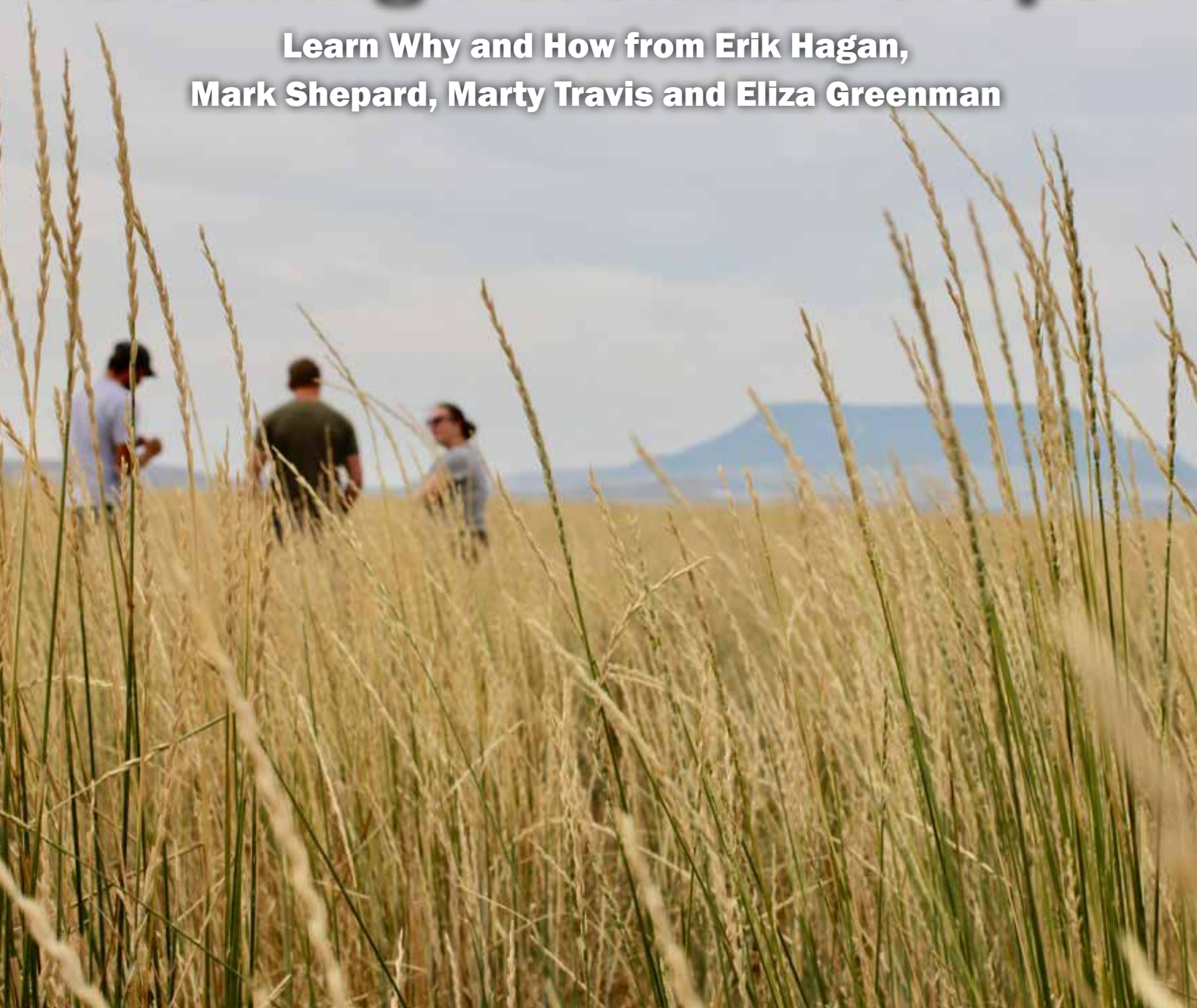


REAL-WORLD
SUSTAINABLE
& ORGANIC
FARMING

ACRES^{USA}®

Growing Perennial Crops

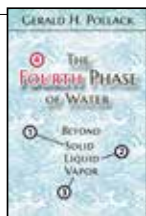
Learn Why and How from Erik Hagan,
Mark Shepard, Marty Travis and Eliza Greenman



Rediscovering Water

REVIEW

The Fourth Phase of Water: Beyond Solid, Liquid, and Vapor
By Gerald Pollack



Surely, one might argue, we have learned all there is to know about water. But perhaps not, according to Gerald Pollack, author of *The Fourth Phase of Water*.

Readers will definitely find that there's more to H₂O than they might have thought. Basic experimental observations, simple logic and elementary principles of chemistry and physics – rather than scientific jargon and complex mathematics – make the entire book readable, enjoyable and fascinating, with a writing style that is comfortable, engaging and compelling.

Pollack begins by demonstrating how an “exclusion zone,” or “EZ,” evolves next to a material immersed in water. When scientists add microspheres (tiny particles commonly used for experimentation and calibration) into the water, over time the microspheres move away from the surface of the material, creating a zone where the microspheres are excluded – an exclusion zone. Magnetic resonance imaging, optical features, infrared absorption and emission, as well as viscosity measurements, confirm the formation of this exclusion zone. Red blood cells, strains of bacteria, dirt, albumin protein and some dyes have been shown to be excluded in the same manner.

Measurements using microelectrodes show an electric potential (voltage) between the EZ and the adjacent bulk water, forming a water-based battery (see Figure 1). Dyes that are pH sensitive were added to understand the electrical dynamic of the exclusion zone. Values of pH

drop by three or four units next to the material surface, indicating a significant number of protons moving from the EZ toward the bulk water.

Pollack demonstrates that the light from a lamp increases the width of the exclusion zone. Further experimentation reveals that it is largely infrared radiation – which is everywhere – that creates the EZ. Electromagnetic radiation emanating from the furniture in your living room, the walls of a building, the rocks outside, sunlight or a warm bath all have infrared wavelengths. Pollack explains that the water in exclusion zones has a structure that is similar to, but distinct from, ice. It is, in his words, the fourth phase of water.

Next, Pollack describes a tube submerged in water. Using the same experimental measurement techniques, an exclusion zone is generated on the inside surface of the tube, and the microspheres suspended in the water form a flow pattern in the middle of the tube. Using pH-sensitive dyes in the water, Pollack shows that there is a continuous flow of protons (H⁺) leaving the tube in this centralized flow pattern (see Figure 2). This has far-reaching ramifications for understanding the flow of water-based materials through other small tubes – like blood vessels or xylem and phloem plant sap circulation. Pollack expands upon many of these ideas throughout the book.

Pollack then discusses colloids – a mixture of particles and solvent. Experimental observations reveal that after mixing a colloid solution and letting the solution sit for a period of time, the particles are drawn close to one another and form an array of evenly distributed particles. Pollack shares his own simple experimental results of two like-charged beads suspended in water with a pH-sensitive dye added to the water. Remember that

like charges are supposed to repel. In this experiment, the two like-charged beads are demonstrated to form a negative EZ layer around each of them, with the characteristic release of protons (positive-charged H⁺), and they move close to each other, despite their like charges. The added pH-sensitive dye confirms that the largest number of protons occurs between the two negatively charged beads (see Figure 3). The positive charge of the protons causes attraction to the negatively charged beads, holding the beads together in a push-pull equilibrium. This is an explanation for the like-likes-like concept of like-charge attraction suggested by Richard Feynman in 1964.

Pollack thus shows the attractive characteristics of all things. Not only do opposite charges attract, but like charges can attract as well. Pollack expands this discussion of attraction to consider the self-assembly of biomolecules into larger-scale structures, the schooling behavior of fish, the formation of clouds and more. These concepts set the stage for a series of paradigm-changing discussions about fundamental physics principles.

With the idea that particles themselves become charged with an EZ layer on the outside – that the opposite charge is released and that the process is driven by the absorption of electromagnetic radiation, mostly infrared – Pollack takes aim at Brownian motion, diffusion and osmosis. These concepts have more than a century of history and experimentation, with some of the greatest minds in physics weighing in along the way. This is the epitome of challenging long-standing ideas.

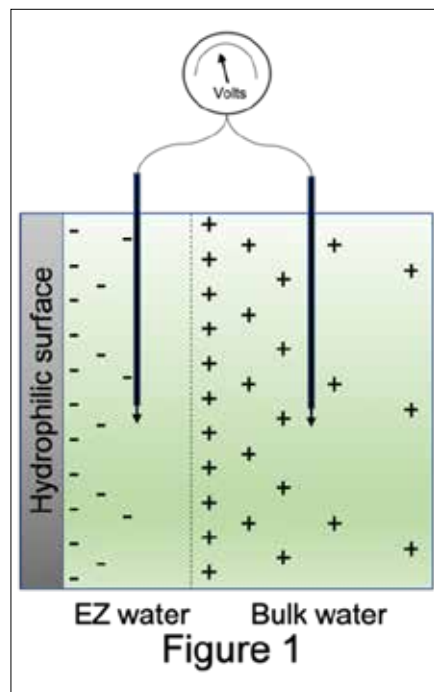
He proposes Brownian motion to be driven by incident electromagnetic radiation that develops charge around particles and the subsequent released opposite charge between the particles that drives “random

motion” – rather than internal heat driving the motion. The continuous absorption of electromagnetic energy by particles provides an energy term into the equations of diffusion, Brownian motion and osmosis, which otherwise treat these motions as a closed system phenomenon – a function of temperature, fluid viscosity, particle radius and a material constant. Later discussions challenge the idea of closed systems. These are colossal proposals with experimental data to back them up.

One quickly recognizes that these revelations and the associated consequences are not only significant in a science laboratory but may have significant impact on all life around us – in soil biology, in plants, in ourselves, in weather patterns, in all of nature. Water is everywhere. The concept of charge separation of water on surfaces must advance models of understanding natural function. *The Fourth Phase of Water* has far-reaching implications.

Many in agriculture have long discussed the effects of cosmic radiation on plants and the structuring of water. Pollack introduces us to the work of Giorgio Piccardi, who for decades studied biochemical reactions. He was intrigued by and documented the significant variation in the time it took for chemical reactions involving water to be completed – chemical precipitation, polymer formation and phase change, for instance. Piccardi and his colleagues conducted experiments measuring times for completion daily for some twelve years. Conducting experiments in pairs – one shielded in a Faraday cage, which would isolate the experiment from external electromagnetic radiation, and the other unshielded – they found significant differences in experiment reaction times between the two. Piccardi concluded water had to be involved and that it must have absorbed radiant energy. The cyclic nature of recorded reaction times implied that the radiant energy could come from the sun, and perhaps other cosmic background from space.

Simon Shnoll continued this work



▲ Charge is established in an exclusion zone adjacent to a material in water and a voltage established between this water and the bulk water in the container.

and included other experiments. He plotted his results in histograms, incorporating objective methods that left little possibility of chance, and showed the time duration of experiments were remarkably similar at intervals of 24 hours, 27 days and 365 days. Shnoll concluded that all phenomena studied must be influenced by “geophysical or cosmophysical sources.” Pollack provides even more evidence that water reactions are influenced by incident radiation from cosmic sources. Even a sealed container of water-based material is subjected to the effects of impinging electromagnetic radiation. Is anything a closed system? Maybe not if there is water involved.

Pollack offers many examples of scientific experimentation and natural phenomena throughout the book that support, or may be explained by, this new model of water – its interaction with surfaces and the separation of charges that are generated on these surfaces.

The separation of charges becomes a useful driving force of various physiological processes. The

flow of blood through capillaries is discussed. Both blood vessel and blood cells will form exclusionary zones around them caused by incident infrared radiation. The separated charges may help move the relatively large blood cells (6-7 micrometers in diameter) through the much smaller capillary diameters (3-5 micrometers in diameter). Pollack reminds us that there is almost no pressure drop across the capillaries and that the red blood cells demonstrably contort when going through them. Could these EZ charges assist the heart in moving red blood cells through capillaries?

Capillary action in the plant kingdom is omnipresent. It is the nature of water that drives xylem sap flow – the flow of water and nutrients from the soil to the leaves and out of the plant via transpiration. This flow requires no energy from the plant itself. Classic models point to water’s adhesion and cohesion characteristics, as well as hydraulic pressure in the soil root area, to drive and draw water upwards. Considering the xylem flow of a 100-meter redwood tree, Pollack states that “the column of water is too heavy to lift more than 10 meters” and “air pockets commonly found within the fluid of the xylem tubes thwart the upward drawing process.”

A colleague of his infused ink particles into xylem tubes, froze them and then examined them under an electron microscope. The results confirmed the presence of an exclusion zone on the walls of the xylem vessels. Experimentation cited earlier shows an exclusion zone on the inside surface of a tube and a flow of protons at the core of the tube. Pollack then cites standard textbooks, which state that the pH range of xylem in maize seedlings is between 4 and 5 – confirmation of protons in the area. He then suggests that protons at the top of the tree draw water upward and that radiant energy is the driver of this flow. Experimental data from other sources have measured protons (H^+) flowing

CONTINUED ON PAGE 62

BOOK REVIEWS

REVIEW

Ready Farmer One
By Diego Footer and
Nina Galle



Think about the last item you purchased – new clothes, a book, or last night's takeout. How did you find it and how did you buy it?

Chances are, you found and bought it online.

Online sales have completely changed the way we buy things. The Department of Commerce estimated that total e-commerce sales in 2021 in the U.S. topped \$870.8 billion – a 14.2 percent increase compared to 2020. Whether the continued increase of online shopping is due to newfound convenience or to the impact of the COVID-19 pandemic, online sales are solidly here to stay.

For sellers, online sales mean higher profit margins, a direct line to customers and an efficient approach to accounting. Online sales offer flexibility and open up a whole new segment of customers. Standing at a farmers market booth all day is no longer needed; just turn on your online store and share it with customers.

This all sounds great – especially for the farmer looking to make life a little easier for themselves — but what do online sales really mean for family farms across the country?

One word: access.

Selling online increases farmers' access to customers and – maybe more importantly – customers' access to local farmers. Farmers markets and co-ops are great sales channels to find customers and establish relationships, but they come with challenges and don't scale very easily. Selling online allows a farmer to set their own terms, establish their own expectations and grow their business without having to rely on a third party.

With new ventures comes a need for new skill sets. Getting started with selling online can seem like a black box. There's a lot to learn and a lot to do. Setting up a website with an online store, choosing sales channels, getting

noticed on Google and social media ... the list goes on.

On top of that, a lot of farmers aren't salespeople. Most haven't cultivated the sales and marketing skills necessary to compete in today's market. Digital marketing, customer communication and administration are not often taught in traditional farm-focused resources.

Ready Farmer One: The Farmer's Guide to Create, Design, and Market an Online Farm Store is the first book of its kind – one that will teach these skills, which are fundamental for online sales. It takes readers through the different stages of starting and scaling an online farm store. From choosing the right sales channels to building your online store to becoming a master of branding and storytelling, *Ready Farmer One* can help grow your farm's online sales.

The book was co-written by Diego Footer, farm podcaster and owner of Paperpot.co, and Nina Galle, Head of Content at Local Line – a platform designed to help farmers sell online. Their aim is to create the industry standard for farmers starting and building their online store and presence.

"In 2020, I hosted an online sales series on my podcast, Farm Small Farm Smart. Throughout this series, I interviewed folks using Facebook groups, email lists, spreadsheets and e-commerce platforms like Shopify or Local Line," explains Footer. "I knew this series needed to go a step further – to provide farmers everything they needed to thrive in this online world."

"I've learned the ins and outs of local food systems at Local Line the past five years – what consumers are looking for," says Galle. "That's how we came to the idea of equipping farmers with the skills needed to develop and reach their sales channels."

Ready Farmer One helps farmers learn how to choose a sales model and a platform that can be used to manage sales; how sales and delivery systems can save time and frustration; how to set up an online store to maximize sales and build a website to convert prospects into customers; and a four-part marketing strategy to grow a customer base and create loyal fans – i.e., all the knowledge, skills and tools

you need to create a successful online store.

The book is full of proven, successful methods used by farmers who are excelling in online sales. It includes anecdotes and lessons from dozens of active farmers, ranchers and farmers market managers. Melissa Ballard, a rancher from Bluegrass Beef in Kentucky, describes how she sends her followers multiple updates every week on what's happening on the farm and what they can expect next; by opening up the realm of digital communication, she's more connected than ever and has a broader range of customers.

Hermann Bruns, a vegetable farmer at Wild Flight Farm in New York, was concerned with how he was going to manage the move toward diversifying his farm's sales models to wholesale and direct to consumer. He's now operating predominantly online and his time spent record keeping has been drastically reduced.

Or Hilary Papuchis, a grower at Hildan Produce in Maryland – when starting her microgreens business, she knew she wanted to sell to chefs in her community. She used social media to target chefs directly, and consumers quickly started showing interest in her products. Her customer base doubled, and online sales allowed her to service wholesale customers and her retail store through one avenue – no farmers market required.

Ready Farmer One has the potential to revolutionize farmers' business and marketing skillsets. J.M. Fortier, organic grower and teacher of the Market Gardener's Masterclass, writes in the book's forward, "You will learn how to utilize the technological tools that are now paving the way for successfully conducting a small-scale farming business. *Ready Farmer One* is the most important new farming book of the next decade. I've learned a lot, and you will too."

And Joel Salatin says, "I haven't been this excited about a book for a long time. Most of us farmers aren't savvy about electronic marketing and social media, but Diego and Nina answer every question like a recipe book – you can do this."

Learn more about the book at readyfarmerone.com.

BOOK REVIEWS

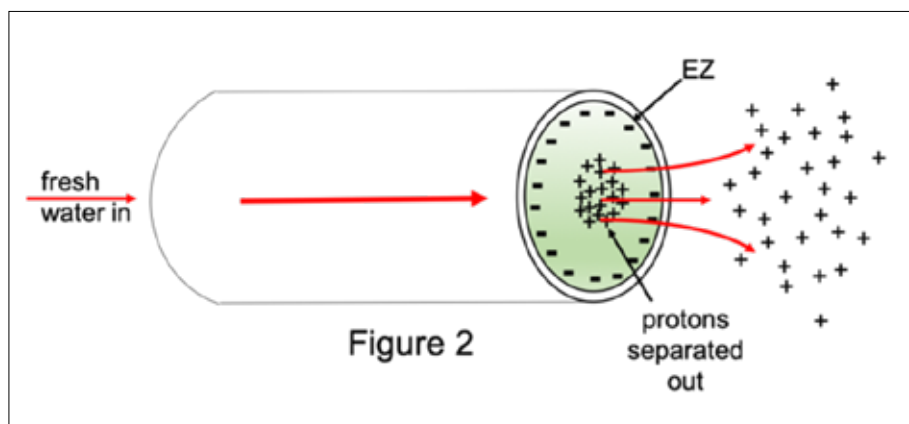
CONTINUED FROM PAGE 57

through plants as well as a potential (voltage) between soil and plant leaves. Might these ideas contribute to an advanced electrical model of plants?

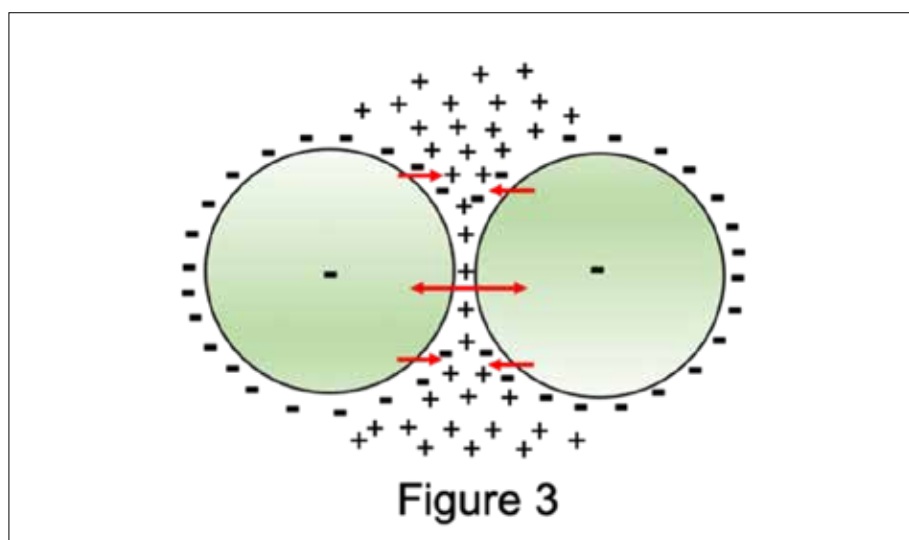
There is experimental evidence of biological cells and other large molecules, as well as nutrient-rich water, flowing in the xylem of plants. The exclusion zone that forms on the walls of a tube moves “contaminants” into the center of flow. Could this be how larger molecules are transported through the xylem flow? Pollack considers membranes surrounding cells and the movement of ions across them. The surfaces of cells are charged as a result of infrared radiation acting on adjacent water. Charged exclusion zones are also generated on the surfaces of the particles inside the cells. Could the subsequent dynamic effect of charges inside and outside cells provide a new dynamic interaction model?

I was specifically drawn to Pollack’s discussion about vortexing water – the spinning of water so as to form a vortex. Spinning water in a vortex cools the water. After explaining the nuanced definitions of heat and temperature, Pollack introduces the concept of radiant energy as a more definitive way to measure energy changes. He speculates that vortexing creates EZ water whose structure reduces vibratory motion of some water molecules. The resulting radiant energy is lower, resulting in a lowered measured temperature. Could temperature be a measure of structuring the water in this manner?

Also discussed in this book is the power of protonated water, ice friction, the process of freezing, capillary action, and droplets and bubbles and their enveloping sheaths. The visible puffs of vapor coming off a hot cup of coffee are described as coming from tubes extending deep into the water. With even more infrared energy, these puffs of vapor turn to bubbles and boiling ensues. All of these



▲ An exclusion zone is generated on the inside surface of the tube, and a continuous flow of protons (H+) leaves the tube in the resulting centralized flow pattern.



▲ Positive charge (H+) is released from the EZ layers around two negative like-charged beads suspended in water, causing attraction with the negatively charged beads counteracting their repulsion.

phenomena are explained using these new concepts. EZ water is everywhere.

Pollack also examines the process of advancing scientific ideas – specifically the difficulties associated with doing so. This is no trivial task. Many great minds in the past hundred years have identified characteristics of water through experimentation that don’t fit the existing paradigm. These have essentially been forgotten or, at best, ignored. Some prominent names will be recognized, some not.

By clearly describing the failure of existing models to predict events and using results from experimental observations, as well as elementary

principles of chemistry and physics, Pollack skillfully builds foundations for a new model of water that will jolt the imagination of any reader.

Now, when I see water, ice or vapor, I think about their formations and transitions with an entirely different perspective, imagining the effect of charge separation in the presence of infrared radiation. The fourth phase of water could indeed be the most significant scientific discovery of this century.

– Nigel Palmer

Nigel Palmer has graduate and undergraduate degrees in engineering and worked as an aerospace engineer for 37 years. He is the author of The Regenerative Grower’s Guide to Garden Amendments.