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November 21, 2019

To: The United States House of Representatives Select Committee on Climate Crisis

Via Electronic Transmission: ClimateCrisisRFI@mail.house.gov

Re: The Salk Institute's Response to the House Select Committee on the Climate Crisis' Request for Information.

To the Honorable Members of the U.S. House of Representatives Select Committee on the Climate Crisis:

The Salk Institute for Biological Studies is an independent, non-profit, scientific research institute founded in 1960 by Jonas Salk, the developer of the polio vaccine. The Salk Institute brings leading researchers and scientists together to tackle the world's most pressing health problems including cancer, poor nutrition, and climate change. Salk's Harnessing Plants Initiative ("HPI") (http://www.Salk.edu/hpi) is a new scientific effort focusing on mitigating climate change through carbon capture and burial by plants. HPI is an innovative and scalable approach to fight climate change by optimizing a plant's natural ability to capture and store carbon and adapt to diverse climate change conditions. We believe our approach can draw down carbon dioxide (CO_2) and store much of it in soils. When combined with other global efforts to reduce atmospheric levels of CO_2, we believe plants can play a central and economically efficient role in efforts to mitigate the disastrous effects of climate change while simultaneously providing sustainable food, fuel and fiber for a growing population. We submit these comments and recommendations in response to the House Select Committee on the Climate Crisis Request for Information.

Salk's Harnessing Plants Initiative

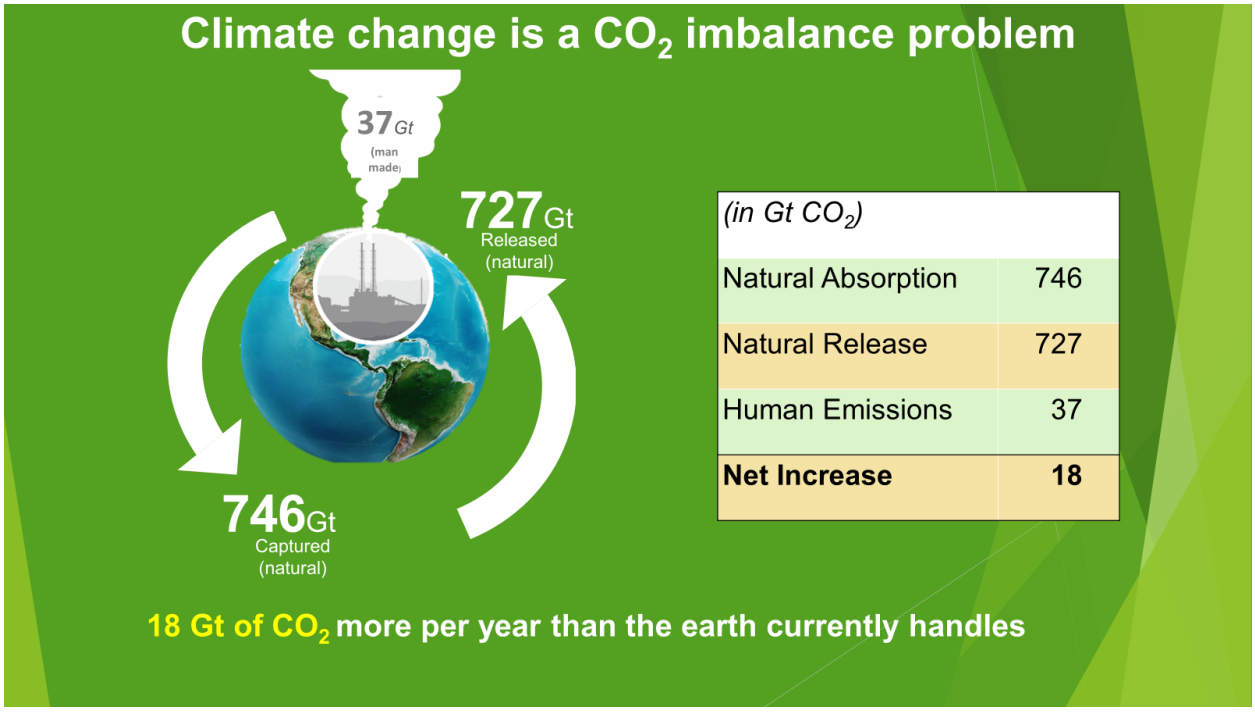
Salk's Harnessing Plants Initiative ("HPI") is a research and development program through which leading biologists and chemists in the fields of plant genetics and biochemistry are advancing processes to enhance the natural abilities of plants to store CO_2, transform them into efficient natural carbon storage devices, and deposit their carbon-rich molecules in soil, via root systems, as beneficial soil organic carbon (SOC). Salk's Harnessing Plants Initiative is comprised of three programs: CO_2 Removal on a Planetary Scale ("CRoPS"); Coastal Plant Restoration ("CPR"); and Plants for the Future.

1. Salk's CO_2 Removal on a Planetary Scale ("CRoPS") Program

Salk's CRoPS program received initial philanthropic funding through a $35M grant in the 2019 TED Audacious campaign (https://audaciousproject.org/ideas/2019/salk-institute-for-biological-studies). CRoPS is focused on improving soil carbon sequestration by leveraging plant genetics and biochemistry to discover better performing plant traits that are key to plant-based soil carbon sequestration. Once the traits are mastered, we plan to transfer them to the world's six most prevalent row crops (corn, soybean, wheat, rice, cotton, and canola) and the three most prevalent cover crops (radish, rye and clover). Once these Salk Ideal Plants™ progress from our lab and greenhouses through field trials they will be licensed and distributed to achieve global distribution and scale.

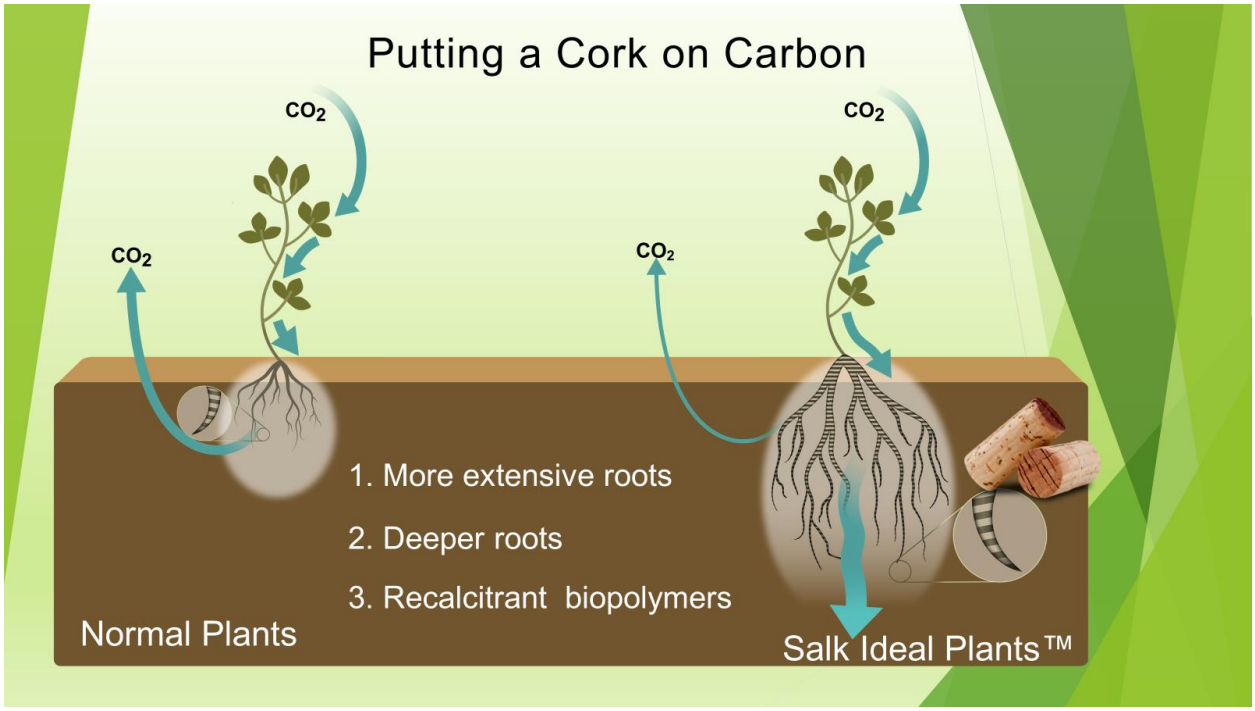
Our technology is referred to as a "negative emission technology" because it takes carbon out of the atmosphere. We expect our impact to be significant if deployed at scale: on the order of removing in the range of 3—8 Gigatons of the annual excess CO_2 in our atmosphere, which is approximately a 20%-46% reduction of the annual excess human

emissions. To put that into context, mankind is currently releasing approximately 18 Gigatons more CO_2 into the atmosphere than the earth naturally removes:

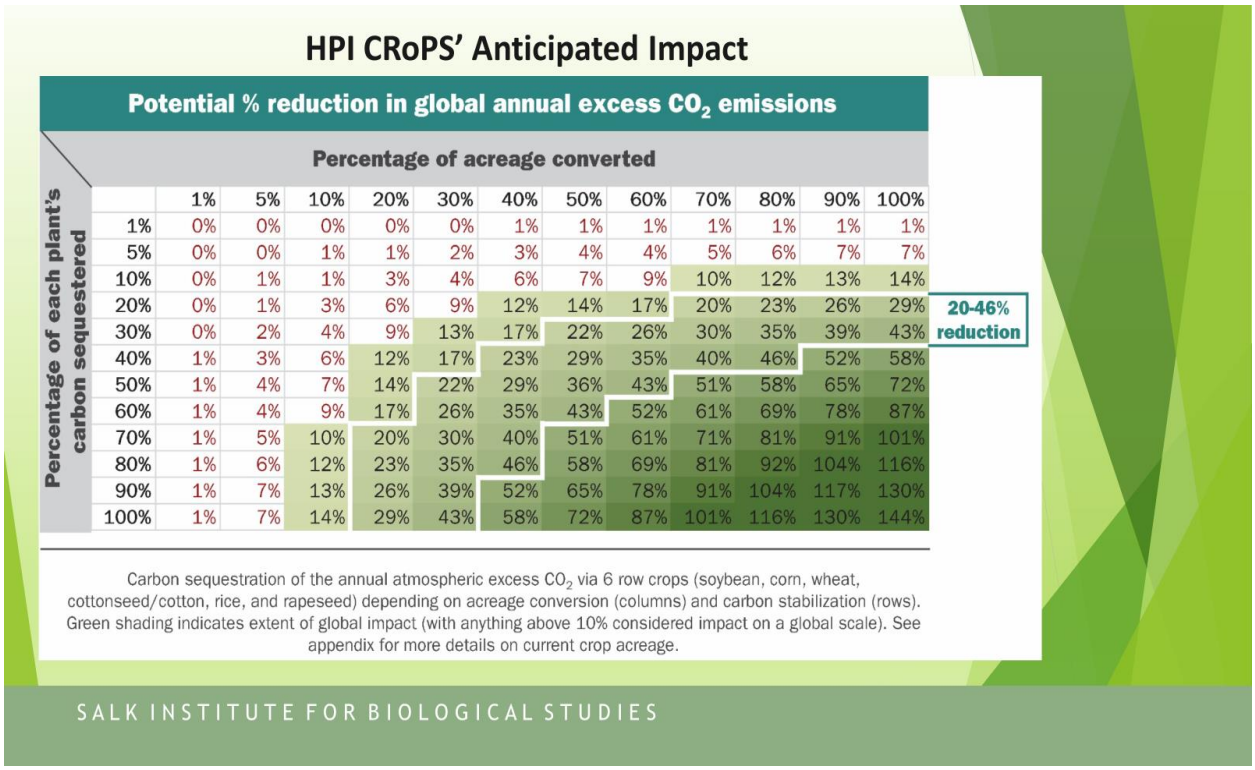


Salk Ideal Plants™ technology will extract CO_2 from the atmosphere by coaching plants, like the Olympic athletes that they are, to bury more carbon in soil for longer periods of time, via photosynthesis, enhanced root systems, and the synthesis of stable natural plant molecules. Normal plants 'breathe' in carbon dioxide and fix its carbon, but a large amount of that fixed carbon is seasonally released back into the atmosphere in the form of respiratory CO_2 as plants are consumed as food or dead plant tissues decay. Salk is discovering and utilizing natural plant genes that amplify root size, root depth, root mass, root suberin and other root polymers. Suberin is a long chain fatty acid polymer that exists in high concentrations in substances that are naturally resistant to decomposition like cork, cantaloupe rind, avocado peels, and potato peels. Suberin acts like a protective shield around plant roots, trunks and stems, is highly resistant to decomposition, and forms a significant fraction of healthy beneficial soil organic carbon ("SOC"). Larger root systems that are rich in carbon dense polymers like suberin are expected to enable plants to capture and store more carbon in soils, thus enriching soils with beneficial SOC while also serving as long term carbon sinks for tens to hundreds of years, or longer.

A graphic description of our Salk Ideal Plants™ looks like this:



Salk's anticipated impact can be visualized this way, where the Y axis is the percentage of additional available carbon stored by each plant and the X axis is the percentage of available acreage converted to Salk's plants. The percentages of the annual excess CO_2 that Salk Ideal Plants™ would remove from the atmosphere under these assumptions are depicted in the table below:



HPI CRoPS' Anticipated Impact

Potential % reduction in global annual excess CO_2 emissions

Percentage of each plant's carbon sequestered \ Percentage of acreage converted	1%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
1%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%
5%	0%	0%	1%	1%	2%	3%	4%	4%	5%	6%	7%	7%
10%	0%	1%	1%	3%	4%	6%	7%	9%	10%	12%	13%	14%
20%	0%	1%	3%	6%	9%	12%	14%	17%	20%	23%	26%	29%
30%	0%	2%	4%	9%	13%	17%	22%	26%	30%	35%	39%	43%
40%	1%	3%	6%	12%	17%	23%	29%	35%	40%	46%	52%	58%
50%	1%	4%	7%	14%	22%	29%	36%	43%	51%	58%	65%	72%
60%	1%	4%	9%	17%	26%	35%	43%	52%	61%	69%	78%	87%
70%	1%	5%	10%	20%	30%	40%	51%	61%	71%	81%	91%	101%
80%	1%	6%	12%	23%	35%	46%	58%	69%	81%	92%	104%	116%
90%	1%	7%	13%	26%	39%	52%	65%	78%	91%	104%	117%	130%
100%	1%	7%	14%	29%	43%	58%	72%	87%	101%	116%	130%	144%

20-46% reduction

Carbon sequestration of the annual atmospheric excess CO_2 via 6 row crops (soybean, corn, wheat, cottonseed/cotton, rice, and rapeseed) depending on acreage conversion (columns) and carbon stabilization (rows). Green shading indicates extent of global impact (with anything above 10% considered impact on a global scale). See appendix for more details on current crop acreage.

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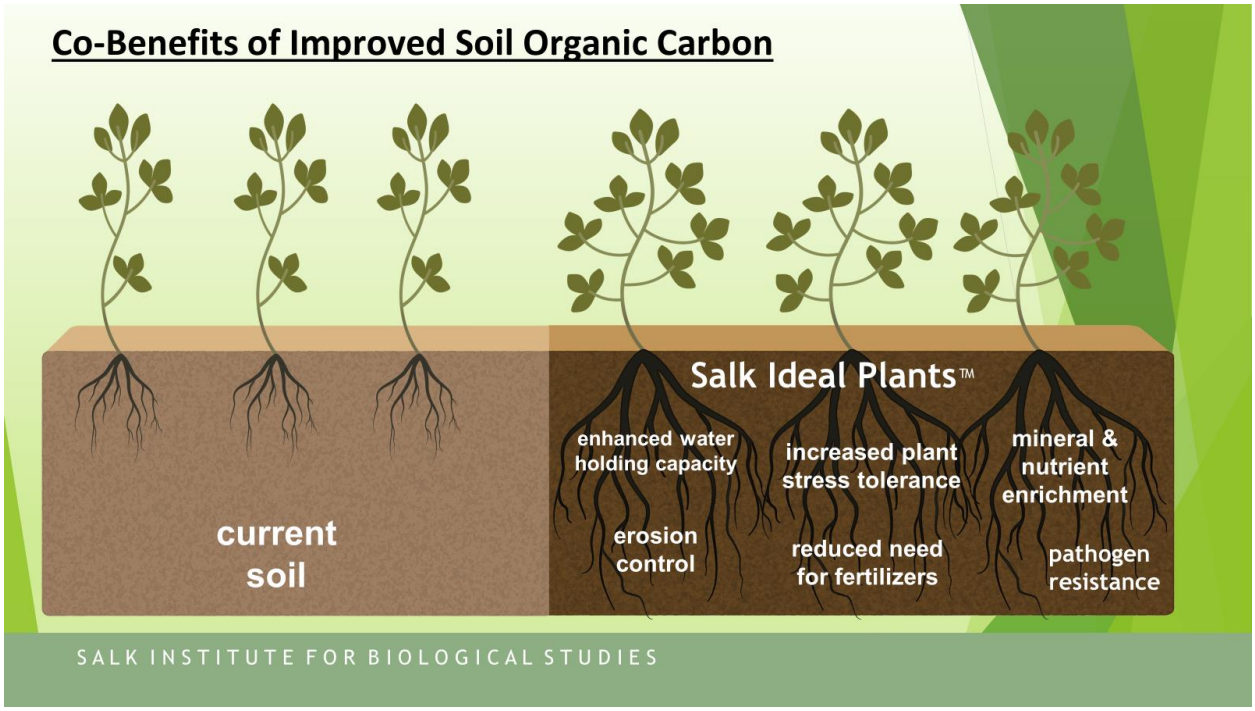
A significant economic co-benefit of the CRoPS program is improved soil health, and the resulting improved agricultural productivity for arable land that is richer in SOC and better at retaining water, requires fewer fertilizer and nutrient inputs and has better microbial life. Deeper, massive suberized roots are also expected to significantly improve plant stress tolerance, resulting in consistent productivity gains during drought, flood and plant disease outbreaks. The co-benefits are visually depicted this way:

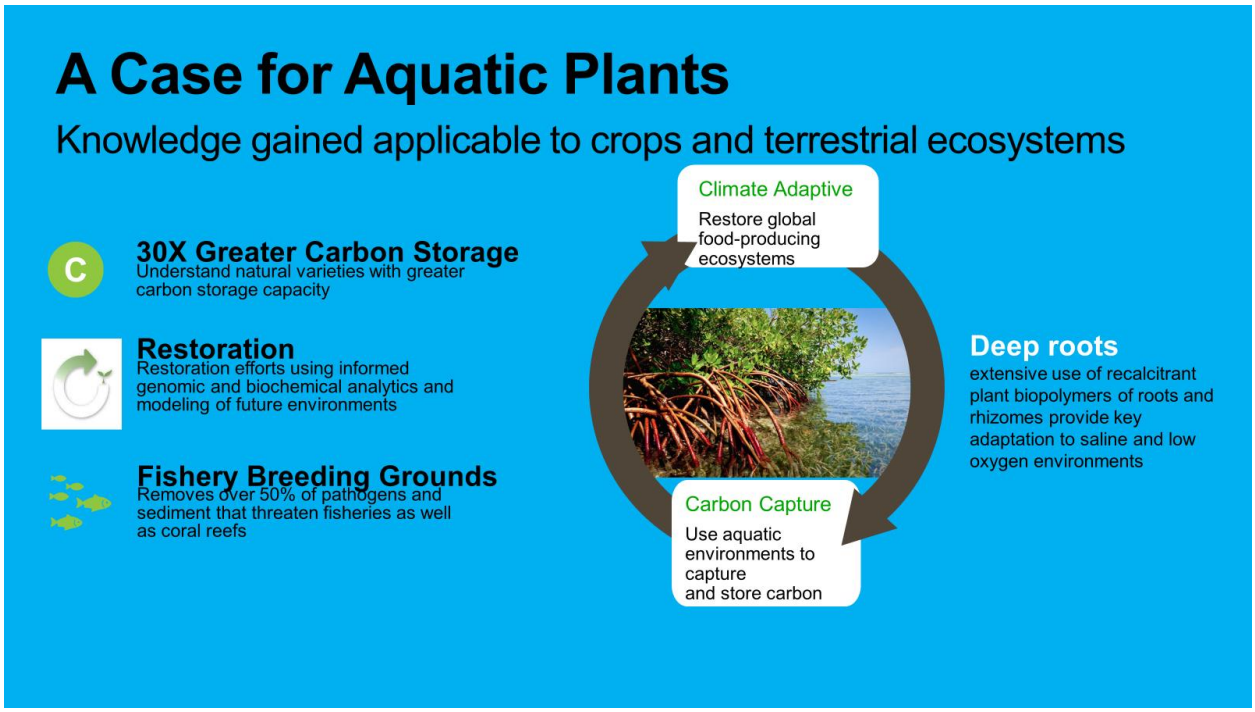


Salk's CroPS program, therefore, simultaneously addresses both (1) climate change, by sequestering more carbon from the atmosphere, keeping our global temperature from rising; and (2) food security and sustainability by producing the trillions of calories that will be required by a population expected to reach 10B by 2050, through better agricultural yields per hectare while minimizing the resources, water, fertilizer and pesticides required to produce that food.

We expect Salk's CRoPS program to begin making a significant impact on climate change within 15 years as we reach significant distribution scale—just in time to make a difference before the climate crisis is projected by the Intergovernmental Panel on Climate Change to become beyond our control. Our time line is as follows:

2. The Salk HPI Coastal Plant Restoration ("CPR") Program

Salk's second HPI program focuses on the genetically informed restoration and preservation of the world's coastal wetlands, which has an even greater capacity than terrestrial soils to stably store carbon for a sufficiently permanent period of time. This program is called Coastal Plant Restoration ("CPR") and focuses on the restoration of coastal wetlands using genomics and biochemistry to map the pangenome of our native plant species and varieties across salt, brackish and fresh water environments and then select the plants that have the optimal capacity to stabilize eroding and disappearing wetlands, while simultaneously storing more carbon, protecting productive fisheries and other economically beneficial ecosystem services most closely associated with neighboring agricultural land. These co-benefits include rapid sedimentation and bioremediation of soil, pesticide and fertilizer laden runoff. A graphic depicting our CPR program is as follows:



Project Drawdown (https://www.drawdown.org/) defines coastal wetlands as the legal protection of carbon-rich mangroves, seagrasses, and saltmarshes, leading to reduced degradation rates and the safeguarding of carbon sinks while stabilizing and in many cases rebuilding land. This additional co-benefit is particularly important as our coastlines experience unprecedented sea level rise. Unlike most terrestrial ecosystems, coastal and inland wetlands continue sequestering carbon for centuries without becoming saturated. As a result, they have accumulated vast stores of carbon, making their global significance high. Unfortunately, as these ecosystems are lost due to changes in water levels and warming temperatures or replaced for other uses, including coastal development and agriculture, their immense centuries old stores of carbon are rapidly released in the form of the potent greenhouse gases CO_2 and methane further exacerbating the climate crisis and preventing future sequestration. The Salk CPR coastal wetlands solution proposes to identify and deploy the optimal and native wetland plants by selecting the best performing genotypes and phenotypes suitable for specific geographies and the future conditions these geographical regions will experience. Protecting and increasing this "Blue Carbon" is a critical objective for the world to meet its climate goals.

3. <u>The Salk HPI Plants for the Future Program</u>

The third program under the HPI umbrella is called Plants for the Future, and will focus on crops and native plant communities that are highly adapted to an increasingly hostile climate, characterized by drought, heat, flooding and other natural extreme weather events.

<u>House Select Committee on Climate Crisis Opportunities to Advance Technologies Like Salk's HPI CRoPS and CPR Programs with Direct Funding and Policy Implementation Promoting Carbon Sequestration</u>

There are several HPI oriented research and development investment and policy implementation opportunities that will advance the goal of limiting global warming to no more than 1.5°C above pre-industrial levels by mid-century. These include (i) direct grant funding for additional plant biology and genetics research and development at world-class research institutes like The Salk Institute; (ii) funding for soil carbon assessment trials through land-grant universities and/or other institutions and entities that are highly integrated with the U.S. Department of Agriculture's National Resource Conservation Service; and (iii) funding for Soil Health Demonstration Trials, which have the parallel focus of measuring improvements to soil health and associated agricultural productivity attributable to additional soil organic carbon material in our soils.

Note is made of a new bill introduced on November 4, 2019 to create the Advanced Research Projects Agency—Terra ("ARPA—Terra") which would create a new agency at the U.S. Department of Agriculture to invest in innovative agricultural technologies that increase economic opportunities for farmers, ranchers and rural communities. Please see: https://www.bennet.senate.gov/public/_cache/files/9/3/9363a3b7-bbf4-4478-8405-151aac3e7065/259FF435A8FBA50112F9011E226A07A0.elt19188.pdf. According to a press release from U.S. Senator Michael Bennett from Colorado "ARPA-Terra utilizes the proven ARPA model that has facilitated the success of federally funded research and development programs like DARPA and ARPA-E, and builds on the Agriculture ARDA (AGARDA) pilot program that was authorized in the 2018 Farm Bill." The release goes on to say "ARPA-Terra would

provide competitive funding to land-grant universities for early stage research on technologies that industry might not undertake due to the long-term and high-risk technological barriers that exist. The agency will enable the United States to develop technologies—and put them into the hands of farmers and ranchers—to enhance export competitiveness, environmental sustainability, and crop resilience to extreme weather." ARPA-Terra, if it is created and funded, would be an ideal mechanism to encourage and fund the crucial projects described here:

1. **Grant Funding to Support Basic Genetics Research and Development for Carbon Sequestering Plants and Crops Focused on Carbon Sequestration and Food Security**

Salk urges Congress to allocate additional direct grant research funding to programs and entities engaged in the fundamental research required to improve plant biology and genetics with a focus on solving the climate crisis. The Salk Institute was fortunate to receive initial philanthropic pledge funding of $35M in 2019 from the TED Audacious program. However, with additional resources, research and development programs could be significantly accelerated by working collaboratively and in parallel on discovering and translating the fundamental genetic and biochemical processes in plants that regulate their climate adaptive and carbon sequestering traits. Salk's first priority is to transfer these traits to the world's most prevalent row and cover crops, but Salk's plant biology solutions will likely be equally applicable to any and all plant life on earth, including trees, grazing grasses, prairie grasses, and wetlands plants. Unlocking additional direct grant funding for this fundamental biology and genetics-based research will accelerate the development and deployment of these technologies to our target and additional plant communities.

2. **Funding for Soil Carbon Measurement Development and Field Trials**

A key requirement for a plant-biology agricultural solution to enhanced carbon sequestration is the measurement, reporting, and validation of the additional carbon stored in soil attributable to the technology, ("MRV"). The amount of additional carbon added to soil and the permanence of that carbon storage ("additionality" and "permanence") must be assessed, standardized and reported in a way that is scientifically sound and widely accepted by regulators, carbon registries and the commercial world including traders, investors, and purchasers of carbon offset credits. As carbon markets mature, and new "Cap and Trade" and voluntary compliance carbon offset markets develop, scientists, economists and investors will require widely tested and accepted methods and protocols for the measurement, reporting and validations of additional soil carbon and its projected longevity in soil. For example, in due course we expect that farmers will be able to sell carbon credits into an open market for the additional carbon stored in their fields attributable to Salk's Ideal Plants™. However, to make that market work, there must be faith in the measurement protocols.

The U.S. Department of Agriculture's National Conservation Resource Service ("NCRS") may have a leading role to develop and/or approve the measurement tools and protocols to assess the additional carbon stored in soil. Likewise, universities, private companies and other entities should be encouraged and incentivized to develop these required protocols, deploy emerging technologies and set standards that will be globally accepted. The opportunities for innovation based public/private partnerships are ripe.

Salk's CRoPS program intends to conduct field trials to collect the necessary data proving soil carbon contributions attributable to its Salk Ideal Plants™, and to support the required regulatory approval packages that will establish that Salk's Ideal Plants™ are safe for the environment (EPA), safe for soils and other plants (USDA-APHIS), and are safe for human and animal consumption (FDA). These field trials will occur across a geographically diverse array of soil and climactic conditions and will measure the amount of additional soil organic carbon material attributable to Salk's Ideal Plants™. Field trials are likely to be carried out with land-grant universities with highly developed agricultural science programs and with private entities who have available farmland. Incentive funding, encouragement and

support for these field trials are critical to advance our climate change goals and the roll out of carbon sequestering crops like Salk's.

3. **Funding for Soil Health Demonstration Trials**

Soil Health Demonstration Trials ("Demonstration Trials") may be distinct from Soil Organic Carbon field trials. The latter may be narrowly focused on the amount of additional carbon stored in soil and for how long. Soil Health Demonstration Trials may more broadly assess the associated soil health improvements, advantages and risks associated with additional soil organic carbon.

In addition to technologies like Salk's, regenerative agriculture practices like no-till farming and soil carbon addition are known to result in healthier soils in terms of water retention, increased microbial life, and the need for less nutrient and fertilizer inputs. See comments from Nobel Prize winner Dr. Rattan Lal, PhD of The Ohio State University and Former Vice President Al Gore at https://www.bloomberg.com/news/articles/2019-10-30/al-gore-says-regenerative-farming-can-help-slow-climate-change

Soil Health Demonstration Trials focused on improvements directly attributable to Salk's Ideal Plants™ will provide data to assess the success of Salk's HPI CRoPS program with regard to its food security and stability co-benefits. One example for Congress to consider is Section 2307(c)(7) of the "Agricultural Improvement Act of 2018" which allocates current grant funding for Soil Health Demonstration Trials to promote healthier soil and a healthier climate through projects that measure additional SOC storage. This Demonstration Trials will leverage federal and state research by providing federal USDA Natural Resources Conservation Service incentives to assist willing farmers in a diverse set of states to assess baseline SOC conditions, implement practices to improve SOC sequestration, and measure the associated sequestration benefits. The Demonstration Trials will also provide valuable information to the USDA's Rapid Assessment of U.S. Soil Carbon (RaCA), which is a program created by the USDA-NRCS Soil Science Division in 2010 to develop quantitative estimates of soil carbon stock distribution for the nation's soils under different land cover and agricultural management practices. The Demonstration Trials will provide valuable data to RaCA through their focus on measuring existing SOC, extending agricultural management practices that would sequester carbon, and measuring and extrapolating the benefits of those practices. According to the testimony from the USDA in support of the Demonstration Trials, their vision is to facilitate continued development of a Soil Organic Carbon Conservation Activity Plan (SOC CAP) embodying carbon sequestration measurement and modeling protocols accepted by climate market validators which are intended to reward carbon performance on farms.

4. Combinatorial Field Trials Involving Complementary Negative Emission Technologies with Salk's Ideal Plants™

Proposals are being considered to test a combination of soil additives that independently may improve soil carbon sequestration. For example, evaluations of "enhanced weathering" are occurring in which milled crushed rock powders are worked into soil to assess their ability to improve soil carbon sequestration and recalcitrance. Salk envisions such combinatorial field trials including combining enhanced weathering techniques with Salk's Ideal Plants™ to assess logarithmic improvements and increases to soil carbon sequestration. Please see: https://www.drawdown.org/solutions/coming-attractions/enhanced-weathering-minerals; http://lawr.ucdavis.edu/people/faculty/houlton-benjamin; https://www.researchgate.net/scientific-contributions/14774111_Benjamin_Z_Houlton

5. Tax Credit Policy and Implementation for Carbon Dioxide Sequestration

In 2005 Congress created the Carbon Dioxide Sequestration Tax Credit (Section 45Q) and made significant changes to the law as part of the "Bipartisan Budget Act of 2018." The new law provides a $10 per metric ton tax credit for qualified carbon oxide which is utilized by the taxpayer (section 45Q(a)(2)(ii))). Qualified carbon oxide means, in the case of a direct air capture facility, any carbon dioxide which is captured directly from the ambient air, and is measured at the source of capture and verified at the point of disposal, injection or utilization (section 45Q(c)(1)(C)(i) and (ii))). A direct air capture facility means any facility which uses carbon capture equipment to capture carbon dioxide directly from the ambient air (section 45Q(e)(1)(A)), but shall not include any facility that captures carbon dioxide using natural photosynthesis (section 45Q(e)(B))). Utilization of qualified carbon dioxide means the fixation of such qualified carbon dioxide through photosynthesis or chemosynthesis, such as through the growing of algae or bacteria, the chemical conversion of such qualified carbon dioxide to a material or chemical compound in which such qualified carbon dioxide is securely stored, or the use of such qualified carbon oxide for any other purpose for which a commercial market exists (with the exception of use as a tertiary injectant in a qualified enhanced oil or natural gas recovery project), as determined by the Secretary (section 45Q(f)(5)(A)(i), (ii), and (iii)).

I.R.S. section 45Q makes a distinction for technology that captures carbon dioxide from the ambient air. It does not include a facility that "captures carbon dioxide using natural photosynthesis," but it does include a facility that utilizes a process where there is "fixation of qualified carbon through photosynthesis or chemosynthesis, such as through the growing of algae or bacteria." Salk believes the language of the statute recognizes that plants are natural carbon storage devices, but that the I.R.S. wanted to distinguish taxpayers utilizing a new carbon capture technology from those where no new technology is applied. Salk submitted a formal comment to the I.R.S. offering the view that, for example, while a taxpayer should not be able to claim the tax credit on a new stand of trees if no additional carbon capture process or technology is utilized, when a new technology is used that follows section 45Q(f)(5)(A)(i) and utilizes photosynthesis, algae production or enhanced plant biology solutions like Salk's, it should qualify for the tax credit. Salk specifically recommended that the IRS regulations include language in the definition of a direct air capture facility that would encompass HPI because it is utilizing qualifying photosynthesis that exploits the natural ability of plants to carry out chemosynthesis to process and store carbon in recalcitrant, soil enhancing forms contemplated in section 45Q(f)(5)(A)(i). To promote development and usage of this beneficial methodology, the regulations should include a definition of a "direct air capture facility" that would allow technologies that utilize a process described in Section 45Q(f)(5)(A)(i) to qualify. Similar to algae, which can be grown in fields as part of algae ponds, Salk's CRoPS program and Salk's Ideal Plants™ would ideally be used by row and cover crops on defined acreages of land. We recommended a definition of facility that would include the area over which carbon capture is taking place, which would be flexible enough to accommodate algae, and would include the Salk Ideal Plant™.

We believe further guidance is needed on the boundaries for lifecycle emissions to determine displacement of carbon dioxide. Displacement occurs with HPI not only when carbon dioxide is captured through the plant's natural breathing in of carbon dioxide, but also when the plant's carbon is transformed into natural chemical forms recalcitrant to decomposition, meaning, structures that are fixed more stably and for longer periods of time as SOC. Therefore, a smaller percentage of the plant's fixed carbon is ultimately emitted back into the atmosphere resulting in a net drawdown of atmospheric carbon dioxide. We recommended that lifecycle emissions include the entirety of the organism's lifecycle from capture of carbon dioxide to the prevention of the release of carbon dioxide back into the atmosphere upon decomposition.

6. **Grant Funding for Informed Restoration of the World's Coastal Wetlands**

Congress should consider increasing direct funding for the basic research required to improve our knowledge of the biology and chemistry for the informed restoration of our wetlands, including inland waterways, coastal marshes and their intersection with fisheries and agriculture. Our wetlands in the United States have undergone significant degradation in nearly every region from north to south and east to west, leading to erosion, land loss poisoning of our water supply, significant greenhouse gas emissions, and exacerbated coastal flooding and population displacement. Salk's CPR program has the aim to restore our wetlands in a manner informed by genomics to solve for optimal land preservation, water purification, and carbon sequestration in these vast carbon sinks known as "Blue Carbon". Increasing National Science Foundation (NSF), National Institute of Health (NIH), National Oceanic and Atmospheric Administration (NOAA), and United States Department of Agriculture grants and other incentive programs will enable and accelerate this critical work, thereby saving billions to trillions of dollars that will be spent on increasingly frequent weather associated natural disasters that negatively impact the economic viability of displaced populations and our food supply.

Additional Responses to Questions Posed by House Select Committee on Climate Crisis Request for Information

1. Carbon-Cutting Policies

a. Carbon Pricing: Salk believes that carbon pricing is an essential tool in any national climate action plan to meet or exceed net zero by mid-century, while also minimizing impacts to low-and middle-income families, creating family-sustaining jobs, and advancing environmental justice. Salk's discussions with industry representatives across multiple sectors, including the oil and gas industry and the agricultural seed industry, leads us to the concern that significant investments will not be made unless and until there is a price signal on carbon. Once business understands and reliably quantifies the value of a tradeable metric ton of carbon, and viable stable markets exist in which to purchase and sell carbon credits, investments will likely be made that accelerate technologies and practices designed to sequester more atmospheric carbon.

b. Innovation:

i. Focus of Innovation: Congress should focus its innovation agenda on agriculture and plant biology for climate solutions. Natural photosynthesis is the most elegant and efficient tool at our disposal to reduce the levels of atmospheric CO_2. Nature is our best ally in solving the climate crisis because it already functions as a "negative emission technology", requiring only our help to super-charge the process through scientific innovation, leveraging the Green Revolution in plant biology and genetics over the last fifty years. Why is this possible now? Because advances in science have permitted molecular biology to intersect with plant breeding. In the 1980s we experienced the molecular genetics revolution, followed in the 2000s by marked advances in our understanding of genomics. By 2010 those technologies were merging to yield the precision breeding and genome editing technologies at our disposal today. Congress may act to advance these innovations and translate them into the technology that will play a significant role in solving our existential climate crisis.

ii. Incentivizing More Public-Private Partnerships and Encouraging More Private Investment in Innovation: The success of Salk's CRoPS program will depend on two primary factors: (1) the effectiveness of Salk's Ideal Plants™ at sequestering more carbon; and (2) scalability, meaning how many acres can we cover with Salk's Ideal Plants™? We believe we will achieve scale by working with the global agriculture and seed industries to multiply and distribute our Salk's row and cover crop seeds. The agriculture industry will also play a leading role in the regulatory process, and the necessary socialization and education for the farming community about the primary and co-benefit advantages of enhanced carbon sequestering crops. Public-private partnerships will be essential to our success. For example, we anticipate engaging with at least the present four largest agricultural crop seed

companies (Bayer/Monsanto, Syngenta/Chem China, BASF, and Corteva (Dow/Dupont Pioneer) which collectively supply approximately 60% of the world's seed distribution business, to multiply and distribute our seeds. We also anticipate partnering with and relying on the United Nations and Non-Governmental Organizations (NGO's) to reach the developing world and small farm-holders. Congress should consider the 2022 Farm Bill and earlier opportunities to work with and incentivize the private agricultural seed industry to adopt, market, and distribute Salk's carbon sequestering improved crop seeds and similar technologies, on a cost-effective basis, to accelerate and ensure their uptake, implementation and climate mitigation results. Congress should further incentivize private industry to philanthropically support, or invest in, emerging technologies like Salk's Ideal Plants™ to accelerate progress with respect to the scope of plants to which Salk's plant biology can be transferred such as additional crops, grasses and aquatic plants, and the pace at which they can be field tested, approved from a regulatory perspective, and distributed on a worldwide scale.

2. Agriculture:

a. The Farming Community and the Commercial Agriculture Seed Industry: The farming community and the world's largest agricultural seed companies are integral to the success of Salk's CRoPS program. In addition to policies addressing complementary solutions like Bio-Energy with Carbon Capture (BECCs) and the reduction of methane emissions associated with the cattle and livestock industry, Congress should consider adopting economic policies that accelerate research and development of technologies like Salk's CroPS and CPR programs, and that incentivize or require their uptake, implementation and adoption. The policies may be based on sound economic positive incentives, as well as penalties and tax consequences, to encourage the farming community and agricultural seed industry to act in a manner that maximizes the climate change mitigation goals that are within their unique sphere of influence and control. Government economic policy should be employed to ensure that the United States' greater interests in mitigating climate change are elevated over private profit oriented, shareholder driven, businesses interests, as we race towards the existential threats predicted for mid-century.

b. The NGO and International Community: The global seed industry controls approximately 60% of the global agricultural crop seed distribution. The other 40% is largely in the developing world where small farm holders run family farms and plots. Economics may not justify the global commercial seed industry serving the small farm-holder market, where the void is taken up by NGOs and entities like the United Nations' World Food Program. Congress should consider policies and methods that encourage these organizations to educate their constituencies and distribute technologies like Salk's Ideal Plant™ seeds to the developing world farming community, and to help them measure and assess the carbon sequestration and food security benefits of Salk's technology. Ultimately, leadership and success in the United States will likely be the model for the world.

3. Oceans, Forestry and Public Lands

Congress should consider policies that advance programs like Salk's CPR program. Economic incentives should be considered and implemented to encourage the required fundamental research to inform the restoration of our wetlands with plant species that are fine-tuned and optimized to both sequester more carbon for longer periods of time in a stable form, and that preserve our wetlands and their associated fisheries and natural filters for producing clean water. The former will advance our climate crisis carbon mitigation goals, and the latter will help impacted regions survive extreme weather events by keeping wetlands intact as a buffer to inhabited areas, and protect the fisheries, oyster beds and shrimping grounds that provide significant food resources to supply an ever-growing global demand.

4. Carbon Removal: Salk believes that once our Salk Ideal Plants™ are developed and tested, they will be dramatically less expensive to deploy and enormously more effective in reducing our annual excess atmospheric carbon dioxide compared to other negative emission technologies. Deploying technologies like Salk's will enable the U.S. (and the world) to meet our 2050 decarbonization goals. Government can and should play a key role in policy making that addresses the needs. Specific suggestions include:

a. Fundamental Plant Biology and Genetics Research: Direct additional grant funding to Salk and others similarly situated to advance our genetic and biochemical understanding and command of the pathways that control plant root depth, plant root mass, and plant polymers like suberin which act as a safe, natural, carbon storage devices for the long term in soil.

b. Soil Carbon Measurement: Tool and protocol development for the measurement of soil carbon including existing baselines by geographic regions, and the additional soil carbon added by technologies like Salk's Ideal Plants. This should include an assessment and implementation of protocols and the technology tools available including remote sensor and drone or satellite-based technology.

c. Soil Health Measurement: Tool and protocol development for the measurement of soil health and productivity of fields growing plants like Salk's Ideal Plants™.

d. Regulatory Approvals**:** Rapid and efficient regulatory reviews of new seeds, plant and seed trait packages by the United States Department of Agriculture's Animal and Plant Health Inspection Service, the U.S. Environmental Protection Agency, and the U.S. Food and Drug Administration.

e. Scaling Incentives: Incentives to commercial agricultural seed companies to in-license this emerging technology on appropriate terms, and to subsequently accelerate the adoption and planting of this technology to the farming community at-large on favorable terms that encourage farmers to plant environmentally supportive regenerative agriculture plants.

5. **International:** It is important that the United States take a leadership role on the issues described above, to encourage the world's largest agricultural seed industry companies to accept, adopt, market, and distribute regenerative agriculture technologies, educate the farming community about their advantages, and work to achieve as close to global hectare coverage with plant biology-based solutions as possible.

The Salk Institute thanks the House of Representatives for inviting and considering these comments responding to the Select Committee on Climate Change Request for Information. We are willing and would be grateful to meet with members and staff on the Select Committee at your convenience.

With best regards,

Kim Witmer
Senior Vice President, Finance and Administration
The Salk Institute for Biological Studies