Testimony of
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Chairman Franklin, Ranking Member Amo and members of the Environment Subcommittee of the Science, Space and Technology Committee, thank you for inviting me here today.

I am here representing Corteva, a world-leading pure-play seed and crop protection company, headquartered in Indiana.

I oversee all aspects of digital enablement and artificial intelligence for research and development at Corteva, and I'm also proud to be part of a family that operates a fourth-generation corn and soybean farm in Lordstown, a small town in Northeast Ohio.

Let me start with a fact that too few people appreciate: innovation lies at the heart of modern agriculture.

Innovation is Critical to American Leadership in Agriculture

American farmers are the most productive in the world, and provide a food supply that is abundant, affordable and among the world's safest. The food they produce is part of a complex, global system that helps feed not only 330 million Americans, but also more than eight billion people around the world.

This remarkable achievement is made even more extraordinary when you consider that our farmers have done this despite the historic storms, floods, droughts and heat waves of recent years: in fact, American farmers produce 300% more per acre today than they did 70 years ago, allowing greater production from a smaller footprint, which in turn delivers significant energy, biodiversity and environmental benefits.

This is a great American success story – and like many such stories, it has innovation at its heart. Agricultural innovation, including that brought to market by our company, Corteva, encompasses everything from more drought-resistant seeds to insecticides that better protect the environment while still ridding crops of damaging pests.

Agricultural innovations take decades of research and testing and hundreds of millions of dollars of investment to bring to market. For example, a single crop protection product takes an average of 13 years to deliver, a biotech trait takes almost 16 years and a new

seed product can take seven years. As the joint pressures of a growing population and a changing environment add to the already-significant demands on American agriculture, we need to increase both our investment in innovation and its speed to market.

Today, I'd like to talk about how artificial intelligence can accelerate innovation, and in doing so, cement American leadership for generations to come.

We believe innovation will become more important in the future than it is today, because the world is adding more people – nearly two billion more by 2050 – but we are not adding more farmland. Today, while more than half[1] of America's land is used for agricultural production, much of this land is also in high demand for housing and other competing needs.

At the same time, crops are getting harder to grow as extreme and changing weather patterns place farmers against new and rising insect, disease and weed pressures. The United Nations estimates that up to 40 percent[2] of global crop production is lost annually due to these pests. Imagine the losses if technology cannot keep pace with these new challenges.

As humanity has countless times in the past, at Corteva we believe we will find an answer. And we believe that answer is technology.

That's why, as a company, we invest nearly $4 million in research and development every day to unlock the latest game-changing tools – from gene editing to hybrid wheat to biologicals and new crop protection products.

Artificial intelligence is already playing an important role in three distinct ways:

- First, in discovery.
- Second, in product development and manufacturing.
- And, third, in helping farmers know when and how to use our products to maximize productivity.

Let me go through each of these steps.

[1] Ag and Food Statistics: Charting the Essentials - Land and Natural Resources | Economic Research Service
[2] https://www.fao.org/plant-production-protection/about/en#:~:text=Sustainable%20plant%20pest%20and%20disease%20management&text=Every%20year%2C%20up%20to%2040%20percent%20of%20crops%20are%20lost,race%204%20and%20wheat%20rust.

Artificial Intelligence: Transforming Discovery

Discovery is the process by which scientists identify new technologies that can be turned into products used on the farm. For seeds, this might mean improving a plant's genetics – resulting in healthier crops that can better withstand pest, disease and other environmental pressures. For crop protection, this might mean finding new molecules that can effectively and safely control weeds, insects, and diseases that harm crops.

Let me underscore here how hard it is, even with thousands of brilliant scientists at our disposal, to discover a new crop protection molecule. And that's because we might think of a crop protection molecule as a key, and that key is intended to fit a very specific target site in pests – typically a particular protein – locking it and eliminating the pest.

The first challenge is that we do not always know all the locks, or proteins, or how they work. So, we cannot know what to target. Historically, it has taken many months and often tens of thousands of dollars to understand the structure of a single protein. And there can be tens of thousands of proteins in each individual pest.

This explains why, historically, discovery has largely been a game of chance.

Let's start with the locks – the proteins.

For nearly a quarter of a century, computer scientists and mathematicians have been trying to develop models to predict the structure of proteins, but with limited success. However, in the past few years, a new class of AI models has changed this. Just like ChatGPT allows computers to process sequences of words to create new text, similar models have been adapted to process sequences of DNA data to create protein structures.

These models are now able to predict protein structures with a level of accuracy on par with laboratory methods, which is one reason their inventors were awarded the 2024 Nobel Prize in Chemistry.

Our teams at Corteva, with our partners at Nvidia, have recently worked to optimize versions of these models, enabling us to predict the structure of proteins in seconds and for a few pennies, as opposed to months in the laboratory and for many thousands of dollars.

Mapping the structure of proteins helps us understand which key we need, and where it needs to go for it to work effectively.

Now let's turn to those keys – the crop protection molecules we develop for farmers.

Not that long ago, we had to rely on screening many thousands of potential molecules by applying them to pests, in hopes of finding the few that might be effective.

But as it turns out, the chemical universe is vast, with around 10^{60} unique molecules. By way of comparison, there are "only" about 10^{18} grains of sand on Earth. While automation helps this process, even with the most advanced automation, we can only screen tens or maybe hundreds of thousands of molecules looking for new products. And this too, takes time.

Today, we are using AI to search this vast chemical universe for specific molecules that can interact with specific proteins within weed, insect, or pathogenic organisms to keep them from harming crops. Our goal is specificity – a match that will do its job and only its job, leaving the rest of the plant and surrounding environment and biodiversity intact. And it goes without saying it must be safe for humans as well.

To bring it all together, AI has revolutionized discovery by allowing us to trade randomness and chance for prediction, specificity and design. We can now model proteins and molecules with unprecedented speed and accuracy, allowing us to search through more parts of the chemical universe.

For example, we recently used AI to model how 10,000 different molecules might be used in crop protection, all within a matter of weeks. This model was able to identify dozens of new potential crop protection molecules that our chemists could not have found otherwise. We are currently testing these now.

This is the new face of ag innovation.

New AI models also allow us to accelerate discovery of new *classes* of crop protection products, like biologicals – nature-based solutions that help farmers grow more food by working alongside traditional crop protection products.

With AI, we can begin to predict the incredible diversity of biomolecules and metabolites that are produced by microbes and other organisms, with the goal of unlocking the secrets within plant biology to develop the next generation of safe, highly targeted, nature-inspired products.

I would add that at Corteva, safety is our top priority by some distance – the health and safety of our employees and the safety of our products for human health. AI is also supporting our already top of the line safety testing processes by further extending our ability to identify any molecules that may pose risks to people, animals or the environment, and eliminate those from our pipeline.

AI in Product Development and Manufacturing

Corteva is an American manufacturer – our largest manufacturing site is in Midland, Michigan – and we have long led the industry in manufacturing innovation. Today, that includes the use of AI.

AI has helped us to continually optimize our manufacturing processes, particularly those for biologicals and the next generation of crop protection products. Let me give you an example: in our industry, fermentation is the process of using microorganisms, such as yeast or bacteria, to produce what we call "molecules of interest" through carefully controlled biological reactions. Today, we use AI to optimize our fermentation processes.

Over the past few years, we have used AI to both engineer the bacterial strains that drive fermentation reactions and to optimize the reaction conditions to allow us to run a manufacturing operation that is as efficient as possible, which helps us maintain a strong manufacturing base here in America.

This manufacturing edge, enabled by AI, has also been recognized nationally – I am proud to say that because of these innovations, we were recently named a finalist for a Manufacturing Leadership Award by the National Association of Manufacturers.

AI on the Farm: Helping Farmers Make the Best Use of Crop Protection

Even the best crop protection products need to be used correctly to maximize their efficacy. Just like personalized medicine for humans, AI is helping us better understand when farmers should treat *each* of their fields based on specific data related to specific environmental conditions, predicted pest pressures and their unique management practices. Remember that many American farms are more than 1200 acres comprised of multiple separate fields, so conditions across fields can vary significantly.

Deciding when and where to apply a particular crop protection product has long been one of the most challenging issues for farmers. The complexity of different factors that need to be considered significantly influences whether they can effectively reduce crop loss, and therefore, if they will see a positive return on investment.

Alongside our investments in AI to discover and develop the next generation of crop protection products, we are also investing in AI to help farmers get the most value out of the Corteva products already in the market.

For example, we are piloting a fungicide timing model here in America in which we combine field-specific information from our customers' farms with our internal data. This combined intelligence then helps them know *exactly* when to spray to combat key corn diseases. The impact of this is significant: we regularly help them increase yields by 4-10 bushels per acre, which is considerable. Farmers appreciate this because, not only does it

make their farming practices more sustainable, but also because, frankly, that yield increase means more money in their pockets.

America Should Seize this Opportunity to Lead

From discovery to safety and throughout the manufacturing process, AI is transforming everything we do at Corteva. It is, without doubt, one of the most profound technologies to ever be invented. While we are still just getting started, the promise that AI has to transform the agricultural landscape is already very clear.

As with any technology, opportunities also come with risks, and I would like to take this opportunity to remind this committee dedicated to the advancement of science that every advancement has inherent risk. It is neither possible nor desirable to uninvent AI, and we believe its benefits far outweigh the risks – and that the risks are manageable with the right policies and enforcement in place.

In conclusion, we believe there is tremendous opportunity for our government to support and incentivize advanced innovation – including by leveraging the benefits of AI – to benefit American agriculture and American farmers. The race to seize this opportunity has begun, but America is not the only country on the track. If we want to win, we need to move smarter and faster than our competition.

As an American innovator, manufacturer and partner for American farmers, based in the heart of our heartland, Corteva believes that with the support of our government, we will do exactly that.

Thank you again for having me here today. I would be happy to answer any questions you may have.