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Subject: Plants

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Hi ---

Not sure how to think about the neurobiology of plants. There is a robust bunch of literature on how plant cells are stressed, how they respond and how they build biological resilience along the way. Because they are sessile and can't just call their doc for a prescription, whatever they do has to be relatively simple and part of a very basic process that either displaces, overcomes, outdoes or modifies a stressor to make it manageable.

Plants don't have nerves per se but they have cells that behave in a similar way for similar purposes as our nerves. Plants do use what we call neurotransmitters catecholamines like dopamine and norepi- they have tons of acetylcholine and the same degradation pathways, and even the same glutamate pathways and receptors humans do. And, more.

Classes of movements are common to almost all plants, just as with humans. Darwin described them pretty well. Breakdown in these movement systems can look similar in humans - we just have more types of motion to deal with than plants ... like when we get dopamine deficient in Parkinson or atrophied alpha motor neurons in ALS. They have similar problems in their motor systems, and usually they overcome them if they can adapt to or beat the stressor.

Plants also have memory (used mostly for growth and reproduction) and some think different types of cognition too. While glutamate is a big player in that process, it isn't the only one. Some of the chemicals have also evolved to serve similar functions, including a lot of similarity in core function between chlorophyll and melanin. Chlorophyll serves to capture light and create energy, the core function require to sustain a sessile plant. Melanin becomes dopamine, which allows humans to move and somehow plays other more important roles that we don't yet understand as the melanocytes are derived from neural crest cells (high priced embryologic real estate...)

Stressors to motor or cognitive processes include(there are more):

- Water
- Sodium
- Temperature
- Heavy metals
- Pathogens (bugs)

Also, light is very toxic to roots and certain type of internal cells in vascular plants.

So can plants get Alzheimer-like protein aggregation diseases that slowly disrupt cognitive function to the point of death? Can they get disordered movement disorders like Parkinson where they lack a particular chemical or wasting diseases like ALS where their locomotion capacity is slowly diminished.

Yes, they do. And many more diseases too.

In the case of acidified soil, aluminum (normally not particularly bothersome unless in super high concentration) acts as a stressor in a very similar way to what we see in alzheimer pathology. Using metabolic pathways, root absorption of other elements, or even transfer of nutrients from root symbionts, plant cells that are not consumed by the stress can manage, adapt or clear the stressor. The pathology in a very specific part of the root appears very similar to plaques/tangles, as does the resulting behavior in plants.

In humans, there is no viable use for aluminum and toxicity has long been known. It is unlikely there is much concern on an environmental basis, but maybe. I think there is probably enough silica . silicates in our water to balance in out. But on a tiny scale, focused hits of aluminum can be very deadly and especially when they are in an acidic environment.

Recently, a common type of drug (PPI / proton pump inhibitor) taken for heartburn, acid reflux or peptic ulcers was correlated w Alzheimer (Sample from 74,000 people over age 75 from 2004-2011 in Germany). Specifically, patients on PPI are thought to have a 44% increased risk of dementia. But in my view the mechanism doesn't quite make sense - what does make sense is that patients with heartburn reflux or ulcers also take antacids. And the most common ingredient in antacids is aluminum. Not

just regular aluminum but straight to the most acidified part of the human body, so that the aluminum becomes quite reactive. Some of the aluminum will be uptaken by the bidirectional parasympathetics (vagal) and transported into the nervous system, but some of the aluminum will also pass through the gut and upset both the microbiome and the gut (enteric) nervous system as well. It doesn't take much and it doesn't even have to stay for very long, but if you are taking aluminum (or other active heavy metal) almost every day for many years, you will pay the price - even if your body can find a way to remove it pretty quickly. Meanwhile the inflammation in the cells will continue.

I do think there is a similar situation happening in the enteric nervous system that is the trigger for Parkinsons - which is why there are gastric, integumentary and gut symptoms very early and persistently throughout. My suspicion is that it affects either the microbiome and/or eventually the dopaminergic neurons of the gut. Over time, this will migrate up the vagus or along some melanin/dopaminergic pathway to make trouble. Whatever pathway that allowed the melanin to migrate to the brain the first place is allowing the stressor to follow, probably bound to some form of co-variable. MOre later on ALS.

But what do plants do, how do they do it and why aren't we doing it?

I've collected nearly 100 papers in the literature. We will have to connect all of the dots because none of the plant scientists are thinking about human science, and vice versa. Perhaps the most elegant experiments were done by Darwin himself.

Tonight I am curating the papers and putting them into a google drive that you can click on anytime.

I will try to make a file where you can upload documents to and send instructions in just a bit.

This is too elegant and simple but my guess is that it will get crushed by pharma and traditional science. Plus everyone who wants to class action lawsuit all of the antacid companies.

More in a bit.