Frank DiMeo

Steven Tanksley
Plant Breeding and Genetics

Steven D. Tanksley

DON'T WANT TO SPOIL THE FUN OF IT

How Did We Get These Things We Call Tomatoes?

Crops are very recent in the history of humans. Humans were foragers. Only in the last 10,000 years did we start farming, and we had to find something to farm. There were no crops—no corn or tomatoes. What existed were wild plants. These were nothing like crops. For example, what we think of as a tomato is a beefsteak tomato. It looks good on hamburgers and in salads. However, a true tomato is seedlike—little berries that are about the size of the tip of your finger—and they're still found in the wild in South America. Today, they are not eaten by humans, but humans had gathered them in foraging. Adapted for birds, these "true" tomatoes were full of seeds. Birds would pick them up for food and carry them around. This is how they were disseminated.

When humans transitioned from hunting and gathering to farming, we had to find plants to grow. During this historical process, we went from small berries to tomatoes that are closer in size to the ones today. Our ancestors left no written records of farming or any indications of the knowledge that brought them to the tomato that is larger that a berry.

I am interested in how we went from this natural diversity that's adapted for birds in the wild, to humans generating a crop through selection or through happenstance that gave rise to agriculture. I've been focusing specifically on how tomatoes came about. What was the genetic change that took place causing berrylike tomatoes to evolve into big tomatoes? It was all done before there was any science! Before genetics! So how did the diversity generate modern agriculture? These are the problems that attract me: the ones related to understanding the diversity of life forms and what that diversity means for life and for humans. There are many manifestations of natural diversity. My research concentrates on answering questions about this common theme of natural diversity and specifically understanding the nature of wild plants that gave rise to crops.

The Answer Has Been Fascinating

When we approach a problem like this, the way we think about it genetically is this: if an organism has a number of genes that makes it what it is, then everything the organism is must be written into the genes. If we could read the blueprint of the little wild tomato and the big one, then somewhere

THE MORE ONE BELIEVES HE KNOWS HOW TO DO EVERYTHING, THE LESS LIKELY HE IS TO DO ANYTHING WITH THE PROBLEM.… IF WE CAN'T CARRY A LEVEL OF HUMILITY ABOUT NEW CONCEPTS AND IDEAS AND KNOW THAT AN ANSWER CAN COME FROM ANYWHERE AT ANY TIME, THEN AT SOME POINT WE SHUT OFF THE CREATIVE SOURCE.

written into that story is what changed. But it is complicated. There are thousands of genes, and each gene is complicated. So we had to devise a methodology to quickly read out the information and get down to the regions of the story or the library of genes that are actually affected. This was some of the first technology we developed when I came to Cornell: the technology to get down from a complex problem to the few genes that are involved. The realization of solving this problem technically is what compelled me to work on it. It could lead to very interesting storytelling.

We helped create a technology called quantitative trait mapping. This is what it means: everything you see in nature is by quantity—either bigger or smaller, one human is taller or shorter than another, or some animals have longer legs than others. It is not like a black-and-white difference. The quantitative difference is more continuous. With the tomato, we knew it was quantitative, but we didn't know how to get to the genes. So our approach was a mapping of the components that cause quantitative differences: quantitative trait mapping. The research goes from the observation that there is continuous diversity to understanding the genes that cause that diversity. We go from the problem of the big tomato to the problem of the little tomato to the answer that one is bigger than the other because there are about 20 genes of change.

We accomplished most of the work here at Cornell, and the technique is now used in lots of organisms—plants and animals, even humans. However, what drove us to create the technology was the interest in solving the problem of plants.

An Open Mind

Much of the discovery process is having an open mind. If we restrict ourselves in how we think about a problem or what approaches we bring to it, then the odds are that we're not going to come up with that next new idea that will take us the next distance. So we have to be willing to recognize that we may not know the best way to get a place, and the best answer could be just around the corner. It could come while daydreaming, reading a paper, or talking with a student who

Frank DiMeo

Frank DiMeo

walks into the office or lab. It could come while I'm playing with my cat.

A researcher always has to keep an open mind and be receptive. I also think a certain amount of humility is needed. The more one believes he knows how to do everything, the less likely he is to do anything with the problem. A person becomes self-restrictive because he knows it all. That's a battle probably for everyone, but for scientists certainly. If we can't carry a level of humility about new concepts and ideas and know that an answer can come from anywhere at any time, then at some point we shut off the creative source. I try to guard against that.

Everything Is Connected

Many things come into play when we're doing research. Sometimes we can point to a particular moment when something happens—a flash or something shook us. Take, for example, the tomato problem. After we had developed the technology (quantitative mapping) and began to identify the affected genes, we began to ask: What is affected about the genes? What changed about the genes to make the tomato big? How does that relate to all of biology? The truth is everything is connected if we can find it. Plants and animals have commonalities of life and life's information genetics. When we used the technology, found the first gene, learned what it did, and were on the verge of knowing the gene that was affected, we didn't have to question if anyone had seen a gene like this. We identified the change in one gene and were able to show that it was the gene affected.

One of the great events of the last few years is that biology moved to reading blueprints of life forms, and the blueprints share a common vocabulary for all life forms. Now we can make comparisons. Before this period, it was hard to do. We could compare two organisms that are similar like two mammals because they have four legs, or a dog's leg with my leg. But how do we compare a human and a plant? When we read the blueprint of a life form, the language is still there. The plants use the same language as animals.

Cornell decided to make major investments in the life sciences in the late '90s. We knew that at the very fundamental level, a lot of the new discoveries, whether they were medical or agricultural, would involve computer scientists and mathematicians who could find patterns in large amounts of information. So we were especially intent on developing the discipline of computational biology, and I got to know one of our first faculty members in this area, Ron Elber (Computer Science) and learned about what he does. He takes readouts of genes and predicts what the protein will look like, and he looks at whether they're similar or not. He doesn't care whether a gene came from a plant or human or bacteria. He processes them.

I took our tomato gene to Elber and said to him, "I got a gene, and we know it's involved in making big tomatoes, but we don't know what kind of biology it does. Can you pass it through your pipeline?" I gave it to him and 48 hours later, I got an e-mail from him, and he said, "I got your match." It was amazing! I thought it would be corn or something, but it was not. It was human. He described what it was, and I had not known anything about this particular gene protein. I began reading, and it turns out that the protein for which he found a computational match in humans was a protein involved in the regulation of cell division. Cell division is fundamental to all life forms. Cells have to divide at the right time and stop dividing at the right time in order to get all the right organs, and if things get screwed up, we get stuff like cancer.

IT WAS AMAZING! I THOUGHT IT WOULD BE CORN OR SOMETHING, BUT IT WAS NOT. IT WAS HUMAN.

Frank DiMeo

It turns out that this particular protein is involved in every basic process of controlling cells, including cell division. In humans, when it undergoes a mutation, the protein can no longer make the cell stop dividing, and humans get cancer. We had been studying this protein and made the same kind of discovery in the tomato. This protein is also a stop sign for cell division. The small tomato lost partial control over its cell division. It had too many cells dividing and what was created was the plant version of a tumor, which is not lethal, fortunately. Otherwise the plants would be dead. We don't call them tumors, we call them luscious tomatoes. It's how we look at it. It's all the same biology.

How do we have stop signs? How do we control them? What happens when they get mutated? If we look at it in a black-and-white sense of is this good or evil, one might say cancer is evil. But the similar type of mutation in plants created agriculture, which gave rise to society and all the great things society does and all the great knowledge enabled by us becoming an agrarian society—in part controlled by mutation. A mutation that creates cancer in humans, but in plants it created agriculture.

Here was a case where the idea came from someone on campus who knew nothing about plants, but knew a lot about how to manage information—taking information and turning it into knowledge in just the flash of an eye.

From Building Blocks to Diversification

Since I have diverse interests, I always have multiple projects. My lab has fundamental projects, such as understanding the building blocks of how plants create what humans need in agriculture. Other research is more directly applied, in that we're studying the natural diversity in wild plants and asking how we can harness some of the natural variations that are still available in the wild through genomic information and new breeding techniques. We have breeding programs in tomatoes and rice for plant improvement and harnessing some of natural variations still in the wild. We are involved in a genome-sequencing project for tomatoes and coffee, which are actually extra-related—coffee is also a small red berry. Coffee and tomatoes have the same plant classification: similar organization, structure, and genes.

ANOTHER EVENT THAT WE WERE FORTUNATE TO HAVE TAKE PLACE AT CORNELL IN MY LAB WAS THE FIRST CLONING OF A DISEASE-RESISTANT GENE IN A PLANT.

How the Tomato Story Began

As a graduate student at the University of California–Davis, I was fortunate to work with Charles Rick, a fantastic botanist, plant evolutionist, and agriculturist, who traveled extensively in South America and held the basic understanding of the origin of tomatoes. He made me think about concepts such as the origin of crops and how short a time humans have been growing crops. Yet, the most profound development in the whole history of society is domesticated crops—not having to spend all our time gathering food, but instead organizing society. Think about this profound event in human history: we would not have universities, great literature, or artisans if we had not transitioned from foraging. None of what we think of as civilization would be here. I had never thought about it before. I thought: we go to the grocery store and buy stuff.


Frank DiMeo

This is what started my work with tomatoes. I have worked with other crops, too: rice, wheat, corn, potatoes, peppers, and such. But I've always worked on tomatoes. I love them! My children don't eat them, so I guess it's not an inherited trait.

Can't Name Just One

When I think of my most exciting discovery or career highlight, it's tough to name one. It's like answering what is the funniest joke you've ever heard. At the time of hearing it, that's the funniest one. It's hard to replace. I have been extremely fortunate in having been able to participate in many, many discoveries with lots of very interesting people. I consider this a privilege, and I always look forward to that next experience. I can't say it's one thing. But here are some stories.

About the time I came to Cornell, it was the very beginning of genomics. There was no large-scale gene sequencing—nothing like today. There weren't even maps of the genomes in any meaningful way. So we began to prepare the first molecular maps of plants, which was a technology feat. This was in the early '80s. It opened the door to a whole new approach to plant breeding and to connecting pieces of genetic information. Consequently, we, as well as other researchers, have developed maps for every crop plant, and they have been used to isolate many very important genes for quality and resistance to environmental hazards—using them to breed plants that yield more, have better flavor, and are able to resist pests without using pesticides. These discoveries have accelerated our ability to feed and clothe ourselves in a much more comfortable environment.

Another event that we were fortunate to have take place at Cornell in my lab was the first cloning of a disease-resistant gene in a plant. It was known that plants have resistant genes, but no one knew anything about the new system of plants with genomes like animals. In order to get an understanding of this, one had to actually isolate the gene that was causing the plant to have a resistance against something—a bacteria or a pathogen. We decided to tackle that problem. It was a twofold problem: no one had isolated a resistance gene, and no one had used a technology called positional cloning to isolate any gene from a crop plant. It was a big technical unknown. I was fortunate to have an extremely talented postdoc, Gregory Martin, join my lab and lead the effort to clone the first disease-resistant gene. This proved the technology, which has since been used to clone many new plant genes, and it provided the first insights into how a resistance gene functions. Martin is back on campus at the Boyce Thompson Institute, one of the most highly visible scientists in the area of plant disease response.

It's hard to understand the implication of something unless you've lived through the before and after. I'm referring to how all plant biology was previously isolated into species-centric enclaves of scientists. For example, if a person wanted to be an expert in corn, he worked on corn, but he had no reason to study anything about wheat. If he wanted to make a better potato, he didn't work on tomatoes, he worked on potatoes. People who specialized in crops knew very little, if anything, about each other or what was being published in the other. They had their own separate journal.

When I first came to Cornell, we began to devise a new technology, called comparative gene mapping, which for the first time allowed scientists to connect genetic information from one species to another. Today a person doesn't think, I'm going to specialize in corn, so I don't care about wheat. Rather, he needs to understand all grasses; wheat, barley, and rice, for

(l. to r.) Researcher Yimin Xu, Steven Tanksley, and visiting scientist Pasquale Tripodi

example, are all grasses and share the same genes. A person can't study the one without knowing the others. This sharing of information jump-started some fields by 20 years. Potato, for example had very little development in modern genetics compared to tomato. When it was discovered they have the same genes and genome, the work we did here at Cornell moved potato development ahead 20 years.

I have been profoundly affected by another story—a still incomplete story. What changes about genes that accounts for the visible differences between species and also for the differences among individuals of the same species? This is a question relevant to both plants and animals, including humans. Genes code for proteins, and proteins have mechanical activity. They make structures and enzymatic activity to catalyze reactions. Many researchers have believed that most of the changes that took place during evolution were changes in the proteins. But we discovered, through isolating a number of natural gene changes, that what is changing is not always the protein, but how and when the organism uses a particular protein. So a protein may go totally unchanged, but having the protein show up too early or too late makes all the difference. For example, with the change in the size of the tomato, the protein didn't change at all. In the large tomatoes, a protein that acts as a stop sign for cell division in developing fruits comes on a week later than normal. A week is a lot of time for cell division. So these fruits have many more cells and hence are much larger. The protein in the large and small tomato is the same. It is how the plant regulates that protein that had changed. The jury is still out on what relative role these two activities have: gene regulation versus protein evolution. We're just starting to see the first sketch of a general picture. I'm extremely interested in how the story unfolds, and hopefully we'll make our contribution to it. It is one of my current projects.

Realizing Our Global Responsibility

Because of new developments in the life sciences, we're living through a period of discoveries. As a society, we need to recognize this profound period of discovery and the possible impacts of these discoveries—also our obligation. Cornell has two obligations. As an academic institution, we have a great responsibility to provide the best environment and training in order for the new generation of scientists to make these discoveries work for the good of the world. The various scientific disciplines have to be integrated with each other. The new life sciences no longer include just biologists. They now include the computer scientists, chemists, engineers, and ethicists. This is the reason for Cornell's New Life Sciences Initiative—to build a totally integrated approach to studying life, medicine, and plants, along with a heavy dose of social responsibility to educate ourselves and our students about not just the great wonders of discovery, but also the implications of those discoveries. Who are we doing this for, who is it going to help, or what may happen as a result of this? What is your obligation to society? Cornell has made a big push for the social aspects of life sciences as part of its overall New Life Sciences Initiative. We have a great responsibility.

THE NEW LIFE SCIENCES NO LONGER INCLUDE JUST BIOLOGISTS. THEY NOW INCLUDE THE COMPUTER SCIENTISTS, CHEMISTS, ENGINEERS, AND ETHICISTS.…A TOTALLY INTEGRATED APPROACH TO STUDYING LIFE, MEDICINE, AND PLANTS, ALONG WITH A HEAVY DOSE OF SOCIAL RESPONSIBILITY.

Frank DiMeo

As a field of science develops with so many applications, it's going to enable people. If it's going to create a stable world, it has to enable the entire world. That means the educational system has to be accessible to the entire world. We are citizens of the Earth, and Cornell University has to think about how we're going to participate in the global education process, enabling everyone to benefit. If we leave behind segments of society as a project goes forward, instead of promoting peace and prosperity, it could create strife. As scientists we don't always make ourselves think about these issues, but we have a huge responsibility for this. In response to problems of sustainability and natural resources in the world, the reality is that nothing has to be the way it was. We have the ability, if we use it wisely, to move to a much more sustainable, much more equitable world. It's going to require training, great minds, and helping people realize their global responsibility.

AS A FIELD OF SCIENCE DEVELOPS WITH SO MANY APPLICATIONS, IT'S GOING TO ENABLE PEOPLE. IF IT'S GOING TO CREATE A STABLE WORLD, IT HAS TO ENABLE THE ENTIRE WORLD.

Creating Knowledge, To Be Present in the Process

I had an experience as a graduate student that I'll never forget. The details of the experience are not as important as how it changed me. As students in elementary school, high school, and throughout most of our lives, we're taught to believe that knowledge exists in books. It's factual, and you need to learn the facts. But from where did these facts come? How did we come to this knowledge? The epiphany was to realize that ordinary people like me would create knowledge.

As a new graduate student at the University of California–Davis, I was working with plant enzymes. One night I was in the lab alone. I had just developed the results from an experiment. The results of the experiment demonstrated that there were two genes encoding their particular enzymes. Everything stood still for a moment, as I realized no one knew this before. No one in that moment in the history of the world knew—it was that new—that there were two genes like the ones I found in these chromosomes that made this particular enzyme. I was there when this information was turned into knowledge, and I got to tell someone. I got to put a little bit in the book. The discovery was minor, but the realization that I could be a person who help to turn information into knowledge that becomes part of the large library was the greatest gift—I couldn't imagine wanting to do anything else in my entire life.

It's like that every day. I don't know what's going to happen here in the lab; I don't know what research problems students are going to bring to the lab. Sometimes I just have to sit down and have them tell me they discovered something, wow! The specifics aren't that important, but just to be present in the process is. It's like when a great symphony is being played for the first time, you get to be there. It's a premiere performance. Everyday is like that. To be allowed by society—to be paid by society—to do for society is a wonderful gift, and something I don't take for granted for a moment.

The Origin of Passion

I had no science background in my family. I came from a family of preachers, which may help when I'm lecturing (laughs). They were Southern, so they were real gusto preachers, including

Frank DiMeo

my father. I'm from Mississippi, so one can imagine what that's like. College and trying to make money for college were responsible for me becoming a scientist. I didn't have enough money to go to college. I got a job as a janitor on weekends in the student union. It was the worst job I ever had, not because of the work, but because of the time. I had to work at 5:00 a.m. on Saturday mornings and 6:00 a.m. Sunday mornings, but the dorms didn't quiet down until about 3:00 or 4:00 a.m. I was not sleeping. I worked at this job for a couple of months. Then one day I saw an advertisement that someone in the Department of Genetics wanted a person to water the plants in the greenhouse. I said, if it's not at 5:00 a.m., I can do that!

So I got a job in the greenhouse watering the plants. While I was watering the plants, I listened to the grad students talk with their professors: "Look at this thing, here!" I didn't see anything, but they were so excited about it that it must have been amazing. I saw their excitement about what they were doing. I began following the professor around in the lab as I was watering the plants, listening to them. One day I asked, "Is there anything I can do in your lab? I'll do anything." He said yes, we need someone to count chromosomes. I said I don't know what it is, but I can count. I'm good in that. So they gave me a job counting chromosomes. They showed me how to make special preparations, how to stain them—they taught me the whole thing. But more importantly they taught me how interesting it was. It was just so interesting. That's when I decided to go to graduate school.

One night I was in the lab alone. I had just developed the results from an experiment....Everything stood still for a moment, as I realized no one knew this before.

Fueling the Passion

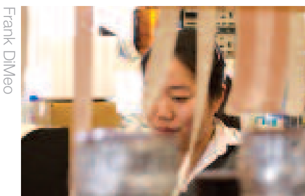
When I came to Cornell, there was a huge explosion of my sense of possibilities. I was blown away. I had been at smaller universities where there was less ambience than at a school like Cornell, where there are so many interesting colleagues and so many exciting students. I can pick up the phone and have a person in math to work with or in chemistry. Coming here was a big eye-opener for me.

To Keep Things Going

The things of everyday life, like paying the bills, can be challenging. I have to pay the bills to sustain a lab. Equipment breaks down, for example. I have to write grant proposals, and sometimes I get funded and sometimes I don't. But I have to keep enough of them going to sustain the lab and the research. That comes with the territory.

I'm so excited about the future of life sciences and Cornell's national and international role that sometimes I want to move faster than humanly possible. The university has been supportive, but sometimes I want to go so fast, it's just not feasible.

Frank DiMeo



Graduate student Feinan Wu

Fruition

I have projects that are in extremely interesting stages right now. We're trying to transform plant breeding by using more genetic variation from the wild ancestors of crop plants. We have several pilot projects, and now we're trying to expand them worldwide—trying to set up a network. I would very much like to see that happen.

I put a lot of interest and time into Cornell's plan for genomics and the initiative for the life sciences. I would very much like to see Cornell emerge at the forefront in research and education in the life sciences in a way that's meaningful to the world. I'm sure Cornell will.

Life Outside the Lab

I have a wonderful family: my wife and two wonderful stepchildren. I also have a son who is in a Ph.D./M.D. program at SUNY–Stonybrook and a daughter who's at the University of North Carolina. My wife is director of outreach for the Institute for Genomic Diversity. We've done research together, and we also have a common interest in natural diversity. She does a lot of international workshops—training scientists from around the world how to use genomics. So we travel a lot together. We're going to Costa Rica and China together. It's a lot of fun being able to travel with my partner and share a common interest like this.

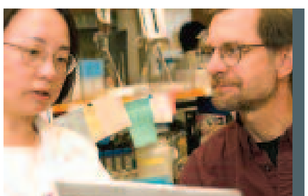
Hobbies? The work is fun, but it's not my only hobby. I love hiking and sailing, and I play guitar.

YET, THE MOST PROFOUND DEVELOPMENT IN THE WHOLE HISTORY OF SOCIETY IS DOMESTICATED CROPS—NOT HAVING TO SPEND ALL OUR TIME GATHERING FOOD, BUT INSTEAD ORGANIZING SOCIETY.

If a Farmer Asks

Farmers make their living off the life sciences. If a farmer is going to produce a crop and make a living at it, he must be able to produce it in a way that makes a profit and do it in a sustainable way. He can't farm the land for two years, make the money, and then what? He has to think about sustainability. All improvements in crops have to do with genetic improvements. That's how things get better. That's how corn yields more. It's how plants defend against diseases. The work we've been doing gets at the heart of where that new genetic generation is going to come from: how we're going to get it; how we're going to put it to use; what problems we're going to try to solve with it; and will it be environmentally friendly. And the genetic improvements work. We've been able to use these techniques to help increase the yield of tomatoes and other crops. Some of the work we began here at Cornell has led to new significant increases in rice yield.

Frank DiMeo



Researcher Yimin Xu and Steven Tanksley

A Response for the Social Scientist

Many of the problems in the world are related to limited resources, damaged environments, and inequitable distribution of resources. A lot of this goes back to plants. Plants produce the food, the fiber, and they will soon produce the energy. If we don't get a handle on this—how to do it, and how to do it in a sustainable and environmentally friendly way—the social problems in the world are going to be horrendous.

The No Genetic Engineering Disclaimer on Food Labels

We as a society are paying for mistakes made decades ago in science. Disclaimer statements such as "no genetic engineering" on food labels relate to the fear of destroying something that we hold precious—nature, food, and clean air—and that someone either doesn't care, has bad intentions, or is willing to harm us in order to make a profit. People also fear that there is something poisonous about it. The truth is that all plants are products of human genetic engineering. The tomato was done by our ancestors 5,000 years ago without thinking about DNA and genetics—they were able to select for mutations that led to agriculture. For the plants in the wild, this was lethal. These plants can't disseminate their seeds if the birds can't pick them up, so they don't grow in the wild. Corn doesn't grow in the wild, for example. Everything we've based society on came from genetic engineering.

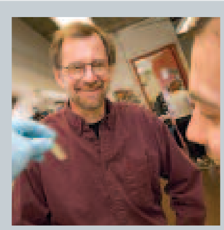
The fear that people have goes back to mistakes made in the past by scientists. Right after World War II, we entered into the age of chemistry. Petroleum was readily available, and we knew enough about organic chemistry to start making things with it. Scientists discovered we could make plastics, fertilizers, pesticides, and more. The impact was incredible. Prior to synthetic fertilizer, people had to haul around manure; after its development, crop yield went up tremendously. With pesticides, scientists found they could kill off insects that were cutting yield back by 50 percent. This was presented to society as fantastic, and it was. It was only later we realized we were also contaminating the groundwater. Perhaps because scientists weren't trained in social responsibility, as we are today, they did not look beyond the "wonderful" to the impact—sustainable use of pesticides versus contaminated groundwater. We feed ourselves, but we damage the heck out of the environment. We say, stop the use of pesticides and fertilizers. Then food production drops by 80 percent. Talk about war—lose 80 percent of our food supply. We can't do that. Neither can we sustain these kinds of actions.

We have to transition to a more environmentally sustainable agriculture that will feed us sufficiently so that we don't have mass starvation. The tragedy is that we're still dealing with the stigma of earlier thinking. We're not going to solve the problem in just one way. However, we've entered a period where we can use genetic engineering in ways that are very sustainable and much more environmentally sound.

Teaching Science to Children

Teach science as discovery—how much is unknown and how interesting it is to try to understand problems and put the pieces together like puzzles. Too much of science is taught as facts. Children are much more interested in video games and puzzles than they are in facts. How the media presents science to students is also important. More outlets have become available in the media with the advent of cable television and good science programs.

Frank DiMeo



It's like when a great symphony is being played for the first time, you get to be there.

What's Next?

I don't know what's next, and I don't want to know. If I knew what the next 10 to 20 years were going to be, I think it would ruin the fun of it. I stay open every day, and say I don't know what will happen; I don't know what I will be doing.

TO BE ALLOWED BY SOCIETY—TO BE PAID BY SOCIETY—TO DO FOR SOCIETY IS A WONDERFUL GIFT, AND SOMETHING I DON'T TAKE FOR GRANTED FOR A MOMENT.

More about Tanksley

Steven Tanksley, the Liberty Hyde Bailey Professor of Plant Breeding and chair of the Genomics Initiative Task Force at Cornell University, is one of two scientists to share the 2004 Wolf Foundation Prize in Agriculture for "innovative development of hybrid rice and discovery of the genetic basis of heterosis in this important food staple." The Wolf Prize is among the most prestigious scientific awards in the world. Tanksley was cited as "one of the world leaders in plant genomic research." He has contributed to the understanding of heterosis in rice by identifying genes in a wild ancestor that significantly increased yields. He shares the award and its $100,000 prize with Yuan Longping of the China National Hybrid Rice Research and Development Center.

For more information:

E-mail: sdt4@cornell.edu


Frank DiMeo