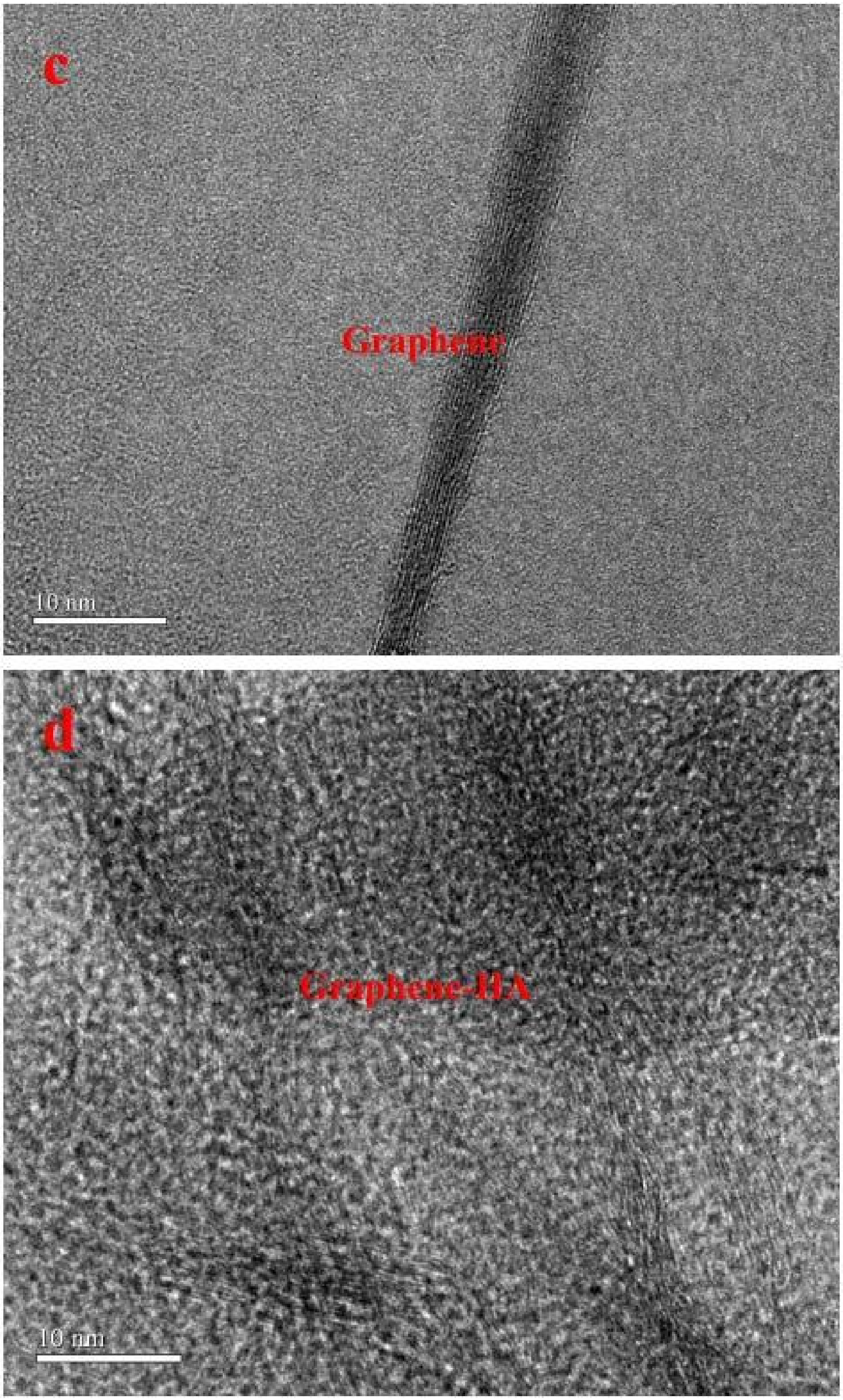

Figure S9. TEM images of graphene and graphene-HA. TEM, transmission electron microscope, HA, humic acid.

Image: Dissolution of Graphene Oxide by Humic Acid under electron microscope

Humic acid contains about 50% carbon and 40% oxygen. Other compositions include hydrogen (5%), nitrogen (3%), phosphorus, and sulfur (both at 1%). Humic acid is a very complex amalgamation of closely-related macromolecules and is developed in the process of decomposition of organic life.

When chelating the positively charged multivalent ions, humic acid leads to the uptake of these ions due to specific mechanisms, one of which includes preventing them from leaching through the soil. It can be used for soil improvement and detoxification as well as health benefits.

Humic acid detoxifies any soil of excessive, heavy metals. Extensive research has proved that these heavy metals can be locked up with the use of humic acid.

Please see this link:

Impact of humic/fulvic acid on the removal of heavy metals from aqueous solutions using nanomaterials: a review

Humic acid (HA) and fulvic acid (FA) exist ubiquitously in aquatic environments and have a variety of functional groups which allow them to complex with metal ions and interact with nanomaterials. These interactions can not only alter the environmental behavior of nanomaterials, but also influence the removal and transportation of heavy metals by nanomaterials.

Humic also has been studied in use in humans. I have used it in my office for years as it does improve mitochondrial function and helps detoxify the body. Since mitochondrial dysfunction is a cause of accelerated aging, improving mitochondrial energy production is key for all anti-aging efforts that are also important in treating vaccine injury and long Covid.

Here is the study link:

Effect of humic substances on mitochondrial respiration and oxidative phosphorylation

Humic Acid as an Antidote for Graphene in Plants

Humic acid acts as a natural antidote of graphene by regulating nanomaterial translocation and metabolic fluxes in vivo

Graphene-related research has intensified rapidly in a wide range of disciplines, but few studies have examined ecosystem risks, particularly phytotoxicity. This study revealed that graphene significantly inhibits the number of wheat roots and the biosynthesis of chlorophyll, and altered the morphology of shoots. Humic acid (HA), a ubiquitous form of natural organic matter, significantly ($P < 0.05$) relieved this phytotoxicity and recovered the sharp morphology of shoot tips. Both graphene and graphene–HA were transferred from wheat roots to shoots and were found in the cytoplasms and chloroplasts. **HA increased the disordered structure and surface negative charges, and reduced the aggregation of graphene. HA enhanced the storage of graphene in vacuoles, potentially indicating an effective detoxification path.** The content of cadaverine, alkane, glyconic acid, and aconitic acid was up-regulated by graphene, greatly contributing to the observed phytotoxicity. Conversely, inositol, phenylalanine, phthalic acid, and octadecanoic acid were up-regulated by graphene–HA. **The metabolic pathway analysis revealed that the direction of metabolic fluxes governed nanotoxicity. This work presents the innovative concept that HA acts as a natural**

antidote of graphene by regulating its translocation and metabolic fluxes *in vivo*.

One of the most concerning effects of the C19 injectables is the toxicity to the reproductive organs and the fetal malformations. Most physicians have so far believed that the cause is the spike protein. However some vials analyzed by researchers did not contain any mRNA or only defective RNA fragments. This would suggest, that other etiologies for reproductive toxicity could be involved. Toxic metal Nanoparticles, that have been found in C19 vials, have known reproductive toxicity.

Potential adverse effects of nanoparticles on the reproductive system

Previous studies have shown that numerous types of **NPs are able to pass certain biological barriers and exert toxic effects on crucial organs, such as the brain, liver, and kidney**. Only recently, attention has been directed toward the reproductive toxicity of nanomaterials. NPs can pass through the blood-testis barrier, placental barrier, and epithelial barrier, which protect reproductive tissues, and then accumulate in reproductive organs. **NP accumulation damages organs** (**testis, epididymis, ovary, and uterus**) **by destroying Sertoli cells, Leydig cells, and germ cells, causing reproductive organ dysfunction that adversely affects sperm quality, quantity, morphology, and motility or reduces the number of mature oocytes and disrupts primary and secondary follicular development.** In addition, NPs can disrupt the levels of secreted hormones, causing changes in sexual behavior. However, the current review primarily examines toxicological phenomena. **The molecular mechanisms involved in NP toxicity to the reproductive system are not fully understood, but possible mechanisms include oxidative stress, apoptosis, inflammation, and genotoxicity.**

Graphene Oxide has known reproductive toxicity. The decrease in this toxicity was evaluated in the embryonic development of Zebrafish.

Mitigation in Multiple Effects of Graphene Oxide Toxicity in Zebrafish Embryogenesis Driven by Humic Acid

During zebrafish embryogenesis, **GO induced a significant hatching delay and cardiac edema. The intensive interactions of GO with the**

chorion induces damage to chorion protuberances, excessive generation of •OH, and changes in protein secondary structure. In contrast, humic acid (HA), a ubiquitous form of NOM, significantly relieved the above adverse effects. HA reduced the interactions between GO and the chorion and mitigated chorion damage by regulating the morphology, structures, and surface negative charges of GO. HA also altered the uptake and deposition of GO and decreased the aggregation of GO in embryonic yolk cells and deep layer cells. Furthermore, **HA mitigated the mitochondrial damage and oxidative stress induced by GO.** This work reveals a feasible antidotal mechanism for GO in the presence of NOM and avoids overestimating the risks of GO in the natural environment.

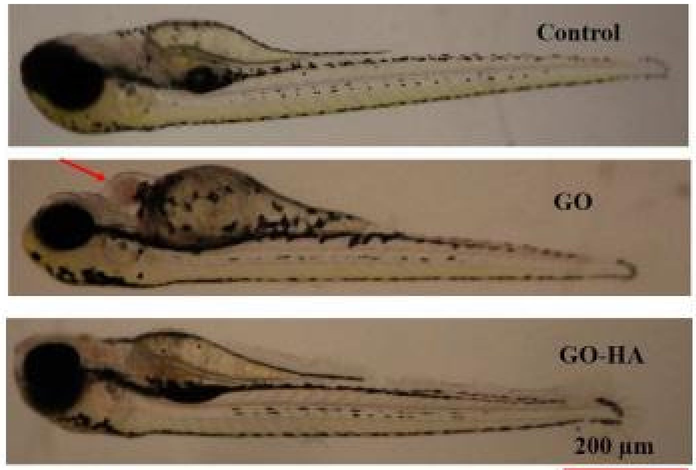

Figure S6. Representative images of malformed embryos. Red arrows denote pericardial edema. GO, graphene oxide at 100 mg/L; HA, humic acid at 10 mg/L.

Summary:

We are evaluating possible ways to dissolve Graphene and self assembly structures in the body. Studies have shown that Graphene Oxide toxicity can be improved in plants and animals via Humic and Fulvic Acid. This is an easy and safe supplement for people to take orally.

Other molecules that dissolve Graphene like EDTA chelation and unadulterated and uncontaminated Carbon 60 also should be considered and further evaluated. The fact that humic acid is able to help toxicity in embryogenesis is hopeful and should be further studied in the context of C19 injection toxicity in pregnancy.