas and ice. The continuous isentropic de- and remagnetization of ice sublimating into gas and vice versa is due to hydrogen bonding over a distance of $18.10^{-12}$ mtr (fig.1). This adiabatic process yields a fluid admittance of $15.10^{-2}$ C per 3mole $\text{H}_2\text{O}^{\text{ice}}$ sec, the equivalent of 0.833moleH$_2$O/litr.sec and this admittance establishes the value pH7 of water (Eq.8). This pH7 is due to hydrogen bonding. The enzyme 3Na/2K-ATPase exploits the water properties by generating net fluid admittance 0.83moleNaCl/cm$^2$.sec (fig.3b)\(^1\). The perpetual water inward flux is due to demagnetization of ice dipoles, creating an instantaneous volume decrease in water, which is compensated by a subsequent remagnetization inward buffer monopole current. The turnover is described by a RC-circuit (fig.2b) with 1sec time constant (1/3*3 sec, fig.2a). Gas and ice are therefore part of current ($Ce$/sec), which means that gas and ice as circuit input both posses the information needed for volume and charge conversion to displace a given $^1\text{H}_2\text{O}^{\text{ice}}$ molecule. This information processing is invariant with the distance $\Delta x$ between source and receiver (invariance of signal processing) because the information is sent through a no compressible ice pathway (fig.'s 2b, 3b). The charge of the electron $e^-$, not the electron, is split in this quantum electro dynamic information circuit (fig.2), showing that magnetic monopoles $e^{+\frac{1}{2}}e^{-\frac{1}{2}}$ can exist when they are part of a current (C/sec)\(^4\). The water properties furthermore are exploited for example by the enzyme 3Na/2K-ATPase in neurons. Informative fluid currents and fluxes in the axon are generated by the enzyme, which can be influenced by field potentials of 100Hz ($10^{-2}$C.cm.sec/Volt) and 1Hz (1cm.sec/Volt)\(^5\). These field potentials interact with the generated net admittance or with the frequency of turnover of ice into gas by 3Na/2K-ATPase, respectively (fig.4b)\(^3\).

The here presented analysis shows that the laws of electricity and physics govern biological processes. For example also the ribosomal messenger RNA (mRNA) system is writing electrical information to the genome, the way information is copied to a hard disk (fig.3c). Short-circuiting the $\text{He}^{\frac{1}{2}e}$ and $\text{OHe}^{\frac{1}{2}e}$ amino acid terminals generates a magnetic $^1\text{H}_2\text{O}^{\text{ice}}$ flux ($\Phi^1\text{H}_2\text{O}^{\text{ice}}$), which opens up the genome while dipole information is written to the genome in retrograde direction (fig.3c). Information is not copied from the genome in antegrade direction. It suggests that all information of the surround must be dismantled into its smallest units and stored as 2-D information, while simultaneously this information is recovered with a 4th dimension of time (second). This unit of time is obtained from the molar conversion of water into gas, which is able to pass the dielectrical vacuum of a capacitor (admittance). It gives us (and protein processing in general), a sense of time\(^6\). This time is copied from the material surround, water, and therefore its is not excluded that the universe also started from the dielectrical vacuum of a capacitor (fig.4d).

Literature

3 www.bijman.info
4 Eaves, JD et al (2005) Hydrogen bonds in water are broken only fleetingly. Proc Natl Acad Sci 102: 13019-22. Eaves et al reported that the free relaxation time constant of $\text{OH}^-$ in water is in the order of $10^{-8}$sec. That result is in accordance with the present finding that 1moleOH$^-$ is reducing the pH to 14 (Fig.1). At pH 7 there is 10$^{-7}$moleOH$^-$ in solution but these anions are part of an electrical current. As such they are not free detectable anions.
Equations:

\[
\delta [H^+]_{\text{mtr}} = \frac{n^* \delta H_2O_{\text{mtr}}}{10^2 \text{cm}^2} \text{ Volt (Q=cV, } \text{ mtr} = 10^2 \text{cm}^2) \quad \text{Eq. 1}
\]

\[
E_{\text{H}^+} = \frac{10^{-2} \times \delta [H^+]_{\text{mtr}}}{n^* \delta H_2O_{\text{mtr}}} \text{ Volt} = 10^{-2} \times R_{es} \times \delta [H^+]_{\text{mtr}} \text{ Volt (} R_{es} = 8.314 \text{Joule/mole)} \quad \text{Eq. 2}
\]

\[
E_{\text{H}^+} = 0.023 \ln \delta [H^+]_{\text{mtr}} \text{ Volt Eq. 2a} \quad E_{H^+} = 0.0277 \times \delta [H^+]_{\text{mtr}} \text{ Volt Eq. 3}
\]

\[
E_{\text{KNO}_3} = \frac{R_{es} + T_K}{F} \text{ Volt} = 0.0267 \text{ Volt (} T_K = 310^\circ \text{K, } F = 96614 \text{C)} \quad \text{Eq. 6}
\]

\[
6.10^{23} \times 1.66 \times 10^{-19} \text{C(e)mtr/moleH}_2\text{O_{mtr}} = \frac{10^{23} \times 10^{-18} \text{C(e)mtr/moleH}_2\text{O_{mtr}}}{10^{23} \times 10^{-18} \text{C(e)mtr/moleH}_2\text{O_{mtr}}} = \frac{10^5 \text{C(e)mtr/moleH}_2\text{O_{mtr}}}{10^5 \text{moleH}_2\text{O_{mtr}}} \quad \text{Eq. 5}
\]

\[
\frac{10^5 \times 10^2 \text{C(e)mtr/moleH}_2\text{O_{mtr}}}{10^5 \times 10^2 \text{C(e)mtr/moleH}_2\text{O_{mtr}}} = \frac{10^5 \times 10^2 \text{C(e)mtr/moleH}_2\text{O_{mtr}}}{10^5 \times 10^2 \text{moleH}_2\text{O_{mtr}}} = \frac{10^5 \text{C(e)mtr/moleH}_2\text{O_{mtr}}}{10^5 \text{moleH}_2\text{O_{mtr}}} \quad \text{Eq. 6}
\]

Faraday = 10^5 \text{C(e)mole(H^+)} \quad (\text{Empirical Faraday is } 96614 \text{C/mole}) \quad \text{Eq. 7}

1 \text{ mole } \text{H}_2\text{O_{mtr}} \text{/mole sec} = 10^2 \text{ mole } \text{(H}_2\text{O_{cat}^{+}+OHe^{+})} / \text{cm}^2 \text{ sec} =

\[
10^2 \text{ mole } \text{(H}_2\text{O_{cat}^{+}+OHe^{+})} / \text{cm}^2 \text{itre. sec} = 10^2 \text{ mole } \text{(H}_2\text{O_{cat}^{+}+OHe^{+})} / \text{mtr} \text{itre. sec} \quad \text{Eq. 8}
\]

\[
3/2 \times 10^2 \text{ C(e)/100cm}^2 \text{ moleH}_2\text{O_{mtr}} = 15 \text{ mole } \text{(H}_2\text{O_{cat}^{+}+OHe^{+})}/100 \text{ cm}^2 \text{ moleH}_2\text{O_{mtr}}
\]

\[
= 0.15 \text{ mole } \text{(H}_2\text{O_{cat}^{+}+OHe^{+})}/100 \text{ cm}^2 \text{ moleH}_2\text{O_{mtr}} \text{ (per } 10 \text{ second, } 1/10 \text{itre/second}) \quad \text{Eq. 9}
\]

\[
15 \text{ mole } \text{(H}_2\text{O_{cat}^{+}+OHe^{+})}/100 \text{ cm}^2 \text{ moleH}_2\text{O_{mtr}} \text{sec} = 0.8333 \text{ Volt/itre. sec} = 0.833 \text{ moleNaCl/sec}
\]

\[
(\text{the value is known as the redox potential of } \frac{1}{2}\text{H}_2\text{O_{O^-} conversion)} \quad \text{Eq. 10}
\]

\[
5.55 \times 0.15 \text{ C(e)/mole } \text{H}_2\text{O_{mtr}} = 8.333 \text{ Joule/mole } \text{H}_2\text{O_{mtr}}
\]

\[
(\text{Empirical gas constant } R_{es} = 8.314 \text{Joule/mole}) \quad \text{Eq. 11}
\]