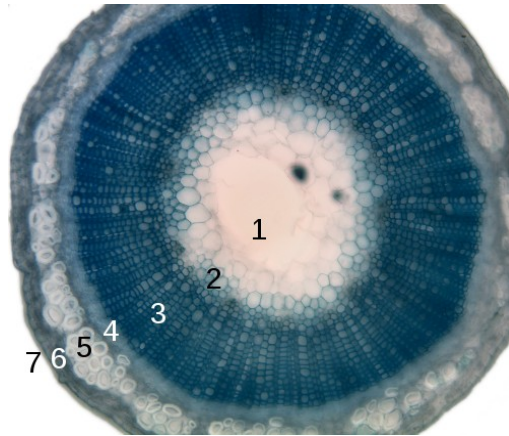


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# THE PRESSURE-FLOW HYPOTHESIS IS FALSE



*by Miles Mathis*

[I recently overturned](#) the electron orbital theory of molecular bonding, and here I will overturn the fundamental theory of transport in plant physiology. In my paper on molecular bonding, I solved the problem using the charge field, and I will do the same here.

The current theory of phloem transport in plants is called the theory of pressure-flow or mass flow. It was first proposed by Ernst Munch in Germany in 1926, and although there have been some updates to the theory, the fundamentals have not changed in 85 years. Please notice the date, for a start. That is also the date of the Copenhagen interpretation I talk so much about. Something crashed in that year, and it has never gotten back on its feet. And, although the name of the Copenhagen interpretation implies that the work was done in Denmark, much of the work was done in Germany. We see a confluence of bad theory and theorists at that time and place, and much of it is still standing to this day.

The theory of water transport in the xylem is also very old, going back even further, to the time of Dixon-July, 1894. Again, this is the true state of the art: no progress in 116 years. The electron hadn't even been identified in 1894 (it was discovered as a particle by Thomson in 1897). With all the supposed advances in quantum theory, physicists couldn't be of any help to plant physiologists in the entire 20<sup>th</sup> century? I guess they were too busy promoting themselves to look at real problems.

In questioning pressure-flow, I am not being quite as revolutionary as when I question electron bonding. The pressure-flow hypothesis is still called a hypothesis, it is agreed to have large question marks by it, and many alternative hypotheses have been presented and have received serious attention over the years. Physiologists are somewhat more honest about the firmness of their hypotheses than

physicists are. But mainly pressure-flow is another theory that remains standing only because no one has been able to propose something better.

[In this paper I will use Salisbury and Ross' textbook, *Plant Physiology*, fourth edition, as my main source. All page numbers not otherwise attributed are from that book.]

I will begin by listing some of the historical points against pressure-flow:

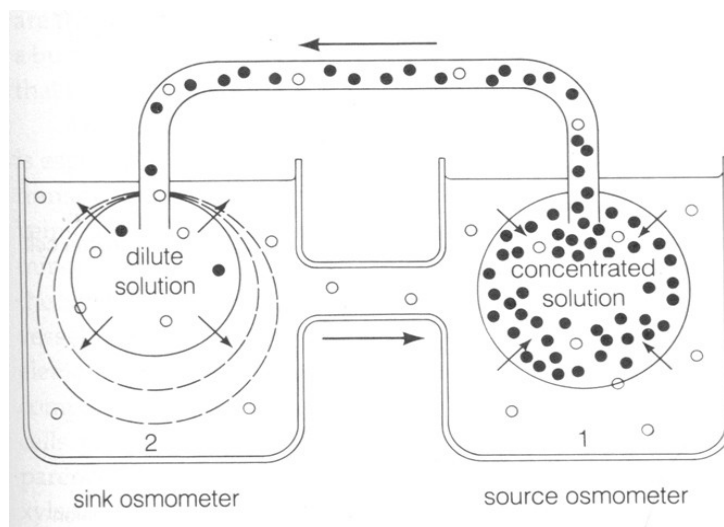
- 1) The solute in the phloem has been shown to move faster than the solution [Biddulph, Cory 1957]. This is a major problem since the pressure is supposed to pull on the solution, with the solute being carried in solution. If the solute is outrunning the solution, it must be feeling pressures the solution is not.
- 2) The concentration of sugar in the phloem is sometimes higher than in the leaf cells, even while transport is taking place [Roeckl, 1949]. Therefore, positive pressures do not always exist at times when translocation is occurring. This contradicts the mechanism of pressure-flow.
- 3) Substances move both up and down in the phloem. In answer, we are told that different sieve tubes are used for each, but this doesn't explain how pressure can be both plus and minus, top to bottom, at the same time. There is either more sugar high or more low, and so the plant as a whole cannot signal the two sieve tubes in opposite ways at the same time.
- 4) Different substances have been found to travel at different rates in the same sieve tube [Fensom, 1972]. As with 1) this cannot be explained with straight pressure top to bottom or bottom to top. If different substances are feeling different pressures or different signals from the plant, this mechanism must be shown. The pressure-flow theory cannot explain it.
- 5) The mechanical resistance to mass flow is very large. This would include not only gravity (in movement up), but the mechanical resistance inside the phloem, including the resistance of the sieve pores. It is not even clear that the pores are open, but if they are, the resistance is still considerable.
- 6) The rates of flow are too fast for bulk flow, since they have been measured at 40,000 times the rate of diffusion. At the level of motion, this is quicker than the eye can move. There is no indication (beyond the fact that it does happen) that pressure-flow can account for this speed.
- 7) Mass flow is a passive process which takes no account of the active nature of plant physiology. Just as one example, it ignores the role of companion cells.
- 8) Translocation is greatly affected by temperature and metabolic inhibitors, which are difficult to explain with pressure-flow.

These are the problems you may read about if you study this problem on your own. I will now show you a problem that trumps all these, one you will not have read about. To understand the proposed mechanism in the xylem and phloem, you have to look first at osmosis. Osmosis requires a membrane, and it is the movement of water across that membrane from a less concentrated solution to a more. The ascent of sap in the xylem is commonly explained by a water-potential gradient, which is fancy way of saying the solution is more concentrated at the top (or at the leaves) of plants. The plant then acts like a big cell, with many internal membranes, and the water is pulled up. Why is the solution more concentrated up high? Because that is where evaporation takes place. The water evaporates, leaving a higher solute concentration in the leaves. This creates a potential that pulls the water up.

Problem is, when we come to the phloem, that water-potential gradient is ignored. We are expected to believe that the gradient exists in the xylem but not the phloem. Remember, the phloem also transports its sugars and other substances in a water solution, and this water solution should respond to the same

water-potential gradient we found in the xylem. Instead, all that is ignored, and you never hear about the water-potential gradient in the phloem. The main motion in the phloem is down, so that the photosynthesizing leaves can feed the roots and the rest of the plant. So the phloem must have some way of turning off the water-potential gradient from leaf to root.

You never hear about that problem, because it is immediately fatal. This is one reason textbooks are careful to separate xylem and phloem into different chapters (they are separated by three chapters and 60 pages in this textbook). This is also why both questions are hidden in long chapters padded with lots of misdirection. As just one example, we can look at chapter eight in our textbook. This is the phloem chapter. The pressure flow hypothesis is stated on page 164, not very directly, then evidence is shown, which evidence is not very convincing, and then—before we hear about “two problems with pressure-flow” on page 183—we get, out of nowhere, a five-page review of carbohydrate chemistry. I find that curious. Also curious is that this important recent textbook only mentions two problems. I listed eight in this short paper, but even my list is truncated and far from complete.



A related problem is found when we study the mechanism for pressure-flow in the phloem, which is also based on osmosis. To explain the motion down, we are given two osmometers in a common or connected external solution that has “approximately the same water potential” around both osmometers (p. 165). If one osmometer has a more concentrated interior solution, and the osmometers are connected by a tube, the solution in the tube will move to the more dilute solution, carrying the solute with it. They have a diagram for this, and they state correctly that this set-up can be created in a lab. Problem is, the plant *doesn't* have approximately the same water potential high and low, as we just saw with the ascent of sap. The plant *already* has a more negative potential at the leaf, and this must short-circuit the diagram. If the external solution at the leaf is also more concentrated, then the osmometer there won't work.

Think of it this way: does the leaf even have an internal and external solution like this? To explain the ascent of sap, they just had a straight water-potential gradient, with no mention of internal and external solutions. But now in the phloem, with internal and external solutions, the motion can be reversed, going straight against the water-potential gradient. Using osmosis alone, they explain both motion up and motion down. They create a bunch of new names and new terms, but the difference is only in the solutions. In one explanation, we have an external solution, in one we don't.

You will say, “Of course the leaf has both internal and external solutions! The leaf is composed of

cells, and cells have membranes and both internal and external solutions.” But my reply is, “It must be one or the other. We either have osmosis as in the xylem explanation, where the whole plant is treated like a cell, with a potential difference top to bottom; or we have osmosis as in the phloem explanation, where we have osmometers in common solution. It is the same plant.”

Or, to say it in a slightly different way, we must either treat the water potential gradient from top to bottom as solutes separated by a membrane, or not separated by a membrane. As they show, the main motion is one way with one, and the opposite way with the other. What I mean is, if we study the diagram above closely, we notice that the solute is moving to the more dilute solution. Well, that is opposite osmosis, since osmosis uses a membrane, and the water moves to the *less* dilute solution. The main motion is opposite. But the xylem and phloem are in the same plant, and the plant can't be running on both schemes simultaneously.

I will be answered, “But look at the diagram: after the thing gets going, we have water moving up and solute moving down. Just what we want. Make the long tube the phloem and the short tube the xylem, and you have it!” Of course that is why they draw the external solution with that short tube between—to get you to think this way. But it is totally manufactured. The diagram could be drawn with or without that short middle tube, since flows will work the same either way. That tube isn't doing anything. Besides that, the current theorists never claim that water moves up in the xylem *because* solute moves down in the phloem. They don't claim that because the mechanism is circular, and I assume they can see that.

Here's another problem with the diagram. Remember that leaves are the point of evaporation, since that is what is supposed to drive the water-potential gradient. Well, if we add that fact to the pressure-flow diagram, we have evaporation not just from the external solution, but also from the internal solution. In other words, that concentrated internal solution on the right (at the leaf) is concentrated because the water has evaporated, leaving more solute. But of course this would cause water in the narrow tube to rise, by the given mechanism of water-potential gradient. In that case, the water solution would be moving in the opposite way to the solute. Are we to believe that the solute is moving down while the solution is moving up?

And again, we also have solute moving up in the phloem. How is that achieved, according to these diagrams? That would appear to require a less concentrated solution in the leaves. Either that, or motion up is caused by a water-potential gradient while motion down is caused by pressure-flow. How does the phloem know to switch from one theory to the other?

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Yes, translocation in the xylem and phloem is just one more fudge. Osmosis is used as the mechanism for both, but this is hidden by different terms and different variables and a melange of pseudo-math. Notice that the direction of overall motion can be switched just by putting the osmometer in solution. A great trick discovered by Munch and never deconstructed until now.

With a closer analysis, the given mechanisms can't even tell us up or down, much less predict a speed or a variation for different solutes.

But the question remains, can I show a better explanation? No matter how bad the current theory is, plant physiologists will be expected to keep it, since it is better than nothing. Until something better

comes along.

My discovery of the charge field has allowed me to propose new theory in many fields, and I will do so again here. Since I am speaking now to biologists, I feel I must give a quick overview of my charge field. My regular readers may want to skip ahead. In short, I pulled apart Newton's old gravity equation, the one we all learned in high school,  $F=GMm/r^2$ . The constant G there has never been assigned or explained, except as a hole filler. [I discovered that it is hiding the charge field](#). The charge field is photons, particles of light.

The charge field is already known. In macro-physics, the charge field is known as the electromagnetic spectrum, and it includes photons of all known sizes, including visible light. At the quantum level, the charge field is known as the pluses and minuses on the proton and electron (and a few other particles). Charge is the force that is thought to explain most of the quantum interactions. It is the main force at the quantum level. But up to now it hasn't been assigned to anything. There is no real field and no real field particle. It just is. When pressed, particle physicists will tell you that charge is mediated by a messenger photon. But this is a virtual photon. It has no mass and no radius and no real energy. It relates charge by simply "telling" the other particle plus or minus.

Anyone can see that isn't satisfactory, so what I did is combine macro and quantum charge. That is, I proposed that quantum charge was mediated by a real photon of some size, a photon with real energy, real mass, and real radius. The field of these photons is then what we call charge. Since this is the same field we have at the macro-level, we must have charge here, too. We have been told that we don't, and that celestial mechanics is gravity only, but [I found](#) that the size of the macro charge field was precisely the size of the hole G was filling in the equation above. Yes, charge was hiding in G all along.

Finding charge at the macro-level ended up giving me what is called a unified field. I have shown since then that both charge and gravity exist at all levels, so we have a unified field both at the macro-level and the quantum level. Historically, physicists were looking to unify their fields by stacking the maths they already had at both levels. I showed that the equations they had were already unified, and that what we needed was a way to break them down, to see what they really contained.

At any rate, this discovery was like the key to the city, as far as fundamental physics goes. It allowed me to rewrite all their equations back to Newton, and to solve all the sticky problems that had accumulated since then. One recent problem that it allowed me to solve very quickly was the problem of [dark matter](#), which I showed was just my charge field. Using simple math, I showed that the size of their dark matter field was *exactly* the size of the charge field that had been hiding in G.

Even more recently, I showed that the strong force could be jettisoned, since my charge field allowed me to diagram the nucleus. [I have shown](#) that charge is actually channeled *through* the nucleus, so it doesn't act to repel protons in the way we thought. This means the strong force is unnecessary.

Diagramming the nucleus also allowed me to [redefine Hydrogen bonding](#), which impacts this paper. Hydrogen bonding is currently used to explain the ascent of sap, since without it water would not have enough tensile strength to rise. I will show below that the new explanation of Hydrogen bonding is the same explanation of translocation in plants: the charge field.

It turns out that charge is actually the main force and the main energy in the universe. Even in terms of mass or mass equivalence, photons outweigh everything else by about 19 to 1. But the most important

thing here is the way that charge interacts with matter. All charged particles like protons and electrons recycle charge by recycling photons. They actually take them in at the poles and emit them at the equators, like little engines. Larger collections of matter do the same thing, and the Earth takes in photons at the poles and emits them everywhere (but most heavily at the equators). The faster the charged object is spinning, the more it emits at the equator and the less it emits everywhere else. So electrons can be thought of as little disks, with almost all the photons being emitted in one plane. But with the Earth, we only have a bit more emission at the equator, due to the relatively slow spin.

What this means for biology is that the Earth is emitting a stupendous amount of charge straight up, wherever the plant or biologist happens to be. Invisible photons, most of a tiny size and energy, are moving up all the time. They are also spinning, and this spin will create a magnetic effect on any ions in the field.

This means that translocation in plants is mainly another electromagnetic or E/M effect. We have long known that plants use electrical or magnetic fields to do some things they do, just as animals do. But without the charge field, it was not understood how these E/M effects were created, or how any perceived force could be created. The known mechanisms were too small or absent, that is, and the charge field was unknown. Before now, physicists would have to explain everything with the ions themselves. But now that we know that it is actually the photons that drive everything, we have a mechanism for many effects. In other words, we don't have to rely on pressure in solutions, since we now have a better mechanism.

But what precisely is that mechanism? Well, to start with, we have molecules in a *water* solution here, and molecules in a water solution are known to be polar. Because the water is polar, the solute will be polar too, to some degree. That is to say, it is charged, or channels charge. Normally, water is called electrolytic only if certain polar ions are in solution, as with salts or Potassium. But because the water itself is polar, the water solution will always be electrolytic to some degree. That is what the Hydrogen bond is: a charge channeling through the water molecule. Current theory explains this as auto-ionization, but whatever you call it, it means that pure water is already a conductor before we add any solvent.

This brings us to my paper on the [Hydrogen bond](#), and this is why I published that paper right before this one. I had to show how water channels charge through the molecule. Water is not just polar, which we already knew. It is capable of directionalizing the charge field, and the charge field runs everywhere the water runs. Actually, charge is everywhere, but the channeled and directionalized field within water doesn't just give us a plus on the Oxygen end and two minuses on the Hydrogen ends, it gives us a potential that runs throughout the water, even when the water contains nothing in solution.

But this by itself cannot be the mechanism of translocation in plants, as we know. The electrolytic potential of pure water isn't enough to move ions against gravity, much less to transport at the speeds we see in plants. Or, I should say, it isn't enough to move ions against gravity in most situations. It isn't enough to move ions up in a glass of water, for instance. But if we make our glass of water a very thin tube, we increase the effect greatly. How?

You probably think I am going to say capillary action. I'm not. This is where I go another direction altogether from the mainstream. To see where I am going, we must look at another problem of the current theory—cavitation. When proposing the water-potential gradient as the mechanism for the ascent of water in the xylem, we find that the tensile strength of water isn't enough to counteract the proposed pull from the leaves. Bubbles should form, and it is found that they sometimes do. However,

this has proved to be no problem for plants. Somehow, the cavitation does not break the pull. Why? **Because it isn't a pull, it is a push.** The water-potential gradient isn't the mechanism, so we don't have to explain cavitation. The primary mechanism in the ascent of sap is the charge field. The plant uses the charge field, which is already going up, to lift the sap. The photons drive the ions, and the ions drive everything else. Anything that is ionized to any degree will be pushed up. [In fact, even things that aren't ionized at all will be pushed up a bit, but we won't consider that here. That little bit is only a fraction of gravity, so it won't enter this problem.]

Yes, the sap takes a ride on the charge field elevator. And to make it do that, we simply have to make the charge force up greater than the gravity force down. That is the first reason the plant uses very small tubes. Even in the largest trees, the tubes are tiny. If the radius of the tube didn't matter, we would expect to see larger tubes in giant redwoods, but we don't. As an analogy, we can compare blood vessels in Elephants to blood vessels in mice. The Elephants have much larger blood vessels. But giant redwoods do not have giant xylem tubes. This is because animals rely on hearts to pump blood, but plants rely on the small radius of the xylem to facilitate the rising of the sap. The xylem can vary in diameter to only a small degree, and it never gets much bigger than about .1mm.

The professor emeritus of plant physiology who read this paper before I put it up had something interesting to add here. Although he is rather attached to the old theory and prefers to stick with it, he told me: "Conifers (redwoods, pine, cypress etc.) do not have vessels, only tracheids. Tracheids do not grow as large as vessels do in many plant species, although they can be longer, and they have smaller perforations in the end walls. One would think that friction would be a factor in the final height of these trees, yet some are the highest of all. This observation would seem to support your explanation of smaller size trumping gravity and helping the sap to rise."

Yes, the small radius is absolutely necessary, and that is because it limits both the cross section of gravity and the cross section of charge in the xylem. In a word, it takes our size down, and since size matters in how gravity relates to charge, we can more easily overcome gravity with charge.

Understanding this is absolutely crucial, but biologists will not understand it without reading several of my [other papers](#). I will try to gloss my explanation to fit this paper. Physicists already know that at our size, gravity is more important, and that at the quantum level charge is more important. Just studying that fact will make you realize that there must be some size level where the two cross. If charge gets smaller as size get larger, and gravity gets smaller as size gets smaller, then at some size they must be equal. This also means that going smaller will automatically increase charge in relation to gravity. Anytime you get smaller, you get nearer that point where they cross.

As I said, mainstream physics has known that for a long time, although it is not something they talk about. But I have shown that they had the point of crossing very wrong. Because they didn't realize that charge was hidden in that variable G, they didn't realize how large charge was at our level. They thought it was very close to zero, but it isn't. At the size level of the Earth, charge is about .1% of the total. Since we live in the Earth's charge field, that is the number for us in most situations.

Since mainstream physicists believe charge is zero at our level and that gravity is near zero at the quantum level, they would expect the crossing point to be about in between, at  $10^{-8}$ m or so. But that isn't even close. I have shown that the crossing point is well within the visible, at about the size of a grain of sand (1mm) or even larger. This puts the diameter of the xylem well beneath it, at  $10^{-4}$ — $10^{-5}$ m.

That's right: charge would already trump gravity in the unified field at the size of the xylem, even if we didn't have billions of photons being emitted by the Earth. Since we have both, the rising of sap is much easier to explain.

You will say, "By that argument, anything smaller than a grain of sand should be weightless." Not at all. I am simply pointing out that charge as a field trumps gravity as a field at that level. But charge must be given a direction opposite gravity to make an object weightless, and an object's own charge field is not directionalized like that. The charge field that is directionalized on the surface of the Earth is the Earth's charge field, which I just admitted is only .1% that of gravity on the Earth. So there is no reason a grain of sand would be weightless. Sap is driven up not by its own weightlessness in the field of the Earth, but by directionalizing the charge field inside the xylem. Which is to say that IF we could directionalize the grain's own charge field, we could make it weightless. But we would not expect it to be weightless under normal circumstances, since under normal circumstances the grain emits its own charge field near spherically. It emits or channels down as much as it does up.

Let me put it another way. Since the grain is solid, its molecules cannot be turned by the Earth's charge field. The molecules are in a solid structure and are not free to align with the charge field. But water, being a liquid, *can* turn to align with the Earth's charge field in some situations. Water can be directionalized as a matter of charge. Under normal circumstances, water cannot be lifted by charge because we cannot take the water to be only its molecules. Water does not "exist" at the level of its molecules, it exists at our level. In other words, if the water fills the glass, and the glass has a diameter of 10cm, the size of the water in question is 10cm. This is because liquids, though weakly bonded, are still bonded. In determining size, you have to take into consideration not just the molecules, but the bonds. The water is the size of its bonds, not just of its molecules. This means, as a matter of operation, that water is the size of its container. This is why the xylem, the container, must be made small.

Therefore, we have a small size, which allows charge to trump gravity. Then we have a liquid, which can be turned by the charge field. This means that the water molecules in the xylem will align themselves vertically, to match their own charge fields to the charge field of the Earth. Once that happens, they DO become weightless. More than weightless, since once internal charge trumps gravity, the molecules are free to accelerate upward. Without the material resistance in the xylem, and atmospheric pressure, the water would move faster and faster as it moved up.

Before I go any further with my theory, let me pause to show how this theory has precursors and even analogues in the mainstream. I am not the first to propose E/M causes in transport and other plant motions. We see this most clearly perhaps when we study the control mechanisms of the stomata. At first this was explained using osmosis again, but physiologists soon saw that didn't work. It was found that the osmotic potential of guard cells became more negative when stomates open [Humble, Raschke 1971]. As our textbook says,

Because the guard cells nearly doubled in volume during opening, this increase in solute concentration occurs *in spite of dilution*. [p. 79]

To explain this, the theory moved to the absorption of Potassium ions. It was found experimentally that a large number of Potassium ions do accumulate in the vacuoles of guard cells during stomatal opening, so this appeared to be the mechanism. Unfortunately, this theory stops short of the correct one, since the ions are only used in this theory to increase the osmotic potential. The theory also requires "a suitable anion to maintain electrical neutrality." We will see that this is not the case. The



Potassium ions are used to increase the electrolytic properties of the solution, not the osmotic potential.

Proof of this comes from Humble and Raschke again, since they observed no anions accompanying  $K^+$  in the guard cells of *Vicia* leaves. Instead, Hydrogen moves out. At first, light was proposed as the trigger for the uptake of  $K^+$ , but it was found that this didn't match experiment, since it also happened in the dark. Then a rise in  $pH$  was theorized, caused by using up  $CO_2$  in photosynthesis, but that doesn't work either since it also is negated by experiment. Presently, the mechanism of  $K^+$  uptake is not known. We will see below in studying ion transport that the mechanism is charge. The solution is not being made more neutral, it is being made more charged. It is not the osmotic potential we should be looking at, it is the charge potential.

We see this again if we look at solute absorption in the cells.

Carriers and channels could passively speed movement of solutes across membranes by taking advantage of the electro-potential gradient established by an ATPase or pyrophosphatase pump. [p. 157]

That is curiously worded, since it is unclear why so much in plants needs to be “passive,” or why an electro-potential would be called a pump, but it shows you that charge is used to create channels or potentials, even across membranes.

As more indication of E/M in the cell, two main types of channels across the membrane have been found, the first of which “responds to the voltage gradient” [p. 158]. Voltage, notice, not osmosis.

This is shown once again if we leave the stomates and look again at the phloem. The electro-osmotic theory has long been pushed to explain holes in the pressure-flow theory, and recently it was shown that electrolyte solutions in plants do indeed exist and do move with an electrical current [Polevoi, 2003]. That is straight proof of the presence of the charge field. This is just an extension of the work done by Fensom and Dainty in 1963, where it was shown that electro-osmosis could be measured across cells of *Nitella translucens*.\* The reason this theory has been mothballed or sidelined is that no one could explain how Faradaic reactions could take place at an anode and cathode, or where the anode and cathode might be in a plant. My theory answers this by pointing to the external field. We don't need Faradaic reactions or internal anodes and cathodes in the plant, because the plant already exists in a field. It exists in the charge field of the Earth. The Earth is the anode and the sky is the cathode. Tesla understood this a century ago, and it should be common knowledge now. In fact, the Earth can be seen as both anode and cathode, since both positive and negative ions are driven up by the charge field. If you look at the anions, the Earth appears to be an anode; if you look at the cations, the Earth appears to be a cathode. This is what will allow us to solve both up and down translocation.

If you want to read a fuller account of the historical theory of electro-osmosis, you can take the link below to Googlebooks, or look up the book at the library: “Water Relations of Plant Cells,” Jack Dainty, in *Advances in Botanical Research*, vol. 1, 1963. However, I have no intention of going into that sort of detail here. I am pointing the way to a new theory, not supplying it in full. In subsequent papers, I will fine-tune some of the micro-mechanisms of electro-osmosis, but for now I am mainly adding my charge field to the historical theory, to give it a better foundation and to answer critiques of it. As part of this update, I will point out that the name is up for a change as well. I would no longer call it electro-osmosis, since osmosis is not the main cause of the motions. In my updated theory, osmosis has been bumped down to a supporting role. The main cause of motion is charge. Translocation in plants is not at root osmotic, it is at root a field mechanics based on charge and gravity. Therefore we might call it charge-flow or unified field-flow.

In short, the plant uses the charge field of the Earth in order to facilitate translocation of food and water upwards. To move food down, the plant turns off the charge field, which reverts the field to gravity. When gravity doesn't move the substances fast enough, the plant can reverse the charge field, to help gravity. It does all this with ions, not only  $K^+$ , but  $Na^+$ ,  $H^+$ ,  $Cl^-$ ,  $N^+$ , various salts, acids, and so on.

We have seen the mechanism for moving ions up: photons drive them. But how does the plant move ions down? In many cases, it doesn't have to move them down. They are already down, because the plant gets them from the soil. If it needs more of a certain ion to be low, it simply transports that ion from the soil to the level needed. If it has too much of an ion high, rather than move it down, it exudes it or allows it to evaporate in solution, then moves new ions up from the soil. Anything it needs to transport lower, it combines into a neutral molecule, which will fall in the unified field. Once the molecule falls to the level needed, the plant can re-ionize it there, by breaking the bond; or simply let it be, as with sugars.

But how can the plant turn off the charge field? It doesn't really turn it off, of course. There is no way to do that. But it can stop its effect by stopping its channeling in the phloem. In other words, the phloem also has a water solution, and we use that now. The basic way of turning off the charge channel up in the phloem is to unalign the water molecules. Instead of allowing them to align vertically, creating a charge channel up, the companion cells use ions to force the water molecules to turn sideways, or horizontal. That is why the companion cells are to the side. In other words, the companion cells use the ions to create a charge field running across the phloem, orthogonal to the Earth's charge field. The water aligns to that field instead of the Earth's field, and the vertical channel of charge is broken or diverted. The charge elevator up is broken, and the field inside the phloem reverts to gravity.

This also explains why different substances move at different rates in the phloem. Once we have charge, it is simple to explain, because each substance has its own particular charge field. No two atoms respond to charge in the same way, much less two different complex ions. If the charge field is on in the phloem, then the substance that is ionized the most will rise the fastest. Or, the substance that channels charge the most effectively will rise the most. If the charge field is off, the heavier substance will fall the fastest, due to gravity alone.

But what about substances moving down in the phloem too fast for gravity to account for? How does the plant "reverse" the charge field? First, the plant short-circuits the Earth's charge field, as above. It turns the water molecules sideways, using ions in the companion cells. Then it ionizes whatever it wants to move down. In most cases, the substance will already be ionized, since it is already in solution. That is why the plant uses solutions. Then, if the ion is positive, the plant creates a current in the phloem tube by stacking negative ions low. If the molecule is neutral, like sugar, the plant must either use a carrier or it must find a way to ionize the molecule. With the anions down low, and the Earth's charge field already priming the field (by induction, see wireless transmission or my paper on the [Battery circuit](#)), a downward potential will be created.

This is why plants don't dry out from phloem transport. It doesn't require water moving down in solution to move the substances. They move *through* the solution, not with the solution. Water may move down slowly in the phloem, but it is not necessary for the solution to move with the solute. This was difficult to show with bulk flow, but it is simple to show with charge flow.

A reader may notice that my theory is much more active than the current theory, despite the heavy use

of external charge. My theory is active in that I don't even pretend that everything is passive, such as ion transport. I assume that plant cells, like animal cells, have monitoring and signalling devices. In other words, they “know” where ions are needed, and can trigger ion motion in order to create charge potentials. I am not here to explain this. This paper is about the larger motions in plants, motions like water and food transport. I cannot tell you how enzymes and proteins and hormones know what to do, or how the mitochondria know what to do, anymore than the mainstream can tell you. This paper is about replacing osmotic potential and pressure-flow with charge. In a word, it is a confirmation that Fensom and Dainty were on the right track, and that had they known about charge they may have destroyed the pressure-flow hypothesis fifty years ago.

Another thing I discovered in studying plant physiology is that there is a definite prejudice against plants, a sort of anthropocentric or zoocentric predisposition to explain everything passively in plants, because, I suppose, even their cells are not smart enough to do things actively. This is curious, because although we have evidence animals are smarter than plants in terms of brain power, we have no evidence animal cells are smarter than plant cells. The cells in the human body are not driven by the brain, so any ability to function they have cannot be explained by animal intelligence. The same can be said of plants, and the perceived lack of intelligence of plants implies nothing about the active abilities of plant cells. In other words, there is no reason we need to explain more functions passively in plants than we do in animals. And yet if we study animal and plant physiology side by side, we see animals cells given active rolls much more freely and readily. Just an observation.

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Now to answer a couple of questions. Some will say that according to my theory, all ions should immediately be blasted into the leaves, and from there into the atmosphere, by this charge field of mine. Even if we turn the water molecules sideways, and put the ions in solution, my charge field should still push them up, shouldn't it? Haven't I said this is what happens in air, with the Earth's charge field pushing ions up to the ionosphere? How does the plant ever get ions down low, or keep them there?

First of all, we don't see a lot of big ions in the ionosphere, so I will ignore the second part of the first question. The charge field is strong, but it isn't strong enough to lift Potassium or Iron into the ionosphere through the air. In most cases the limit is about Neon. My charge field isn't “blasting” ions anywhere, it is simply helping the plant's own charge field to channel ions up. It does this first by induction, by aligning the plant's internal charge field vertically (where it can), then by augmenting it. But, as I said, it can only augment it up. It can *induce* it in either direction, by setting the channels, but the photons are moving up—they cannot also move down.

Well, you will say, if the charge field isn't strong enough to lift these ions like Potassium in the air, how can it lift them inside the plant, where there is more material resistance? Because, again, it isn't lifting them on its own. It is augmenting the plant's own charge channels. Charge moves through all ions and all molecules and all atoms, and in channeling charge, matter strengthens charge in the channel. For this reason, charge is stronger where there is more matter. Since there is less matter in air than in the plant, the plant has stronger channels of charge. This is why charge channeled through the plant can lift liquid water. In air, the charge field can't lift water vapor much or very fast. It lifts it slowly and a short distance—to the clouds, not to the ionosphere. At atomic number 10, water vapor is right at the limit of what charge can lift in our atmosphere. But in the plant, the charge field up is considerably stronger, due simply to the denser matter in the plant. Unless charge is blocked or diverted by crossing charge, as we saw from the companion cells, this channeled charge will be able to lift both liquid water

and most ions and molecules.

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In closing, we will look more closely at ion transport, especially the movement of Potassium. Peter Mitchell received the Nobel Prize in Chemistry in 1978 for his work on ion transport and the so-called proton pump. In the current model of the proton pump, we are told

In this model, Potassium ions can move from left to right into the cytosol *down* an electrochemical gradient but *up* a Potassium concentration gradient. [p. 158]

As with most Nobel Prize-worthy things, that makes no sense. Either the electrochemical gradient or the concentration gradient must be the defining mechanism of the channel at any one time. The Potassium must be moving according to one or the other; it cannot be moving according to both, unless we are told why and how one trumps the other.

A similar problem is found in carrier transport. Since “it seems impossible for a channel to perform countertransport,” a carrier is proposed that can somehow transport  $H^+$  one way and  $Na^+$  the other way, although they are both positive. Of course we aren't told how a carrier can do that where a channel cannot. The carrier needs a mechanism just as much as a channel, and the theory doesn't provide one.

Both these problems are caused by the inability of researchers to find a true Potassium pump in plants [Kochian, Lucas 1988]. Charge is that pump. It is said that electro-potential gradients cannot explain absorption of sugars, and will repel anions, but that is a misunderstanding of electro-potential gradients. The problem is the belief that the charge field is a dipole, when it isn't. Yes, ions tend to be either positive or negative, which looks like a dipole, but this dipole doesn't imply opposite motions in all circumstances. Again, I point you to the charge field of the Earth, which is moving up. Charge is not a dipole there. The photons will drive *all* ions up, positive and negative. Ions move in opposite ways when they are in a magnetic field, but in the same direction when they are in a charge field. Charge is photons, electricity is ions. Ions are dipole, photons are not\*\*. I am explaining motion in plants with charge, not with electricity. Charge will cause electricity, but the two are not equivalent. It is charge that is moving up in the tubes, not electricity. A flow of ions will create an electric current, but it is the charge that is causing the main motion, not electricity.

This must be understood to understand anything about plants, animals, quantum motions, or celestial motions. Currently this is NOT understood, because currently the difference between charge and E/M is misunderstood. A lot is known about electricity and almost nothing is known about charge. Whenever we have E/M effects, the electricity, magnetism, and ions get a lot of attention, but no one knows that charge underlies and causes them all. In other words, it is photons that do everything, and the ions just respond to the photons.

This clarifies ion transport, because we simply have to remember that this field is saturated with photons, like every other field. Charge is everywhere, in everything. Ion transport is just a smaller section of the larger field, and it works just like the larger one, and for the same fundamental reasons. If the cell wants to transport  $K^+$  one way and  $Na^+$  the other way across the membrane, for example, the cell simply varies the density of the solute in those specific places. At that level of size (much smaller than the diameter of the phloem tube), any change in matter density, from any cause, will change the charge field. Anywhere you have more matter you have more charge, because more matter recycles more charge. Therefore any increase or decrease in solution or solute density—using any mechanism

and any atom—will create minor fluxes in potential across the membrane, and those fluxes will be extremely localized. This is the fundamental way the cell pulls needed ions across the membrane in either direction. Channels and carriers may be used as well, but they are secondary explanations, in that even these channels and carriers must be explained using the charge field.

So I have shown that charge is the Potassium pump both inside the phloem and outside. Charge is the pump of every ion and non-ion in the plant.

[http://books.google.com/books?id=9MgOdyQOEw4C&pg=PT342&lpg=PT342&dq=fensom+electro-osmosis&source=bl&ots=4aBBBFpgwy&sig=GVZEaw3f5NLXQmRSbPLJSowCzIM&hl=en&sa=X&ei=YP\\_8TtrwCKKRiAKcyfSMDQ&ved=0CDoQ6AEwAw#v=onepage&q=fensom%20electro-osmosis&f=false](http://books.google.com/books?id=9MgOdyQOEw4C&pg=PT342&lpg=PT342&dq=fensom+electro-osmosis&source=bl&ots=4aBBBFpgwy&sig=GVZEaw3f5NLXQmRSbPLJSowCzIM&hl=en&sa=X&ei=YP_8TtrwCKKRiAKcyfSMDQ&ved=0CDoQ6AEwAw#v=onepage&q=fensom%20electro-osmosis&f=false)

\*\*I will not bring anti-photons into this.