Boundless Science for Bountiful Agriculture: Winning Student Essays, 2003

Council for Agricultural Science and Technology
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Boundless Science for Bountiful Agriculture

This essay contest for 6th, 7th, and 8th grade students was conducted by the Council for Agricultural Science and Technology (CAST) in collaboration with the U.S. Department of Agriculture's Cooperative State Research, Education, and Extension Service and the Natural Resources Conservation Service.

ESSAY TOPICS

Ag Science in the City: "The Importance of Agriculture for Urban Areas"

Alternative Fuel Research: "Bioenergy Powering the Future"

Conservation of Resources: "Working Cooperatively to Ensure a Bounty of Food and Natural Resources"

Cultivating New Technologies: "Producing Food in Space" or "Using Lasers, Robots, and Computers in Agriculture"

Dynamic DNA: "Boosting Agricultural Bounty with Genetics"

Food Science and Nutrition: "Using Science to Create a Safe and Healthy Food Supply"

Weather and Crop Production: "The Impact of Atmospheric Sciences on World Food Supply"

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This material is based upon work supported by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Agreement No. 11.

Contents

Foreword

At the March 2002 CAST Board of Directors meeting, the board approved a motion for CAST to enter into an agreement with the U.S. Department of Agriculture's Cooperative State Research, Education, and Extension Service (CSREES) to conduct a nationwide student essay contest on the topic of agricultural science. Through this contest, CAST hoped to educate and excite students, teachers, and parents about timely issues such as bioenergy, urban agriculture, and conservation. The CAST Science Education Committee strongly endorsed the project and offered assistance.

Beginning with initial funding from CSREES and a list of suggested essay topics, CAST staff developed the project. Students in grades six, seven, and eight were eligible to submit an essay of up to 500 words on one of seven pre-selected topics. All submissions were made online, by November 1, 2002. A total of 804 entries were received, from 40 states, the District of Columbia, and the U.S. Virgin Islands.

CAST recruited volunteers from among its broad base of members and their colleagues in the agricultural sciences to serve as judges for the essay contest. Entries were judged on the basis of originality, creativity, organization, background research, and writing mechanics. Winners were selected at the school, Congressional District, state, and national levels.

Names of the school and Congressional District winners were announced and posted on the CAST website in January 2003. Congressional District winners were invited to attend special VIP Day celebrations, hosted by participating universities nationwide. At these programs, district winners received medals and the state winner was named and awarded a plaque. From among all state and territory winners, three national winners were chosen and awarded a trip to Washington, D.C. during National Agriculture Week.

This Special Publication compiles all national, state, and territory winning essays from the 2002–2003 contest. The students' writing is presented in its original form with only minor editing and formatting changes. This document also contains acknowledgments of the many persons who helped to make this contest possible, names of judges who participated in the selection of the winning essays, and recognition of donors whose financial support was crucial to the success of this contest.

CAST was extremely pleased with the number of young people who chose to participate in this new activity and with the high quality of their essays. The judges were impressed by the creativity and thoughtfulness demonstrated by these sixth, seventh, and eighth grade students. On behalf of CAST, we thank all the individuals and organizations involved, and we congratulate all students who entered the contest.

L. J. Koong
President

Teresa A. Gruber
Executive Vice President

Linda M. Chimenti
Managing Scientific Editor

Acknowledgments and Special Thanks

CAST would like to acknowledge its Board of Directors for their approval of the essay contest proposal. Their encouragement and support have been essential to the successful completion of this contest.

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Special thanks are due to the following individuals who served on the CAST Science Education Committee at the time this contest originated. A number of them worked diligently and persistently throughout the course of the contest, and they are to be commended for their commitment to the project and their dedication to education: Don Beitz; Alan Bell; Gary Eilrich; Kurt Getsinger; Maud Hinchee; Keith Karnok; David Ledoux; Barry Palevitz; Jill Schroeder; and Gary Wingenbach.

***

CAST was fortunate to have the help of two public policy interns who served in turn as project manager for the essay contest: Stephanie Michael, who prepared the grant proposal to begin the work and established the framework that was followed; and Jamie Mishler, who organized publicity for the contest and identified additional funding sources that were critical to the project. The terrific groundwork laid by these two individuals paved the way for staff member Tamara Mitchell to continue management of this task when she joined CAST. Tamara's diligent efforts culminated in the announcement of winners at the school, Congressional District, state, and national levels, and a series of successful VIP Day celebrations.

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Thanks also are due to: Debbie Cavett, Cooperative State Research, Education, and Extension Services, for support; Michelle Fuller, Risk Management Agency, for providing general information on conducting an essay contest; Rick Kirchoff, Executive Vice President and CEO, National Association of State Departments of Agriculture, for providing information; Holly Sharpe, Plano Independent School District, for providing ideas for topics; Eldon White, Agricultural Councils of America, for scheduling events for the National winners; and the following for assistance in communicating with Congressional offices: Nona Donnell, Congressman Tim Holden's office; Karil Bialostosky and Mark Halverson, Senate Agricultural Committee; Dave Johnson, Senator Richard Lugar's office; and Ryan Weston, Congressman Frank Lucas' office.

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CAST expresses appreciation to the following for help in identifying and instructing the judges: Maria Bynum, National Agri-marketing Association; Debbie Cavett, Cooperative State Research, Education, and Extension Services; Kathleen Cullinan, National Program Leader, Agriculture in the Classroom; Amy Lloyd, Congressman John Thune's office; Alison Melson, President, Arkansas Public Relations Society Association Chapter; Kathleen Montgomery, National Agri-marketing Association; Kathleen Roth, President, Alabama Public Relations Society Association Chapter; Gerrit Shufstall, National 4-H; Michael Skonieczny, Congresswoman Rosa De Lauro's office; and Karmen Wilhelm, President, Cedar Valley Public Relations Society Association Chapter

***

The many individuals who served as judges for the essay contest at all levels—school, Congressional District, state, and national—are deserving of abundant thanks for sharing their time and expertise. Their willing participation made it possible to conduct the contest in a timely manner. (See Appendix A for a complete list of judges.)

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A special thank-you to the host institutions and event coordinators who graciously created VIP Days for Congressional District winners in each state or territory represented. Their kindness and generosity helped to provide a memorable experience for these talented young people. (See Appendix B for a complete list of VIP institutions and coordinators).

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Acknowledgments and Special Thanks (continued)

Making young people throughout the country aware of this opportunity to learn about agricultural science was of vital importance to the success of this contest. Therefore, CAST is grateful for all of those who helped publicize the contest:

Caroline Anderson	State Farm Bureau
Ellie Ashford	Editor, *School Board News*
Amy Baker	American Farm Bureau
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Karen Coble Edwards	KCE Public Affairs
Cindy Cruea	WIFEline
Kathleen Cullinan	National Leader, Agriculture in the Classroom
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Christy Gloeckler	Junior Master Gardeners
Trish Gorman	Editorial Department, American Federation of Teachers
Matt Hutchings	Junior Master Gardeners
Jay Jackman	National Association of Agricultural Educators
Rick Kirchoff	Vice President and CEO, National Association of State Departments of Agriculture
Mark Leitman	National Council for Agricultural Educators
Katie Lower	Michigan Blueberry Growers Association
Peter Magnuson	National Elementary School Principals
Anna Malodia	Future Farmers of America
Kathleen Montgomery	National Agri-marketing Association
Jennifer Morrill	Farm Credit Council
Sally O'Briant	National Association of State Universities and Land Grant Colleges, Division of Public Affairs
Elizabeth Raines	Junior Master Gardeners
Ken Roberts	National Science Teachers Association
Debra Shapiro	*National Science Teachers Association Reports*
Gerrit Shufstall	National 4-H
Alan Smith	Cooperative State Research, Education and Extension Services
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Sally Zakariya	Editor, *American School Board Journal*

and: The American Farm Bureau Federation
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Platinum Sponsor ($50,000 or more)

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Intervet, Inc.

Kentucky Turfgrass Council

New York State Vegetable Association

North American Colleges and Teachers of Agriculture

Seneca Corporation

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Dedication

This collection of winning essays is dedicated to the crew of the Space Shuttle Columbia:

Rick D. Husband
William C. McCool
Michael P. Anderson
David M. Brown
Kalpana Chawla
Laurel Blair Salton Clark
Ilan Ramon

The winners of the Essay Contest had already been selected and this collection was near publication when on February 1, 2003, the Space Shuttle Columbia was destroyed upon reentry. The families and friends of the crew, the NASA community, and people around the world have mourned this profound loss. In light of that somber event, we were deeply moved that so many of the young people who entered this Contest had chosen to write about the Space Program and to express their dreams of one day becoming astronauts themselves. Indeed, the essays as a whole reflect optimism, energy, and a deep concern for the future, qualities inherent in the mission of the Columbia's crew. So, although our memory of this disaster and the seven who were lost may diminish in time, the inspiration they have been to a new generation will not end. To paraphrase a line from Christina Zarrilli's 1st Place entry, in knowing that we will always have some of their beauty down here with us, perhaps the astronauts will be a little less "homesick for Earth."

National 1st Place Winner

Name: Christina Zarrilli
State: Florida
Essay Theme: Cultivating New Technologies
School: Home Schooled

Space Mashed Potatoes, Anyone?

The new agriculture technologies of cultivating food in space interest me because I want to be an astronaut and become the first human on Mars. I believe Mars would be an ideal place for agriculture to occur in a man-made biosphere. Fascinated by what I learned about hydroponic gardens at Space Camp, Florida, I further researched growing potatoes in space. Over 60,000 articles were available on the Internet on that topic. I read that potatoes were the first plant to grow in space on the Space Shuttle Columbia in 1994.

Plants and astronauts will be ideal partners in space because humans consume oxygen and release carbon dioxide, and plants consume carbon dioxide and release oxygen. The plants will be food for the astronauts, while human waste will be fertilizer for the plants. This symbiotic relationship will decrease the amount of supplies we will need to carry to our colonies on Mars as well as decrease the amount of waste we will have to return. This could save billions of dollars in fuel and parts.

Plants also help keep astronauts healthy and happy mentally because they feel more at home when they see greenery. Studies show that astronauts receive additional psychological benefits from growing and nurturing vegetation. Foliage in one's living environment has proved to keep a person healthier and reduce stress. Plants will aid in keeping astronauts from being homesick for Earth because they will have some of its beauty up there with them.

NASA's research on growing food will not only benefit space travel but also humans on Earth. The population is expanding, causing a need for more food than ever, and the housing requirements are reducing agriculture space to meet this demand. We need an efficient way to grow bountiful food in smaller spaces, on other planets, and moons.

In September 1991, eight people moved from Biosphere 1 (the Earth) to Biosphere 2, to see if they could make an artificial environment as required in space. The $2 million structure sits on over 3 acres in Arizona. It contains five biomes: a desert, a marsh, a savannah, a rain forest, and an ocean. Biosphere 2 was only allowed to use what was inside, so the plants had to create all the food and oxygen. Several problems occurred; the most serious being oxygen levels required for human life could not be maintained. It was discovered that too many microbes in the soil were using up the oxygen faster than the plants could replace it. Much more research is needed to create a self-sustaining environment for our space travelers.

The important symbiotic relationship between humans and plants will continue in space. Space gardens will provide food and oxygen critical for survival. Potatoes will be a key agriculture product because they are relatively easy to grow, very nutritious, and can be used in a variety of recipes to make tasty, diverse foods. I look forward to growing potatoes and making my fabulous mashed potatoes for my fellow astronauts.

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National 2nd Place Winner

Name: Emily Groupp
State: New York
Essay Theme: Ag Science in the City
School: Home Schooled

The Importance of Agriculture in Urban Areas

How can a city dweller eat healthier, live in a better environment, and save money all at the same time? Natural resources are limited in urban areas, so nothing should go to waste. Urban agriculture is our chance to save money, help our environment, and improve health. Urban agriculture can benefit all of society.

Urban agriculture can save the city money, the building owners money, and the growers money. Urban consumers might even save money. The Toronto Food Policy Council introduced the idea of rooftop gardens. Rooftop gardens will reduce the cost of storm drain system maintenance. This can be accomplished by decreasing the water runoff. The soil on the roof will absorb rainwater, and that will mean less water going into the storm drain system thus reducing storm drain maintenance costs.

The expense of using heating and cooling systems will be lower if rooftop gardens are planted. Buildings will be warmer in the winter and cooler in the summer. The soil acts as a natural insulator. It keeps the heat from rising through the roof in the winter. In the summer it prevents the sun from warming the air inside.

Urban consumers might even save money. When produce is grown and distributed locally, the result is lower packaging and shipping costs for the grower. Hopefully the producer will pass on the savings to the buyer.

Urban agriculture improves the environment in three ways. Gardens naturally cleanse the polluted urban air. Plants and trees absorb carbon dioxide and produce oxygen. City gardens benefit the wildlife we share existence with. They provide homes and refuge for uprooted wildlife that come to the city seeking shelter. The environment is also helped because natural resources are used less for packaging and shipping (e.g., fuel, paper, plastics). Less pollution and waste would be generated.

City farms improve the health of the body and society. They can supply fresh, undamaged produce. Certain waxes and sprays must be applied to protect shipped fruits and vegetables; these chemicals would not be necessary for local foods. Also, the fresher the food, the more nutrition it retains. Involving individuals in urban gardening restores the people's connection to nature. The responsibility of ownership helps produce respect of the land's natural process. This sense of stewardship can generate a feeling of community.

Society can benefit from city farms as we see in Cuba. They have practiced urban gardening for several years and discovered a way to feed their famished country with a surplus to sell. In Philadelphia and California the crime rate was lowered after starting gardening projects. A Philadelphia police officer noticed that crime reduced from "40 to 4 incidents per month" after she started a gardening project. In California the crime rate "decreased 28%" after 1 year of gardening.

Urban agriculture is nothing new; it's at least as old as Cleopatra—according to excavations of ancient Egypt. It provides an opportunity to bring the country to the city. This paper only begins to explain the advantages of urban agriculture. City farming can save the budget, the environment, and our health. The best way to see this happen is to plant some seeds.

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National 3rd Place Winner

Name: Marshall Edwards
Essay Theme: Dynamic DNA

State: Georgia
School: Ebenezer Middle School

Biogenetics in the Future

Imagine this scenario. The weather is cool and gloomy. You are at a plant genetics lab at State University. As you approach the greenhouse you notice something strange. There are tears in the plastic on the greenhouse. Your heart begins to beat faster. As you open the door your heart drops. Your mouth is dry and you have a sick feeling deep in the pit of your stomach. You realize your greenhouse has been vandalized. On the floor the intruders have spray-painted the words "STOP GENETIC MUTILATION!" Years of valuable research have been lost.

This scenario is true. These events actually happened to Dr. Bob Milikin at the University of Buffalo. Dr. Milikin was doing research on genetically modified crops. He was trying to develop a plant that would be resistant to pests without the use of pesticides. Ironically, the "ecoterrorists" had destroyed the work of a scientist who was doing research to HELP the environment! Dr. Miliken was trying to find a way to develop a safe, plentiful, healthy crop without using so many chemicals.

Now, pesticides are no small problem in our world. Farmers use about 2.5 million tons of pesticides each year. In 1992, the World Health Organization reported that 3 million pesticide poisonings occur each year. Scientists believe that overusage of pesticides could result in immune dysfunction and may be linked to sterility. A number of states have programs in place to reduce pesticide usage by 50% by the year 2010.

So, WHY? Why would ANYONE want to sabotage genetic engineering research? Some people believe that genetic engineering is an activity akin to "frankenscience." While a bit of fear and reservation is understandable, we in the agriculture community should make it our duty to inform the public of the immense benefits of biotechnology.

For example, there is research going on today to genetically modify bananas to fight dysentery. Although great progress has been made in inoculating children in much of the world, in the poorest nations very little has been achieved. It would be possible for millions to be protected from life-threatening illnesses.

On the other hand, there are documented health effects for genetically modified (GM) crop varieties. For example, a GM food with a higher content of digestible iron is likely to have a positive health effect if consumed by iron-deficient individuals. Alternatively, the risks of transferring genes from one species to another need to be evaluated and classified before commercialization. Individuals allergic to certain nuts, for example, need to know if genes conveying this trait are transferred to other foods such as soybeans. Among the possible ecological risks classified are extended weediness, a result of cross-pollination where pollen from GM crops spreads to non-GM crops in nearby fields.

In closing, a quiet revolution in the way food is produced is under way. Last year, American farmers planted more than 50 million acres of GM soybeans, corn, cotton, and potatoes. Four years ago, the figure was zero. Biogenetics is our country's future.

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Name: Cameron Mulvaney
State: Alabama
Essay Theme: Cultivating New Technologies
School: New Life Christian Academy

Producing Food in Space

Crops in space? Absolutely! Especially if people are to travel months, even years, to other worlds and solar systems. It would be nearly impossible to send along enough food and water with a team of space explorers on a long-term mission. The reality is food biomass and water production for hydroponics are essential for extended space exploration. Furthermore, space may provide an effective, efficient environment to produce rare or genetically modified proteins needed by humans. Challenges in space are (1) lack of gravity required for development of roots, (2) controlled growing climate, (3) consistent sunlight, (4) essential nutrients including purified water supply, and (5) appropriate insects for cross-pollination. Well, biogenerative support systems consider all these challenges. A new science for space agriculture, called Astroculture, has been born to research conditions needed to create biogenerative life support in space.

Humans and plants are ideal companions in space and on Earth. People breathe air and generate carbon dioxide, which plants collect and convert to oxygen. Humans consume plants or parts for sustenance, but this results in waste by-products, which in turn can be used to provide nutrient support for plant growth. Considering how to capitalize on these extraordinary relationships between plants and humans, one must consider problems of sources of energy, reproduction of clean water, plus the effects of low gravity in space to optimize plant growth. Light energy must be provided but must be filtered from harmful wavelengths. Exciting possibilities for gaining insight for increasing the yield and quality of food production on Earth and establishment of self-sustaining life-support systems for people in space exist today.

Since early space exploration, astronauts experimented with growing plants. Today, industries and scientists are allowed to explore and study plant growth and long-term plant production on the International Space Station. They seek systems with high energy conversion efficiency. Establishment of the Space Station enabled agriculture in space to enter a new era. Although there were technical difficulties, wheat crops have been grown and harvested in space. A Bulgarian-built greenhouse enables the right conditions for plant growth, and other crops have had success. A new age of food production in space was launched, and scientists saw how space technology may assist many of the Earth's environmental problems. Interestingly, NASA scientists found microgravity of space presents a very efficient environment for use of bacteria to enable transfer of targeted genes that affect plant immunity to diseases and pests.

To close, Eric McLamb states, "Simply put, if we can sustain food production in space, then we can sustain human life anywhere in the universe. Plants, like all living things, depend on nourishment and the right living conditions in order to grow. And with a burgeoning population on Earth, Astroculture benefits will help us better provide food, sustenance, and required healthy ecosystems essential to promoting public health." Astroculture connects people directly with components necessary to the web of life. While challenges are great, opportunities are greater, and U.S. Department of Agriculture scientists and agriculture have an exciting future in space.

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Name: Lauren Griffiths
Essay Theme: Alternative Fuel Research

State: Arizona
School: Ira A. Murphy Elementary

Bioengineering Agriculture for a Brighter Future

With advances in bioengineering, we now have the ability to utilize the true potential of our agriculture. Bioengineers have shown that agriculture has much more value than food alone. Chemicals, fuels, and industrial materials can all be refined from our bountiful crops. “Whole Crop Utilization,” a term that means using the entire crop including the parts normally thrown away, means that farmers will soon find many markets for agricultural products. This includes providing the raw materials for clean, low-cost energy production.

The Idaho National Engineering and Environmental Laboratory (INEEL) has thousands of scientists working on ways to use agriculture to its potential. Two of the biggest problems we face are air pollution and dependence on fossil fuels. Bioengineering our agricultural products can provide a possible solution to both problems while providing more income to farmers. If we can produce energy using bioagriculture rather than fossil fuels, we will reduce the pollution caused by power plants and lessen our need for fossil fuels.

One example of this is bioengineering crops to produce hydrogen. Hydrogen gas is a clean-burning fuel that only releases water as a by-product. It is used to power fuel cells that generate electricity for all kinds of applications such as electric motors in cars. It can also be burned to create heat without the harmful pollution that burning fossil fuels creates. The problem is that there is no cheap way to produce hydrogen. We usually have to burn fossil fuels to get electricity, then use electrolysis to remove the hydrogen from the water, an expensive process.

INEEL is presently working on a biotechnology process that produces hydrogen gas from farm crops. There are several methods, with one using microbes “through action of well-studied anaerobic metabolic pathways and the hydrogenase enzymes.” This means that special genetically engineered microbes would react with the harvested crop to release the hydrogen gas from it. This gas could be stored in tanks and used to power fuel cells or even power generating plants themselves.

To this point, the largest barrier to developing alternative fuels from agriculture has been the high cost. This is changing since the U.S. Departments of Energy and Agriculture have been pushing this as a real solution to our energy problems. It is possible that bioenergy from agriculture will become the number one renewable energy source of the future.

One thing America does well is grow crops. We grow enough food to feed ourselves many times over. We have the world’s most advanced farming methods, and we have the natural resources we need. Yet we throw away 350 million tons of useful agricultural waste each year. It is now time to take advantage of our technology and realize the full value of agriculture for a brighter tomorrow.

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Replacing petrochemicals with biochemicals. 1994. <http://www.carbohydrateeconomy.org/library/>

Name: Frances Ferguson
State: Arkansas
Essay Theme: Alternative Fuel Research
School: White Hall Junior High School

Bioenergy Powering the Future

The demand for energy has increased steadily, not only because of the growing population but also because of the greater number of technological goods available and the increased affluence that has brought these goods within the reach of a larger proportion of the population. As the result of the increase in the consumption of energy, concern has risen about the depletion of natural resources, both those used directly to produce energy and those damaged during the exploitation of the fuels or as a result of contamination by energy waste products.

Most of the energy consumed is ultimately generated by the combustion of fossil fuels, and the world has only a limited supply of these fuels, which are in danger of being used up. Also, the combustion of these fuels releases various pollutants, such as carbon monoxide and sulfur dioxide, that pose health risks and may contribute to acid rain and global warming. The environmental consequences of energy production have led many nations in the world to impose stricter guidelines on the production and consumption of energy and for safety of people and the environment.

Solar energy is a major option. The Earth receives huge amounts of energy every day from the sun, but the problem has been harnessing this energy so that it is available at the appropriate time and in the appropriate form. Solar energy is expected to become a more viable and competitive source of energy by the end of the 21st century. Some scientists have also suggested using the Earth's internal heat as a source of energy, which is released naturally in geysers and volcanoes. Another possible energy source is tidal energy. Experimental systems have been set up to harness the energy released in the twice-daily ebb and flow of the ocean's tides.

Another direction of research is in the search for alternatives to gasoline. Possibilities include methanol, which can be produced from wood, coal, or natural gas; ethanol, an alcohol produced from grain and currently used in some types of U.S. motor fuel that is much less polluting than gasoline and is currently used by a half-million vehicles around the world; and electricity, which if ever practicable would be cheaper and less polluting, especially if derived from solar energy rather than gasoline.

Biodiesel is a domestically produced, renewable fuel that can be manufactured from vegetable oils or recycled restaurant greases. Biodiesel is safe, biodegradable, and reduces serious air pollutants such as carbon monoxide, hydrocarbons, and air toxins. So you see, other alternative fuels are being found so we can lead safer and more healthy lives. The atmosphere will be cleaner, and these advancements in fuel research can lead to new exploration. This can lead to a new future. Hopefully, in the future, we will use these technologies for our benefit.

Reference:

Internet Public Library. 1999. Encarta Encyclopedia 99, AFDC, <DiscoveryChannel.com>

Name: Jonathan Ainley
Essay Theme: Alternative Fuel Research
State: California
School: Crossroads Middle School

Fuels to Power the Future

With fossil fuel stores in the world depleting, it is critical to find new alternative fuel sources in order to survive. We need to find renewable fuel sources to prevent repeating today's problem. I think a few of the most promising renewable fuel sources are biodiesel fuel, P-series fuel, and hydrogen fuel cells.

Biodiesel fuel is made from vegetable oil and animal fats. It is somewhat like regular diesel fuel, but it burns a lot cleaner. One major advantage is that biodiesel can be run in many engines made since 1994 (even nondiesels), and it costs between $1.00 and $2.00 per gallon. However, it's tough to transport because it requires a trained crew to monitor the fuel due to warranty concerns. Biodiesel is made from soy products, recycled cooking oil, and recycled animal fats. There are not enough of these products to meet demand for biodiesel. Only a maximum 1.9 billion gallons can be produced. Scientists are working to develop ways to make the fuel with mustard seeds. If they succeed, they can increase production by approximately 5 to 10 billion gallons. Biodiesel's main targets are trucking companies and large fleets of vehicles.

P-series fuel is a colorless liquid used in combustion engines (using a spark to start). It is designed to be used alone or in combination with gasoline. It has an octane rating of between 89 and 93, much like gasoline. P-series is for use in flexible fuel vehicles (FFVs) that are designed to run on E85 (85% ethanol and 15% gasoline). These ethanol FFVs are currently produced by all three American automakers and one of the Japanese. The important point is that P-series is made from 60% renewable products, and if used could reduce the fossil fuel use by 49 to 57%. Also, P-series produces 45 to 50% fewer harmful emissions than oil and gasoline. However, there is no distribution infrastructure for the P-series fuel, so it can't be found at gas stations.

Scientists are developing a system in which hydrogen fuel cells could be used in combustion engines. Hydrogen can be farmed during electrolysis, a process in which a water molecule splits into hydrogen and oxygen. This process makes hydrogen an almost unlimited resource. We don't have the technology to use it in engines today, but someday we will. Now there is no distribution infrastructure for hydrogen, but it is often transported in canisters and in tanker trucks. If used in car engines, hydrogen produces almost no harmful emissions.

The clock is ticking, and we need to invest in alternative fuel sources before it's too late. Eventually we're going to run out of fossil fuel. I think that the P-series fuel would be the best solution as a temporary fix, but in the long run I think we need to develop an engine that will run on hydrogen fuel. It could be cheap to harvest, wouldn't hurt our environment, and it is renewable.

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Name: Cory Weinstein
Essay Theme: Dynamic DNA

State: Colorado
School: Acres Green Elementary

The Adventures of Dart the Fly

Hello, I'm Dart the fly. One night I went flying for an adventure. I came across a tobacco plant that was glowing. I asked the plant, "Why are you glowing?" It answered, "I am genetically modified, which means that scientists cut out DNA from a plant or animal and put it in a another species to change the original plant or animal to produce a new property. I have a gene from a firefly in me." "Wow," I said, "that sounds so cool. Think of all the future combinations possible!"

A bit down the road I saw a field full of colors and a corn about a million times my size. I looked at it in amazement and asked what its name was. "I'm called *Bt* corn. I have a gene from a bacteria that helps me make a natural pesticide inside me," said the corn. "It kills the insects that usually eat me. Farmers use fewer pesticides, so this leaves fewer residues on food. Fewer insecticides go into the soil and the streams. I also have a better yield, so that saves money too!"

After a few hours flying, I came to a field that was all green. Under all the leaves was a big soybean pod. "Hi, what's your name?" I asked. "I'm called the Roundup Ready soybean. I'm genetically modified, and I'm immune to the pesticide called Roundup. Roundup kills the weeds around me, but not me," said the soybean gleefully, "so that means less pesticides used."

I flew over to a glass house and saw a scientist. He said he was busy creating golden rice. I asked, "What's that?" The scientist said, "I take two genes from a daffodil and one from a bacterium and put them into rice plants. This makes rice produce beta-carotene, which a human can turn into vitamin A." I said, "That sounds like a great product since so many children suffer from vitamin A deficiency and can go blind."

"Wow!" I said, "I have so many ideas for the future: plants that will handle droughts, floods, or extreme temperature changes; disease-resistant plants; longer-lasting vegetables; plants with more yield because of the growing population; healthier plants that have more vitamins and nutrients or that have beneficial effects in humans like antibiotics and vaccines. Maybe plants can even treat diabetes or cancer!" The scientist explained that although I have great ideas, many people are afraid about using genetically modified foods since they don't know much about them.

I decided to pay a visit to the Environmental Protection Agency. I put on my top hat and coat and went to one of the offices. I explained all the benefits of genetically modified foods and their future possibilities. I demanded more research to prove that genetic modification is safe for humans and the environment, and that the foods won't cause allergies. I suggested more education and labeling so people could make a choice—and I begged him not to swat me!

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Name: Amira Anuar
Essay Theme: Dynamic DNA
State: Connecticut
School: Harry M. Bailey Middle School

Dynamic DNA

Let it be a well-known fact that science has no limit to its endless possibilities. We can make miracles happen with the technology of brilliant scientists. Genetic DNA manipulation has helped the world of science accomplish a countless number of nearly impossible tasks. What is DNA? DNA is a hereditary material that controls all cell activities and contains information for making new cells.

We can use DNA exploitation technology to increase agriculture's production. Genetic manipulations have fueled the growth of agriculture. Using the technology, farmers, ranchers, and herders can control the reproduction of their crops and livestock. This way, each generation will hold as many genes as possible. How do they do this? They do it by following a brief number of steps.

Animals can have foreign genes implanted into their DNA structure that can help them do things they couldn't do without it. To do that, the foreign genes have to be implanted into a fresh fertilized egg before it develops. First you have to identify the wanted and helpful genes in the donor cells of a foreign animal. Next you use restriction enzymes to cut the genes out of its DNA chain. It is clipped into the DNA molecules of a bacterium that will carry the traits. Once it is ready, the carrier will transplant the genes into a host embryo. The embryo will either duplicate or immediately be inserted into a pregnant mother or egg so it will develop.

These genes can do many things to help the animals. They can help to fight diseases, grow stronger, or withstand harsh environments. For example, an antifreeze-producing gene that was extracted from a cold-water flounder can be inserted into certain kinds of salmon so they can be raised in chillier climates.

Not only can genetics help animals, but they can be beneficial to plants as well. The process is almost the same for a plant as it is for an animal. You find the target gene, cut it, and transplant it into the carrier where it is then inserted into a plant.

Although the processes are very similar, the benefits to plants are very different. Fruits can have a strong resistance to bruising. A crop defense against disease and pests can be made stronger. Soybean can be made into a healthier food source. Green plants can have more efficient photosynthesis. All that and more can occur. It's all thanks to DNA manipulation and genetic exploitation.

The manipulation of genetics has really propelled agricultural bounty. It's no wonder agriculture is leading the way with its cutting-edge, gene manipulation techniques.

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Name: Philando Brown
Essay Theme: Weather and Crop Production
District of Columbia
School: R. H. Terrell Jr. High School

Abundance of Food from Biotech

Plants are grown in many different soils over different seasons. In the process, the soils may become depleted of nitrogen, phosphorus, and other materials that are necessary for crops to grow successfully. This report will examine the opportunities that are necessary for plants to grow and survive in any type of soil and weather.

Some of the factors that affect the quality and the quantity of the yield of foods are as follows: (1) location for planting of crops, (2) the weather conditions of the area, (3) the soil conditions, (4) the time of the year, and (5) adequate irrigation and watering conditions. Farmers and biotechnologists have to consider these factors when examining the yield of foods and the problems that must be considered.

It is not a given that all plants and crops will grow under every condition. If there is heavy rainfall, then the erosion of certain layers may remove nutrients in the soil that will affect the productivity of the crop. Therefore, the weather of a geographical area like Washington, D.C. means it is not the correct place to plant greens, corn, cabbages, etc. in the months of November, December, or January.

However, some scientists from the University of Michigan have discovered a gene that controls the cold effects on plants. This gene is called the cold-response gene. Michael Thomashow of Michigan State University has isolated the cold-response gene that can control the effects of cold. In parallel research, a team of scientists from the University of California have changed the ability of tomatoes, rice, and alfalfa to withstand salty conditions by overexpressing a particular gene in the plant. Using genes from the Arabidopsis plant, a crop can shunt salt into storage cavities, allowing the plants to thrive in otherwise impossible conditions.

I am asking scientists to follow the lead given by these researchers to see if they can duplicate the same techniques for growing greens and vegetables indoors in greenhouses during the winter months. As an 8th grade student in an urban school, I will be excited to see an abundance of foods growing in the future years in places like greenhouses. In the tropical states of Hawaii, Florida, and California, the problems of soil quality and soil erosion can be corrected by enriching the soils and protecting the land with the correct landscaping procedures to prevent the waste of nutrient soil.

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Name: Stephanie Danielson
Essay Theme: Cultivating New Technologies

State: Hawaii
School: St. Michael's School

Producing Food in Space

The idea of producing food in space originated from NASA's interest in long-term manned space flights and the possible colonization of the moon and planets. The purpose was to provide food to support life without having to bring it. NASA wanted to keep the astronauts alive much longer with food grown in space instead of bringing packaged food to support the entire trip. It would be impossible to send along enough food and water for space explorers on an extended space mission.

Food is part of an astronaut's life-support system. Life-support systems also consist of potable water and breathable air. The food that the astronauts need to eat in order to live is made of carbon, water, and other mineral elements, the same from which plant biomasses are made. Water can be recycled from wastes and collected from plant biomass, and plants produce the oxygen for the breathable air.

Plants have proved to be a very important life source to the astronauts in the spaceship, because in order to live, the astronauts need a supply of oxygen and food. Plants can provide both and are also important in the Biogenerative Productive System, or BPS, in which food is produced and human wastes are recycled.

Before NASA could design a life-support system for long space flights they had to design a plant that could grow well in space. They needed to make 3,000 kilocalories per day for every astronaut. They had plenty of sunlight and could bring water, but they needed a plant that could grow in microgravity—that is, very little gravity, almost weightlessness.

Apogee wheat is one food supply that NASA developed that can be grown in space. It grows faster than the wheat on Earth and produces enough food to support the astronauts. Bruce Bugbee is a biometeorologist from Utah who invented this wheat that grows in microgravity. There are other wheats, too, that can grow in space; for example, dwarf wheat. This gives a variety to the astronauts.

Another food plant is astroplants, a plant that can provide astronauts with food, helps the BPS, and grows well in space. The International Space Station is allowing NASA scientists and other researchers like students to explore and develop food production systems in space. NASA calls the research "Astroculture," a study that will enable sustained life-support systems. These studies also will help increase Earth's environmental and public health.

In the future we will travel long distances in space. We will have to be ready to feed the explorers who make the trip. Today's research and the future space station research will help us develop food that will support our future exploration.

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Name: Jamie Lancaster
Essay Theme: Food Science and Nutrition

State: Idaho
School: Canyonside Christian School

Eat Safely with Irradiated Meat

I live on a beef ranch with my parents. We do everything we can to produce top-quality animals. When we ship our cattle to the market we know that they are healthy. Then we read in the media about people getting sick from eating beef, particularly from the presence of the bacteria, *E. coli* 0157:H7. This news reduces consumers' confidence in buying our beef. Now the government is working toward identifying *E. coli* 0157:H7 and finding ways to kill it. As a result, our family and other producers can sell our products without getting the blame for producing infected beef products.

E. coli 0157:H7 was first identified in 1982 when three outbreaks of food poisoning were linked to it with six more outbreaks between 1984 and 1986. Then in 1993, a major outbreak in the western United States was linked to the consumption of undercooked hamburgers infected with the bacteria. As a result, 4 people died, and more than 500 other people became ill. This form of *E. coli* is more common now because of the shipping of boxed beef, larger packing plants, difficulties in keeping carcasses clean, careless handling, and undercooking beef products.

Currently all U.S. Department of Agriculture (USDA)-inspected raw ground beef is tested for *E. coli* 0157:H7 and recalled if it is found. The occurrence of *E. coli* 0157:H7 in raw meats is very low; however, the presence results in serious consequences. In 1997, the identification and recall of 25 million pounds of infected ground beef started the Food and Drug Administration (FDA) working to approve a new safety process of meat irradiation. Meat irradiation has been considered since the 1970s but has only been approved by the FDA in 1997 by the USDA in 1999. In over 40 countries, 60 foods have irradiation approval.

Irradiation is an effective proven process to improve the safety and quality of the food supply. During irradiation, the food is exposed to a controlled amount of gamma rays from Cobalt 60. These rays are similar to X-rays but have a shorter wavelength and very high frequency. It is impossible for food to become radioactive, because it never comes into contact with the radiation source. Irradiation causes the same nutrient loss as canning or cooking.

After accepting irradiation use, consumers can safely buy meat. The food labels will say either “irradiated” or “treated with ionizing radiation” on the label. This means it doesn't have the bacteria. However, it does not kill all the bacteria, so consumers must still handle the meat properly and cook it completely. In the future, the irradiation of food has the potential to be used in meat processing just as pasteurization is used in the processing of milk.

By using irradiation, we can help ensure consumers that harmful bacteria have been destroyed. We can stop recalls that cost the beef industry millions of dollars, and most importantly, we can prevent illnesses and deaths that are caused by this form of the *E. coli* bacteria.

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Name: Keri McDaniel
Essay Theme: Alternative Fuel Research
State: Illinois
School: St. Bruno

Biodiesel Fuel

Biodiesel fuel is leading the way into the future. Biodiesel can be made from trees, grasses, and agricultural crops. Biodiesel is being used in cars, boats, and tractors. It is being produced in the United States and in other countries around the world. Invented by Rudolf Diesel, biodiesel first came onto the market between 1920 and 1924. The first biodiesel pump in Central Illinois opened in May 2002.

Biodiesel burns cleaner than regular diesel. Soy biodiesel was the only alternative fuel to pass the Environmental Protection Agency's Tier 1 and Tier 2 Health Effects Testing. It is made from renewable materials that consist of animal fats and vegetable oils. Through a chemical process called transesterification, the glycerin is removed from the fat and vegetable oil.

Biodiesel benefits us in many ways. Using biodiesel reduces our dependence on foreign oil companies. It helps to save our fossil fuel supplies. Renewable fuel production also provides many new jobs in rural areas.

Some people may worry that biodiesel fuel might somehow damage an engine; however, this is not true. While using biodiesel, there is no difference in the performance of your car compared with using regular diesel. In fact, biodiesel may actually be better for it. In cold weather, regular diesel can cloud and turn to gel, but with biodiesel, it can get to 3 to 5° Fahrenheit before any effects happen.

Overall, biodiesel is a cleaner-burning fuel and its popularity seems to be spreading. One and a half billion gallons of biodiesel are produced per year. Biodiesel can now also be bought anywhere in the United States. Unlike petroleum products, biodiesel is more helpful to the environment and can be produced continuously. Hopefully, countries will continue to explore biodiesel as an energy source. In the future, biodiesel may be all we have left.

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Name: Neil Ahrendt
Essay Theme: Conservation of Resources
State: Indiana
School: Carmel Junior High School

A Pathway to the Future

A businessman sits atop his leather chair, plotting new ways to cut down the rain forest. Nearby his office window, a woman drives needlessly in her gas-guzzling sport utility vehicle, intent on wasting as much fuel as possible. People all around the world stop supporting botany centers, to cause the extinction of all plants, many of which produce life-saving medicines. In reality, however, human beings are not that intent on destroying valuable resources. Even so, one might believe the above situation is true after seeing the damage that has and is being done to planet Earth. Unless conserving resources and food supplies is brought into higher priority, the human race will inevitably bring about its own untimely demise.

Resources are being used up at an alarming rate, rapidly enough that it is predicted oil will run out in the next 50 years. Thought technology is heading forward with alternate fuel supplies; fossil fuels provide power for hundreds of different inventions. The most memorable of these is the most common kind of transportation, the car. Trains, however, run on coal and still provide efficient cross-country transportation for a company's goods. Airplanes not only provide travel for people and cargo, but also serve as a main military weapon. If gasoline was to run out before an alternate fuel was discovered, any government would be left with whatever remaining supply they had. People all across the world would be left without cars, gas stoves, lawn mowers, chainsaws, and other fuel-consuming devices.

The switch from gasoline to an alternate fuel source, such as solar-powered or electric, would actually help the Earth because of the reduction in pollution. Pollution caused by the exhaust from cars badly damages the air and therefore humans. The exhaust from a car contains carbon monoxide, benzene, and formaldehyde, among other things. All three of these pathogens are harmful to human lungs, yet car companies still persist in creating cars that emit harmful agents into the already polluted air.

Though biotechnology has produced plants without seeds that are able to withstand bugs, and rectangular watermelons, it is still no match for Mother Nature. If an entire species of plant is destroyed, no amount of scientific gene splicing will bring that plant back. Since plants contribute to one-fourth of all medicines, people should pay more attention to the decrease in farming and botanical research being performed.

Though no man may really be seated in any chair scheming the destruction of the world's resources, the evidence is there that the population of the Earth collectively is. Though some eco-conservative humans, often referred to as "hippies," strive for a better planet, much of the world must realize the terrible repercussions of its actions. Each minute an acre of the rain forest disappears, even though the rain forest is the main place where cocoa, bananas, coffee, and hundreds of other everyday products are harvested. Fossil fuels are rapidly being used without remorse or consideration toward the future. The future is looking troubled. Obviously, something must be done. Amen.

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Name: Ian Michel
Essay Theme: Conservation of Resources

State: Iowa
School: Mid-Prairie Middle School

Conserving Our World—Together We Can Make A Difference

Have you ever wondered about conservation and what it means? Have you thought about your world and what you can do to protect it? Both of these questions were meaningless to me because I really didn't know what they were asking. I didn't know what the word conservation meant and I didn't know what I could do to help. But I decided to find out.

During this past year I enrolled in the wildlife conservation project area through 4-H to learn what conservation was. I got some books on conservation from our local Extension services and I went to the Internet to see if I could find some answers to my questions. I found a really cool website that had a quiz so you could test yourself on conservation. I found out a lot of things I didn't know, and I also found out that I knew more than I thought I did. It was interesting because I also found out there is a lot I can do to help protect habitats and our natural resources.

I decided to share what I learned with lots and lots of people by giving a presentation on the topic and by making a quiz board that I displayed at the county fair this summer. It allowed people to quiz themselves and learn more about the environment and learn what they could do to help protect it. Some of the things I learned and shared were about farming and irrigation, about erosion, about composting, and about creating backyard habitat.

I learned that contour farming is the best way to farm on a hillside because it helps keep the soil from running off down the hill during wet times. I also learned that drip irrigation is the best way to water plants because it doesn't cause erosion and it gives the plants just enough water to survive. I learned that crop residue helps to protect the soil from running off during the rains, and that is why farmers leave cornstalks in the fields until the next planting season.

I learned that composting is a good way to help control garbage and also a good way to get fertilizer. A container on the counter can turn food scraps into fertilizer for house plants, or a large compost pit in the yard can make yard waste into garden fertilizer.

I also learned a lot about creating habitat. You can build butterfly houses or birdhouses that can be put up in your yard. You can create a backyard wetland to provide habitat, or you can leave land in natural grasses to provide food or cover for wild animals.

In conclusion, I learned what it means when someone asks how you can help protect natural resources. My family already leaves most of our acreage in natural grass, and we have planted many trees to provide food and habitat. My brother and I also have plans to make a wetland area in our yard. I learned that conservation is not only helpful to our Earth but it can be a lot of fun. If everyone did a little, our world would be a better place. Together we can make a difference.

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Name: Garrett Lister
Essay Theme: Alternative Fuel Research

State: Kansas
School: Marysville Elementary

Alternative Fuel

I just can't wait until our next family meal. When Mom asks me to eat my vegetables, I've planned a great response. I will respectfully say, "Mom, as much as I would love to eat these vegetables, I should do my part in powering the future with bioenergy!" After I stun her with my brilliance, I'm sure I'll have to explain my theory.

Although not all vegetables are being considered as possible energy sources, one common vegetable has found its way from the table to the fuel tank. Corn is the main ingredient in ethanol, which is rapidly gaining popularity as a renewable fuel source. In my home state of Kansas alone, ethanol production doubled in 2001. We boast five ethanol plants with more plants under construction. These five plants use about 26 million bushels of grain to produce between 65 and 70 million gallons of ethanol fuel. That's good news for farmers in the heartland and for local economies by creating employment opportunities in rural communities.

Ethanol's advantages don't stop there. With the highest octane rating available, ethanol allows cars to run smoother and keeps fuel systems clean for best performance. Ethanol also reduces air pollution by burning cleaner to reduce tailpipe emissions and greenhouse gas emissions, which add to global warming.

Another oxygenated bioenergy source making its way into the market is biodiesel. This fuel source is made from such things as vegetable oils, animal fats, and recycled cooking grease. Biodiesel is a cleaner-burning replacement for petroleum diesel.

Nearly half of biodiesel production is from vegetable oils, most commonly soy. Because of product surpluses in recent years, soybean prices have declined. Soybean producers are therefore especially interested in biodiesel as an energy source of the future. I think it's interesting that since most farm machines run off diesel, it seems that biodiesel has made its way from the farm as soybeans back to the farm as fuel. That's what I call renewable!

Although ethanol and biodiesel are renewable fuels that promise to power the future, they could be short-lived because of another energy source: methanol. Although most methanol production currently is from natural gas, it can be made from renewable sources such as seaweed, waste wood, and garbage. Methanol is currently being researched for its ability to produce hydrogen for the fuel cells that could power electrical vehicles within the next decade.

As methanol is further explored, I think it would be exciting to see research looking into production from renewable sources such as agricultural by-products. If animal waste could be used, it would give a new meaning to my chore of cleaning our barn of sheep and cow manure!

It's exciting to think of the possibility of living in a world powered by our own renewable agricultural products. It seems better to me to lessen our dependence on foreign oil and rely more on American agriculture. The same people that we rely on to feed us could help power our country into the future.

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Name: Corey Hatfield
Essay Theme: Cultivating New Technologies

State: Kentucky
School: Phillip A. Sharp Middle School

Producing Food in Space

I am here to tell you about "Producing Food in Space" or "Using Lasers, Robots, and Computers in Agriculture." Which is…

I am first going to talk to you about something called a "BioBLAST." Now the BioBLAST was designed to model the growth of NASA Advanced Life-Support. These crops are under a variety of conditions. This will be used with the Farming in Space Project.

Second, let's talk about "The Plant Production Simulator." This device models the growth of wheat, soybean, potato, and lettuce. Data used in the simulator were collected in the Biomass Production Chamber at Kennedy Space Center. These data can be viewed by clicking on a button called the "Database" and the simulator users can manipulate lighting conditions, CO_2 levels, harvest cycles, and experiment length, among others. During every run, users can monitor the growth of the crops. They can also monitor gas exchange and water production. In addition, detailed analysis is available at the end of every run.

Here are some questions to consider:

- Why look at plants?
- Is it worth the cost?
- What knowledge will be gained by further crop growth research?
- Is knowing the reaction of specific plant species to microgravity important? How? Why?

And these are just some of the questions that people are asking themselves.

Third, I'm going to tell you about wheat production. It took more than a whole decade to develop wheat suitable for space forms.

Fourth, I'm going to talk to you about things that plants need that they have lack of in Space. Plants need gravity, and Space has very little gravity. Because of this lack of gravity, plants cannot develop strong roots. In Space there is lack of sunlight and plants need sunlight to make their food. And there are many more difficulties for the plants to grow in Space.

Fifth, we are going to talk about something called the "Remote Sensing System." The sensing is able to sense 15 multispectral radiation channels across the thermal-near infrared-visible spectrums. The sensor also incorporates onboard, active calibration sources for all bands.

Well, this is all of the information I've got; I hope you enjoyed this document. I know I enjoyed writing it, and if we do end up living on Mars I'm sure glad they invented "Producing Food in Space."

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Name: Jeremy Wingate
Essay Theme: Ag Science in the City
State: Louisiana
School: John Curtis Christian School

The Importance of Agriculture for Urban Areas

Urban agriculture is critical to the future of the planet. With the seemingly endless migration of rural populations into urban areas, especially in developing countries, the need for urban agriculture to help these areas become more self-sufficient is increasing. With more land being consumed by larger and larger cities, using every available parcel for urban agriculture is important to ensure the health of these cities.

There are many success stories springing up of urban agriculture, such as around Paris, France, where a small amount of land (10%) is responsible for a much greater amount (35%) of production value, with the producers selling their goods at city markets and to locals. In London, one bright spot is beekeeping, with about 27,000 kilograms of honey being produced every year. Portugal is seeing some of the best grapes for winemaking being produced in suburbs of Lisbon. In St. Petersburg, Russia, backyards and rooftops are being used by over half the population to grow fruits, vegetables, and flowers.

Another idea is being developed in The Netherlands, where city dwellers are getting the opportunity to help decide what is to be grown by also making a commitment to buy some of what is produced. In Israel, small city farms are helping bring people together to work and grow food. These farms are also being used as teaching tools, where thousands of school children can visit to learn about everything from composting to reusing wastewater. In Mali, the capital city of Bamako produces enough vegetables to be self-sufficient.

All of these examples of urban agriculture are critical to the future of the planet. Many people are already recognizing the need for “sustainable development,” where we can meet the needs of today’s population without risking the ability of future generations to meet their needs. Organic farming is on the rise, with many people willing to pay higher prices for food produced in ways that don’t harm the Earth the way big commercial farms can. In fact, the U.S. government has just approved a new labeling procedure that will certify products as “100% Organic,” “Organic” (95%), “Made with Organic Ingredients” (70%), or “Some Organic Ingredients” (less than 70%).

The benefits of urban agriculture cannot be overstated. It has been shown that gardening can improve students’ grades, attendance, and morale while lowering crime rates. It can increase the income for poor families while improving their nutritional well-being. It will have a positive impact on the health of the planet. With all the vacant land available in the United States and elsewhere, it will be in everyone’s best interest to encourage urban agriculture in sustainable ways, increasing everyone’s quality of life and improving the condition of the Earth.

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Name: Jarrett Remsberg
Essay Theme: Food Science and Nutrition
State: Maryland
School: Middletown Middle School

Is *E. coli* Lurking in the Drinking Water of Your Town?

Fear and the realism of terrorism are upon us. The era of Harry Potter and wizardry has come and will go. However, the Holstein breed will remain forever. But all is not well in "Holstein Land," for *E. coli* is lurking in the water.

E. coli is the most common member of the fecal coliform family. *E. coli* is responsible for three types of infections in humans: urinary tract infections, neonatal meningitis, and intestinal diseases. The purpose of this research project, which I conducted, was twofold: (1) to determine the difference in total coliform, fecal coliform, and *E. coli* levels in well water and bovine drinking waterers on Holstein dairy farms; and (2) to investigate the prevalence of *E. coli* on dairy farms and the effects it may have on the food supply and the environment.

Harry Potter has invaded Professor Snape's lab with cauldrons boiling to their tops. As was I, on six Holstein dairy farms collecting water samples from well and bovine drinking waterers in sterilized bottles. Water samples were tested by using the Most Probable Number 5 X 3 Multiply Tube Fermentation technique. Positive presumptives were transferred to Brilliant Green Bile and EC + Mug medium and were incubated using standard procedure.

The total coliform, fecal coliform, and *E. coli* levels were significantly higher in the bovine drinking waterers than in the well water. Farms 1 and 3 revealed the highest bacteria levels (>1,600/100 ml) in all three categories. Results indicate that the bovine drinking waterers were contaminated with bovine manure. Farm 4 exhibited a high level of total coliform (1,600/100 ml) and a moderate level of fecal coliforms and *E. coli* (170/100 ml). Data reveal that the spring-fed water source is polluted, and the manure in the free-stall barn is contaminating the waterers. Farms 5 and 6 had the lowest bacteria counts, which suggests that these Holstein farms are using proper waste management procedures.

The following Good Management Practices should be employed on Holstein dairy farms as a means of reducing the amounts of these harmful bacteria: (1) clean drinking waterers on a weekly basis and use stainless steel waterers; (2) scrape free-stall barns twice daily and keep surrounding area clean; (3) body-clip Holstein cows and keep them clean; and (4) administer tablets to waterers to kill any unwanted bacteria.

Research has shown that bovine feces are a potential vehicle for disseminating, transmitting, or propagating *E. coli* to cattle, food, and the environment. *E. coli* can cause mastitis and intestinal diseases in Holstein dairy cows and also be responsible for water pollution, which may create illness to humans. However, with the pasteurization of milk and the proper handling and cooking of meat these pathogenic organisms pose little risk to human health.

So yet another discovery has been made that will benefit the Holstein breed. Harry Potter may take care of villains, but I will manage to control the prevalence of *E. coli* that lurks in the drinking water of Holstein cattle.

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Name: Levi Bissell
Essay Theme: Cultivating New Technologies

State: Massachusetts
School: Herberg Middle School

Grain Grown in the Galaxy

Farming in space is a new and growing idea that will change space travel and many aspects of human life. This new agriculture is being developed to affect long-term stays in space, such as moon colonization, make support systems to produce food, and recycle human wastes. This development of growing plants in space will surely not only change space travel, but also, it will alter the ways of life on Earth.

The growth of this innovative farming is a very complex advance in agriculture. NASA is the group from which the idea of plant growth in space has sprung. Several organizations, such as Orbitec and Utah State University, have expanded from NASA's study.

Plants such as dwarf wheat, Apogee, and super dwarf are all wheats that scientists think will grow in space. Super dwarf wheat is the only one of the three to have been tested in space for growing results. The first crop of the super dwarf grown in space grew poorly and produced low yields. Any growing of plants for eating will probably take place on the international space station, which is the location where the super dwarf wheat was grown.

Growing wheat in space is no easy task. Carbon dioxide levels are set; there are also set temperatures, and light must shine all day. There are no spacious fields for the plants to grow in. Not only do the scientists have to adapt the conditions for plant life, but they also must discover a plant that survives in these present conditions that are so different from those on Earth. The plants that are being grown in space are without their roots in soil; the roots are suspended in the air.

Growing wheat in space is being developed for space missions that will involve large crews and/or large amounts of equipment so that food will not add to the weight in a shuttle at lift-off.

In the future, farming in space will greatly affect life. Spacecrafts won't need as much fuel to lift food for astronauts, and eventually, more food will be available to the public because of more farming locations.

Farming in space will impact our lives, farming, and space expeditions very much. With our thirst for knowledge and answers, we have commenced to solve the problem of diminishing farmland and the problem of getting food to astronauts more readily.

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Name: Andrew Stein
Essay Theme: Dynamic DNA
State: Michigan
School: Oxford Middle School

Need More Food? Use Genetics!

People have been dabbling in the realm of genetics for over 4,000 years! Pioneer scientists such as Gregor Mendel and Thomas Fairchild paved the way to new discoveries. Wouldn't they be surprised to learn that their ideas are being used to splice spider genes into lamb genes and flounder genes into tomato genes? With this technology, maybe someday we could grow plants that produce more food in a room than an entire farm does today. Imagine going into your "walk-in garden" to harvest this week's produce, knowing that your abundant plant supply will make up for the loss in a week's time. This could be made possible by using tools from the past along with some exciting new technologies that are changing the way we think about food production.

Hybridization, a tool used widely in the past and present, is a way of producing offspring with desired traits by pairing two organisms that possess the desired trait, together. For instance, you could pair a corn plant that produces a few big ears with another that produces lots of small ears, together. With this cross, you would hope to get a stalk with lots of big ears.

Inbreeding is another tool used to produce organisms with desired traits. It is when two plants with the same form of a desired trait are bred to produce offspring with that trait. The offspring is referred to as a purebred. However, genetic disorders often occur with inbred organisms.

These tools are great, but is there a better way? DNA (deoxyribonucleic acid) may prove to be the answer. We have found that DNA, known as a building block of life, can be manipulated. Genetic engineering is a widely beneficial, but controversial, tool. It is a way of splicing genes from one organism into another. This is done by cutting a chromosome on a certain gene and splicing the chosen gene from another organism into it.

You may wonder what this has to do with boosting agricultural bounty. It has everything to do with it! Scientists have already spliced genes from a flounder into tomatoes, making a tomato plant that is resistant to cold. We are on the threshold of some pretty amazing breakthroughs. For instance, you might be able to splice the gene that codes for a strawberry to be perennial into a potato plant. Or you could splice the gene from certain weeds that rapidly reproduce into a wheat plant, making the wheat rapidly reproduce.

Using these examples, perhaps now you can understand how the "walk-in garden" of the future could work. It would be full of rapidly producing, perennial plants with special characteristics such as being resistant to cold or bearing lots of fruit. The possibilities are endless. Who knows what the future holds in store for agriculture? Genetic engineers and people who have creative imaginations to put their tools to use—that's who!

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Name: Aravinth Karunanandaa
Essay Theme: Dynamic DNA
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School: Northeast Middle School

Boosting Agricultural Bounty with Genetics

In 1973, discovery of the recombinant DNA technology by Stanley Cohen and Herbert Boyer led to the birth of genetic engineering and biotechnology. Biotechnology is defined as "application of living organisms to develop new products and processes." Use of biotechnology has been dated back to 6000 BC, when yeast was used by Sumerians and Babylonians to make beer. Plant biotechnology is a general term used for the tweaking of a plant genome by inserting foreign gene(s) or modifying the existing gene to obtain desirable trait(s) to boost agriculture. Plants are considered as factories of nature. They have the chemistry and metabolic pathways to produce basic nutritional needs for animals and humans.

Scientists predict that in the next 40 years there will be double the population and triple the demand for food. Since the major component of human diets is derived from plants either directly or indirectly, the ever-growing demand for food can be met with the use of plant biotechnology to boost agriculture without the fear of degrading the environment. The marriage of plant biotechnology and plant breeding has enabled scientists to create plants with the following traits: higher yield, herbicide tolerance, pest resistance, enhanced nutritional value, elimination of allergens in food, and drought and stress tolerance.

Monsanto's Roundup Ready (RR) soybean (herbicide resistant) and YieldGard (insect resistant) corn are examples of two major agricultural crops that are genetically modified (GM), introduced into the U.S. market in 1995. In addition, Bollgard cotton (insect resistant), and RR canola have been successfully grown in the Western Hemisphere. In 1999, of the total of 72 million acres in the United States planted with soybeans, half were planted with RR soybean. Introduction of RR soybean has benefits of increased yield, lower operating cost, reduced groundwater pollution, and soil conservation.

During the past 50 years, increasing crop yield has been the primary objective of modern agriculture. Nutritional content and composition of crops have been largely overlooked in breeding programs. Basic nutritional needs of most of the world's population are largely unmet. Hence, modifying the nutritional composition of plant foods is an urgent worldwide health concern. According to the World Health Organization, diet deficient in vitamin A affects 250 million children globally. Vitamin A deficiency has been implicated in poor vision, protein malnutrition, and immune function-related diseases. Ingo Potrykus, a Swedish scientist, has created golden rice, rich in vitamin precursor beta-carotene, through genetic engineering. This is the first kind of GM rice that harnesses the genetic potential of an agricultural crop to offer improved nutrition for the billions of people in developing nations who depend on rice as a staple food. Currently, scientists are working to increase the sterol content of plants that have potential to reduce human serum cholesterol and cardiovascular diseases (CVD). Approximately 115 million people in the United States face potential death from cholesterol-related CVD.

The above examples portray the power of biotechnology and plant breeding to boost agricultural bounty as an environmentally sustained solution.

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Name: Morgan Cunningham
Essay Theme: Cultivating New Technologies

State: Montana
School: Hysham Public School

The New Challenge to Boundless Agriculture

"A media frenzy, killer mosquitoes, dead birds in the yard, and my horse is sick." Does this sound familiar? It is the new worry in the United States: the West Nile Virus!

This virus has been in Europe and other countries for many years, but recently in 1999 it came to the United States and it is here to stay. The first cases were found in exotic birds at the Bronx Zoo in New York. These birds had come from the country of Egypt, near the Nile River, so that is why this virus is called West Nile. The unusual thing about this virus is that it did not slowly spread through the nearby states. Instead it jumped from New York to Florida from the migration of virus-infected birds. There, the infected mosquitoes spread the virus to horses.

This virus grows best in birds, which are considered its primary host. The virus particles multiply inside the bird until there are millions of West Nile virus particles going through the bird's bloodstream, and when a mosquito bites the bird it picks up the virus quickly. But when it is in the mosquito's body, the virus doesn't replicate. All the mosquito is doing is acting like a dirty needle spreading the virus to other animals.

Other species that are affected by the West Nile Virus are humans and horses, and it affects cats and dogs but not very often. When you are bitten by a mosquito that has West Nile, there is a 3 to 14-day incubation period, but there is a very low chance of you getting sick from the virus-infected mosquito bite. For example, when a horse is bitten by an infected mosquito, 1 in 150 will get sick, and out of 10 that get sick, 4 will die. Victims that are either young, old, or already have a disease of some sort are the most likely to get sick and die from this virus. Actually, more people die from the flu every year than from West Nile!

One of the many problems of this virus is that there are no antibiotics that will kill the virus. Your body has to make antibodies of its own to fight and kill the virus. However, there is a vaccine that you can give to horses to help protect them if/when they are bitten by an infected mosquito. The vaccine fools the immune system of the horse into thinking it is infected by the virus so that it will make antibodies to fight the disease. So if the animal does get bitten by an infected mosquito, there will be antibodies there to fight and hopefully kill the virus.

Scientists are still working all around the world to control new sicknesses, including the West Nile Virus. I believe boundless science for bountiful agriculture will provide a better quality life for everyone!

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Name: Adam Peetz
Essay Theme: Conservation of Resources
State: Nebraska
School: Sidney Middle School

Conservation of Resources

This year the United States went through one of the worst droughts since the days of the Dust Bowl. The drought affected everyone, even those living in urban areas. In my hometown of Sidney, Nebraska, the drought was so severe that water restrictions on lawns were implemented and many farmers had to shut off their groundwater irrigation wells. To develop a plan to conserve our water resources, we must understand the water resources available to us and the cause of the current drought, the effects of the drought on our environment, and the technology available that will help us improve and measure our conservation efforts.

What caused this horrible drought? El Niño. El Niño is a large mass of abnormally warm surface temperatures in the southern Pacific Ocean that has caused our weather to be warmer and drier. El Niño has caused the levels of our state reservoirs to drop dramatically in this past year. Lake McConaughy near Ogallala, Nebraska, is at a 45-year low, and many local farmers were restricted on the amount of water used for irrigation. The Ogallala Aquifer, which is a giant underground lake that runs from Texas to Canada, is the main source of groundwater in the Midwest. Hydrologists have completed studies that indicate that this water resource is becoming depleted because of the growing number of agricultural users and the high demand from many urban customers. Many experts say that if Nebraska doesn't receive exceptional rainfall this year, many of our lakes, streams, and groundwater tables may decline further or even disappear.

Irrigated and dryland crops were severely strained due to lack of precipitation and declining groundwater levels in wells. Livestock also felt the effect of the drought when watering holes and windmills went dry and green pastures turned brown. Many ranchers were forced to either sell their herd or move them to feedlots for feeding.

How can we conserve our great water resources? Farmers can use no-till farming that requires less water. They can also install center pivots to replace flood irrigation, because pivots are more efficient than flood irrigation. Planting drought-resistant varieties of crops that do not need as much water can also conserve water. Another conservation practice is to only water crops and lawns when needed. New technological advancements have been developed that can measure the amount of moisture in the soil and command sprinklers to water at optimum times of the day for the most efficient water usage. The drilling of new wells should be restricted. Homeowners can also install water flow restrictors in their homes so water will not be wasted needlessly. You can go to your local NRD to find out more ways to conserve water.

Everyone must consider adopting practices to conserve water. New farming techniques and equipment are a beginning for conservation plans, but both rural and urban users need to cooperate to ensure that an ample supply of water is available now and for the future.

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Name: Amber Hoogestraat
State: Nevada
Essay Theme: Cultivating New Technologies
School: Pau-Wa-Lu Middle School

Producing Food in Space

A favorite meal to an American family usually means hamburgers, fries, and a shake. But food to an astronaut consists of some things that might scare you just looking at it! Freeze-dried powders and semi-liquids may not seem appealing to you, but that's the kind of food astronauts take into space at the present time. That method of food in space is rapidly changing.

Currently, scientists are studying how to produce food in space. We all know that it takes sunlight, water, food (nutrients), and gravity to produce a plant. These things aren't all available in space. We take these things for granted here on Earth, while scientists research and simulate food reproduction in space. The air we breathe is everywhere here on Earth and, well, nowhere in space. That's why it is crucial to have plants in space not only for breathing purposes, but also for food.

Green plants store energy from the sun by making their own food. This process of making food is called photosynthesis. A chemical known as chlorophyll captures energy from sunlight. This energy fuels a chemical reaction between carbon dioxide and water. The products of this reaction are food and oxygen, which humans need to sustain life. That is why humans and plants make ideal space-traveling companions. Humans consume oxygen and release carbon dioxide. Plants return the favor by consuming carbon dioxide and releasing oxygen. Humans can use edible parts of plants for nourishment. Gardens in space will produce plenty of air and everything will be great, right? Well, not exactly, there is a problem; there is no gravity, so how is a plant supposed to grow?

Let's talk gravity. That problem can be resolved with artificial gravity that will help the plants grow and continue to do their job. The direction of growth for a plant is influenced by the direction of the pull of gravity. This effect is called geotropism. Artificial gravity must be used in space to grow a plant. The roots grow toward the pull of gravity. The stem and leaves grow away from the pull of gravity. Without gravity, the parts do not know which way to grow.

So what are the plants going to grow in? They can't just grow in pots and soil because it is too heavy to travel into space. Scientists are researching a solution called hydroponics. There is no soil in a hydroponic garden. A growing medium is used to replace soil. Nutrients that plants usually get from the soil are added to the water. As plants are being watered they are also being fed.

To end this adventurous journey through space with plants, I got to thinking that the amazing technology being researched today will help us and our future generations live a better life. Gardens in space are a great idea, and I hope that this project works successfully. I leave you with just one question, what will they think of next?

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Name: Kevin Lane
Essay Theme: Alternative Fuel Research

State: New Mexico
School: C.V. Koogler Middle School

Manure for a Renewable Future

The U.S. Environmental Protection Agency and farmers have been looking at ways to use biogases (mainly methane) from cow manure to create electricity. In order to make electricity using manure, I need to find out several things: how much methane can be made from a given amount of manure, what helps create the most methane, and what is the most efficient way to convert methane into electricity. I am conducting science fair experiments that help to answer these questions. Last year I completed an experiment to determine if there is an optimum moisture content that creates the most gas from cow manure. I discovered I needed better test equipment, and my assumptions about the bacteria were incorrect.

At the beginning of my research last year, I thought gas was created from aerobic (uses oxygen) bacteria that live in the manure. In addition to oxygen, a bacterium would need water and enough organic matter to make cells, grow, and reproduce. The gas is the waste made by the bacteria.

I thought that different amounts of water would affect the amount of gas created. Not enough water would limit the amount of bacteria that could grow and in turn make gas. Too much water would drown the bacteria and no air would be available for the bacteria to breathe.

I interviewed a man who operates a large ranch and is a local electrical engineer. He suggested using canning jars for test chambers and balloons to measure pressure. Using the same amount of dry manure, I added different amounts of water to the test chambers. During the first 10 days, the balloons on the jars with water inflated. I measured the circumferences of the balloons daily. After 12 days, the balloons started to deflate or stay the same.

I put the results into an Excel spreadsheet and plotted the balloon size for each jar by date measured. The balloons from the jars with moisture contents of 91% to 203% grew the largest and seemed to stay filled the longest. But it appeared the balloons did not give me an accurate measurement of the gas pressures. I think the balloons leaked, because the molecules of methane may be smaller than the pores of the balloons.

From last year's experiment, I concluded that water is needed to create gas from manure, and dry manure will make little or no gas. An optimum moisture content >91% weight is needed. Further research indicates that the bacteria are actually anaerobic (without oxygen) and the manure should be water saturated.

This year I am testing different animal manures including cow, sheep, chicken, and pig. I am using stainless steel pressure bombs with pressure gauges. So far, the chicken manure has created the most gas in the shortest period of time. Once everything stabilizes, I will analyze the gas in a lab to determine the amount of methane each sample produces.

I believe that by conducting these experiments, I will learn what it takes to create methane and make electricity from it using manure, which can be a renewable resource.

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Name: Sarah Vines
Essay Theme: Weather and Crop Production

State: North Carolina
School: East Wake Academy

Impact of Weather Anomalies on Agriculture

For as long as we've known, there's always been an unexplained weather event in our oceans. Though we've only recently uncovered the mechanisms behind these anomalies, crops and farms worldwide have always been affected.

The weather anomaly that Americans are most familiar with is the El Niño pattern. El Niño brings warm temperature and a surge of wet air. This cycle has always occurred; however, over the years it's intensified, devastating rural farm-dependent areas as far as the Atlantic coast.

Recent El Niño cycles began in the 1970s and appeared last in the late 1990s. The most severe of these in the last century were the 1987 and 1997 patterns. When El Niño sweeps through, it brings periods of extreme drought and heavy flooding, withering and saturating the crops all in a couple of months. This happens mainly in the Pacific areas, though damage is evident as far as America's eastern coast, as the cycle for southeastern crops is disrupted. It is also noted that a huge threat to farmers is the spring after El Niño comes through, because of the numbers of plant diseases and a boom in the insect population.

Another known event, though not as familiar to American farmers, is the Indian Monsoon. Monsoons are seasonal changes in weather. In the areas of India, Pakistan, and Pacific countries, these changes are drastic. In 1987, there was a drought in Asia, from Afghanistan to the Philippines. This drought was attributed to El Niño, resulting in below-normal rainfall and scorching temperatures damaging crops. Main-season crops all over southern Asia were reduced in production. The western and southern oilseed, grain, and cotton areas, along with rice in the east, are rain fed and rely on the normal weather patterns. These crops suffer the most when El Niño arrives, changing their regular Indian Monsoon. In the same 1987 drought, the temperatures were record low in the northern and central rain-fed farms, making summer-planted crop production plummet. The irrigated fall-planted crops tried to balance the shortfall, but also suffered losses. Another setback for the farmers is late monsoon surges, which soak the crops and bring diseases because of the heavy rains.

It is evident from the intensity of the most recent El Niño that our climate is changing. While it may just be variations of the sun's energy, some scientists believe these storms and fluctuations of weather cycles are due to global warming. Global warming does affect our agriculture. Deforestation and the burning of fossil fuels puts large amounts of CO_2 in our atmosphere. Scientists working in agriculture believe that if we put more carbon in the soil, it can help offset the effects of global warming. By sequestering carbon in trees and plants, it helps fertilize the soil so that the CO_2 can be used for photosynthesis. If we do this, the impact of El Niño, and all the weather anomalies it brings, won't be nearly as intense as it was in 1987 and 1997.

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Name: Remington Zacher
Essay Theme: Cultivating New Technologies

State: North Dakota
School: Parshall High School

Agriculture Thrives on Technology

Wouldn't it be a blast to farm in space? This idea has been tossed around and the technology to do so is being pursued, but I think it would be smart to perfect technology on Earth first.

When you think about farming, most people think of a farmer working in the field, when in fact, farming is far from "just" that. My dad claims, "Working in the field is the best part of my job," and as a 12 year old who is just starting to farm, I think fieldwork is great.

Farmers today must farm many acres in order to survive. Some of them hire help, but others would rather do fieldwork themselves. In order for farmers to stay in the field, they must be able to run their equipment efficiently, minimize office work, and use technology to keep their business profitable.

Some of the technology used today includes global positioning systems (GPS). This technology aids farmers so they won't overlap—saving them time, money, and effort. Since the development of GPS, farmers can measure the bushels they produce per acre, which aids them in site-specific farming. A nice addition to this system would be technology that could measure the quality of the grain being harvested. If farmers could use laptop computers linked to satellites that obtain grain prices from area elevators, farmers would be able to market their grain as they harvest it.

Another system that could work hand-in-hand with GPS is an on-the-go soil-sampling system. Farmers could sample their soil as they do fieldwork, in the exact same location every year. Advanced technology would allow the farmer to analyze nutrients available, determine what needs to be added for the next year's crop, and know what chemical residues were left in the soil.

It would also help farmers if technology could help determine which crops would be most profitable on certain pieces of land. As farmland comes up for sale or rent it would be helpful to know the highest price they would dare bid in order to keep farming profitable.

Weather is another unpredictable factor that hurts farmers. I realize weathermen are doing what they can and that cloud modification is conducted in some areas, but technology needs to be perfected to help farmers prepare for good and bad weather.

When I'm a senior in high school, politicians will be trying to convince me to stay in North Dakota, and my father will probably want me to farm. However, technology has made many other jobs more attractive. When choosing a career, most people want to know their salary; for example, if teachers knew that they could lose money after years of teaching, would they still want to teach? Certainly technology will be developed so farming becomes an attractive occupation for many generations. My grandmother calls farming "a million dollar business that's run off the kitchen table." I call that a need for technology!

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Name: Mallory Rosswurm
Essay Theme: Alternative Fuel Research
State: Ohio
School: Home Schooled

Can the USA Grow Its Own Fuel?

Imagine our country being able to grow all of its own fuels. Sounds like a dream, but by developing, producing, and using fuels made from plant material, the United States could boost the farm economy, increase its energy independence, and improve its environment. Bioenergy can be made from alfalfa, corn, sorghum, willows, poplars, soybeans, and switchgrass. So far, there is no perfect crop for making bioenergy, although there are advantages and disadvantages to all the crops.

Biofuels produced from trees require 1,000 acres to produce enough electricity to supply 25,000 people. Poplars can be harvested only every 3 to 5 years. Willows are harvested every third year for 22 years. Making ethanol from corn takes as much energy to make it as it produces.

Two ethanol crops that show promising futures are switchgrass and miscanthus. Switchgrass is native to the American prairie. Many farmers already grow switchgrass for ground cover or for livestock feed. Scientists are working on changing its DNA so that it does not use so many chemical fertilizers. If ethanol is made from switchgrass, it makes four times as much energy as is used to make it. Miscanthus is a grass that is grown in Europe and has only been experimented with in the United States. Its high yields and annual harvest make it a desirable ethanol crop.

Producing ethanol from biomass requires a plant with a lot of sugar. Corn has starch that can easily be changed into sugar. The sugar is taken out by crushing and washing. The sugar syrup is mixed with yeast and kept warm, so the yeast breaks down the sugars into ethanol. The ethanol is then purified by distillation and dehydration. Biodiesel is made from the oils of crushed soybeans or other oil seed crops.

Besides the fact that these fuels are produced from renewable sources, biofuels are also beneficial to our environment in several other ways. Burning biodiesel or ethanol helps prevent excess carbon dioxide emissions into the air. The plants biofuels are made from use as much carbon dioxide as the burning biofuels emit. If spilled, the fuel is less dangerous since it breaks down easily in water. To help the Earth stay cleaner yet, switchgrass can be planted along streams to prevent erosion and help filter out herbicides and pesticides.

Perhaps the biggest advantage yet is that the United States would be more energy self-sufficient while boosting its own farm economy. If the United States adds just 1% biodiesel to all diesel fuel sold, it would create a need for 300 million gallons of biodiesel and add $800 million dollars more to farmer income. Gasoline can be blended 80% gasoline to 20% ethanol without changing the engine of a vehicle. Ethanol made from corn sells for $1.20 to $1.50 a gallon, making it a competitively priced fuel.

Currently the main two bioenergy markets are electricity-generating plants and chemical-processing plants. This is just the beginning of the unlimited potential of biofuels.

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Name: Sierra Simpson
Essay Theme: Conservation of Resources

State: Oklahoma
School: Chisholm Middle School

Working Cooperatively to Ensure a Bounty of Food

Twenty years ago, who would have thought that in 2002, you would pull into a convenience store to fill up with gasoline and get a refreshing drink, and that you would be paying more per ounce for the thirst-quenching water than for the gasoline? We can live without gasoline; we cannot live without water. How quickly we forget the importance of our most precious natural resource.

Water is our most valuable natural resource. Every living thing needs water to survive. Plants need water for photosynthesis so they can grow. Animals need water to drink. Many animals depend on water-based environments for their nutrients, water, shelter, and space to raise their young. In turn, we consume plants and animals that depend on clean water to exist.

Many kinds of household, industrial, and agricultural products wind up in our waterways every day, contaminating the water for fish and other animals. Nonpoint source pollution has been known as a major contributor for declining water quality. Typically, nonpoint source pollution originates from rain and melted snow flowing over the land. Many pollutants are picked up by the water such as sediments, fertilizers, pesticides, nutrients, toxins, and other contaminants. These contaminants threaten watershed ecosystems as well as drinking water supplies. Agriculture has been identified as one of the contributors to nonpoint source pollution through over-fertilizing, confined animal-feeding operations, and poor conservation practices.

Through cooperative efforts by several organizations, agriculture is cleaning up its image. The Natural Resources Conservation Service recommends the installation of buffer strips to help control pollutants. Buffers slow water runoff, trap sediments, and enhance water infiltration. They also trap fertilizers, pesticides, bacteria, pathogens, and heavy metals, lessening the chance these pollutants will reach surface or groundwater supplies. Conservation buffers protect livestock from harsh weather, offer a natural habitat for wildlife, and improve fish habitats. Legislators also support buffer construction as they will provide monetary incentives to farmers through the 2002 Farm Bill, to establish buffer strips on their farms.

Land-grant universities have conducted studies to modify animals' diets to help protect the environment. These studies have indicated that by lowering the amounts of protein and phosphorus that are fed to poultry and livestock, producers can limit the animals' waste of nitrogen and phosphorus that may contribute to water pollution. New technologies, such as ideal protein, potentially can reduce nitrogen and phosphorus waste by swine and poultry. This could be a major breakthrough for agriculture producers who raise animals in confinement. Also, universities are doing research on value-added products that can be made from the animal waste.

Ensuring a bounty of food directly depends on the preservation of our natural resources. Agriculturists are faced with the challenges of producing economical food products while protecting our environment. Regardless of where you live, you should be concerned about environmental issues in your watershed. Education is the key to prevention. In another 20 years what would you pay for a thirst-quenching bottle of water?

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Name: Adam Hunt
State: Oregon
Essay Theme: Conservation of Resources
School: Obsidian Middle School

Ensuring a Bounty of Food and Natural Resources

Wouldn't it be productive if every year there were 1,000 more fish in the Deschutes River system of central Oregon? One thousand more fish would feed predators and naturally benefit the fight against pest control. This would boost agricultural health in our community, increasing the efficiency of our aquatic and agricultural resources here in central Oregon.

Each year as the irrigation season comes to an end the canal streams are drained, stranding thousands of fingerling trout. In the fall of 2001, The Castaways 4-H Sportfishing Club went into the quickly draining Tumalo Feed Canal of central Oregon and rescued over 1,000 fingerling fish. These were primarily rainbow trout, but there were also brown trout and brook trout. These small fish had made their way through the canal headgate and down into the canal where they were stranded when the water began to recede. The Castaways 4-H Sportfishing Club equipped with nets, buckets, and boots, stomped down into the ditch and rescued the fingerlings, returning them to Tumalo Creek.

Mr. Jim Wise of the Oregon Department of Fish and Wildlife (ODF&W) states that the survival rate for fry rainbow trout in this area is about .06. This means that if 1,000 fish are saved, approximately 60 may live to maturity. The rest become food for predators. One fingerling trout typically eats 200 to 300 food items (caddis flies, mosquitoes, etc.) per day. From eight inches through maturity, a trout eats an average of 400 to 500 food items per day. The math adds up to a substantial decrease in the insect population, protecting crops and people.

A permanent plan for fish salvaging should be formed by ODF&W, private owners, and service groups. One thing that could be done is construction of a better system at the headgate. One approach would be to build a series of grates to stop floating debris from jamming the headgate, and to keep small trout out of the canal system without slowing the water velocity. Instead of netting by hand each year, service groups could participate in fund raisers for new headgate systems, and ODF&W could share their knowledge of stream habitat. The private owners could permit access to the canals. With everyone's cooperation, a successful plan could be worked out that would benefit all parties.

If everyone worked cooperatively on fish salvaging, the whole community would benefit. One may ask, "How does saving fish benefit agriculture?" One of the major benefits is that more fish means a lower insect population, which means healthier people and less crop damage. Another reason is that a better system at the canal headgates would mean potentially less damage to expensive irrigation systems. Finally, an increased healthy raptor population would also mean a lower rodent population and less damage to crops and fields. A cooperative change in the system would strengthen our bounty of aquatic natural resources and our communities' agricultural health!

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Name: Erik Muhlenhaupt
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Essay Theme: Alternative Fuel Research
School: Rosemont School of the Holy Child

Bioenergy Powering the Future

Global warming is a big problem around the world. When carbon dioxide is emitted into the atmosphere two things happen. Heat from the sun travels through the atmosphere more easily because the carbon dioxide is more transparent to solar rays. The carbon dioxide is less transparent to the reflected radiation from the Earth. As a result, more heat enters the atmosphere and less heat escapes. This is called the "greenhouse effect," and it causes an increase in the Earth's atmospheric temperature. This is known as global warming.

Fossil fuels are used to make electricity and gasoline for automobiles. They're nonrenewable and when burned, emit carbon dioxide and other chemicals that contribute to global warming. We need a new way to power the world that doesn't contribute to the greenhouse effect. The world's population must institute new sources of energy.

Picture a truck spewing out black smoke into the atmosphere. In addition to contributing to the greenhouse effect, people are choking on the fumes from trucks, buses, and cars. These hazards to the environment and to peoples' health must be stopped. Scientists and car designers are working on several new prototype cars and alternative fuels for the near future.

Already on the market is the Toyota Prius, a car that runs on both gasoline and electricity. The Prius can get up to 52 miles per gallon! Other prototypes include a fuel-cell car from General Motors. This car runs on hydrogen and it emits water. Since the fuel-cell and hydrogen tank only take up the space of a 6-inch-thick skateboard and the steering column has been replaced with handgrips, this has freed up the space that the engine used to take up. As a result, there's a lot more room for people and cargo in these cars.

Daimler-Chrysler unveiled its design for an environment-friendly car with the Smart car in Europe and Japan. It uses lighter, more aerodynamic carbon-fiber polymers. They call their recyclable thermoplastic alloy, Xenoy. However, the Smart car is much smaller and slower than the cars Americans use. For example, it takes 17 seconds to get from 0 to 60 miles per hour–much slower than the average American car at about 5 seconds.

Cars aren't the only factors in the global warming problem. Plants that burn coal to produce electricity also emit an enormous amount of greenhouse gases. There are solutions to this problem, too: wind is one of them

Wind power is the "world's fastest growing power source…," writes Margot Roosevelt. Wind power can provide up to 12 percent of the world's electricity in the next 20 years. There are already many "wind farms" across the country and the world. Germany is the world's biggest user of this hi-tech energy source, and Germans are continuing to build more wind farms. Wind is a promising alternative to burning fossil fuels for electricity.

There are many potential solutions to the growing problem of global warming and the greenhouse effect. We must choose the best environment-friendly resource to power our future.

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Name: Adam Kenny
State: South Carolina
Essay Theme: Cultivating New Technologies
School: St. Peter's Catholic School

My Intergalactic Diet

I have been astronaut for over ten years now, and the most popular questions I am asked are these: Of course, there is the obvious one…"How do you, you know–go to the bathroom?" Well, I'll deal with that another time; but the other most-asked question has got to be, "What do you eat up there?" Food actually grown and prepared in space must be a scientist's dream. Scientists tried to grow seeds in lunar soil brought back to Earth during the Apollo space program, and in 1975 every Russian space mission lifted off with a planting bed. However, the lack of gravity affects a plant's ability to put down roots, different light conditions disrupt growth, and the absence of insects in space inhibits pollination.

It is not all disaster though; in the early 1990s, cosmonauts succeeded in growing lettuce and radishes in aluminum greenhouses on board the space stations. NASA and the leaders of Russia's space program hope that crops in space over a long period of time would help long-term piloted missions to Mars. I was told by one of these scientists, "You can't take all the food you're going to need in the rocket…for 16 months of space flight. It's not possible."

The food we prepare and eat in space has certainly changed though. In those early days on the Mercury mission, the astronauts were forced to endure bite-sized cubes of freeze-dried food and semi-liquids in aluminum toothpaste-type tubes–yuk! Furthermore, crumbs from these foods had to be captured to prevent them from fouling up the instruments. In the Gemini missions things hadn't gotten much better. Imagine this for your dinner: to rehydrate your food, water was injected into the packs of freeze-dried food through the nozzle of a water gun. After kneading the contents, the food became a puree and was squeezed through a tube into the astronaut's mouth. You have to be pretty dedicated to endure that sort of diet!

Things did start to look up considerably for the Apollo program. Those astronauts had the luxury of preparing their food with hot water, and this did improve the taste. Along came the introduction of the "spoon-bowl" package for rehydratable foods. A pressure-type, plastic zipper was opened and the food removed with a spoon. The moisture content in the food enabled it to cling to the spoon, making eating a more normal experience.

Now back to my personal diet. Recently, on board the International Space Station I feasted on broiled lobster tails, stir-fried chicken, and fettuccine Alfredo. I placed the sealed packages of food in the conduction food warmer in the galley. It takes about 10 minutes to heat to a serving temperature. The food warmer plugs in and has essentially hot plates that the food is spring loaded onto. Perhaps I could start a new cooking show in space called "The Galactic Diet Show"… Bam, Bam! Or has that already been done?

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Name: Josie Oakland
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Essay Theme: Ag Science in the City
School: Bristol Elementary

The Importance of Urban Agriculture

Who would think that the food we buy or eat may have come from someone's backyard or flower box in big cities like New York City? Urban agriculture is defined as the food production within cities that occurs in all regions of the world, in developed and developing countries.

Urban agriculture isn't like rural agriculture. Perhaps the biggest difference is where it's grown. I can look out my bedroom window and see our plentiful apple trees or our garden where we raise produce such as tomatoes, peas, or onions. In urban areas someone may look out and see a flower box filled with strawberries on the windowsill. Food can also be grown on rooftops, in water using hydroponics, or on one's property. It can be grown in public places such as county farms, parks, and school or community gardens.

Common crops that are grown include fruits, vegetables, maize, beans, cassava, berries, nuts, herbs, and spices. Poultry, birds, pigs, a few cows, and other small livestock—cheaply grown sources of protein—are commonly raised in metropolitan areas.

Agriculture plays an important role in some urban families. In addition to providing a source of food, some farmers are able to sell their crops and make a profit to support their families. In this way agriculture helps families financially. A farmer can sell cheaper and fresher crops because he is closer to the consumer.

Growing food in urban areas also improves a farmer's mental and physical health. Mentally, agriculture helps certain urban farming residents cope with situations. For some, it is a way to socialize with others and meet a wide range of people with different cultures, customs, or languages. Agriculture is important to the grower's physical health because scientists' data show that those who cultivate plants in urban areas are more likely to be active and consume more fruits and vegetables than nongrowers.

Agriculture does a number of things for nature. It helps the polluted city air to be cleaner and easier to inhale. Since the product doesn't have to travel as far to the retailer and needs less packaging, it helps reduce sewage and packaging waste. In the process of growing foods, agriculture helps recycle and reuse things such as water and some wastes, and uses unused space and land for a good cause.

In Europe and Asia urban agriculture has become a tradition. Over the years the following conditions have brought more attention to urban agriculture: the increasing population in cities, worsening conditions for the urban poor, natural disasters and wars that reduce the food supply from rural areas, and food scarcities. Today 700 million people are supplied by food from 200 million urban farmers, or about 12%. Between 1974 and 1982, the amount of U.S. farmland in urban areas increased by about 50%.

In conclusion, urban agriculture's hidden potential is to reduce some of the world's poverty and waste. Picture that flower box of strawberries: how important urban agriculture is to a grower's health and state of mind, to nature, and to world communities!

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Name: Tyler Boyd
Essay Theme: Food Science and Nutrition

State: Tennessee
School: Newport Grammar School

Science: Developing Tomorrow's Bounty Today

When people bite into a juicy apple or take a sip of ice-cold milk, do they need to question the safety and healthiness of those foods? Many Americans take their safe and abundant food supply for granted. As farmers, my family and I recognize the importance of delivering high-quality, safe food to consumers. Research in the areas of biotechnology, aquaculture, antibiotic testing, integrated pest management, and aeroponics will enable all to learn to live with the land and ensure environmental and healthy well-being.

Biotechnology uses living cells or tissues to improve crops, animals, or microorganisms while allowing for higher yields and less pesticides. The U.S. Food and Drug Administration, Environmental Protection Agency, and U.S. Department of Agriculture regulate foods changed by this method. In Senate testimony, Joseph Levitt revealed that no evidence existed to prove that genetically modified foods on the market were unsafe to eat. Consequently, biotechnological developments include bananas with Hepatitis B vaccine, lettuce with anti-cancer agents, soybeans with higher vitamin E levels, and rice containing more beta-carotene. Foods having longer shelf life and less refrigeration are also being developed, such as the Flavr Savr tomato.

Scientists at EPCOT's USDA research facility are also investigating farming methods with environmentally friendly crops and alternative food sources. Using nutrient-enriched water instead of soil, aeroponics and hydroponics aid in preventing bacterial contamination and eliminate erosion and pesticide/herbicide use. Utilizing this method, oxygen and waste products could even be recycled while producing food in space. In integrated pest management labs, parasitoid wasps are an alternative to pesticides for leafminer fly control in soybeans, a benefit to farmers and consumers by reducing pesticide contamination in foods while increasing yields.

Agricultural advancements in food production are not limited to plants. Aquaculture using freshwater shrimp, thriving on natural pond foods and high-protein catfish feed, has become another popular alternative crop in the past two years, especially to Tennessee's tobacco farmers.

Other significant developments to food producers are breakthroughs in antibiotic use and testing. Through tighter regulations on extra-label use and improved on-farm detection devices, farmers are increasingly able to keep antibiotics out of the nation's food supply. Susceptibility tests by veterinarians for bacterial pathogens can focus on quantitative outcomes like minimum inhibitory concentrations, thus regulating dosage and type.

Biosecurity on farms is integral to food safety now more than ever. Anthrax studies have been escalated at the USDA's National Veterinary Services Lab, and over $2 million has been committed to research on detecting and combating animal diseases. On our farm, tours have been cancelled, feed deliveries are monitored, and facilities are more secure. This further increases the quality of product from the source to the consumer.

Advancements in scientific research have developed programs that keep this diverse living system called Earth in harmony while producing high-quality foods for the world. These foods, safer and healthier than ever, will keep America at the forefront of agricultural production and will provide security for generations to come.

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Name: Jessica Vallery
Essay Theme: Ag Science in the City
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School: Carpenter Middle School

Urban Agriculture

About 800 million people are engaging in agricultural activities in urban areas worldwide. Urban agriculture plays a very important part in feeding the world's cities. Urban agriculture can increase household food security, support waste and open space management, and improve the well-being and health of urban dwellers, as well as strengthen income generation. Understanding that there are some risks involved when participating in agriculture in urban areas is important as well.

Farming in city surroundings produces more availability and access to food because it is closer to the population and won't perish as quickly. Producing food in urban areas creates rapid delivery to market. This is better, due to the fact that preservatives aren't as necessary. Not using preservatives makes for a better quality of product.

Utilizing excess land from churches, schools, and large corporations by growing crops can help open-space management. Harvesting crops supports waste management by recycling waste as composts and fertilizers for the crop soil. Agriculture also helps reduce environmental health risks in that there will be cleaner air to breathe because of the phenomenon of photosynthesis. Growing agriculture also reduces the pressure to cultivate in new rural areas. If you use the excess lands in urban areas, then you won't have to expand to rural areas to cultivate crops.

Urbanites who practice agriculture enjoy benefits on many levels. The citizens usually have better diets with lower health risks. Planting and caring for crops and livestock is proven to be a stress-relieving activity. Cultivation in urban areas can strengthen income generation by saving money on foreign exchange. If you have the food in your own backyard, why buy it from another country?

Although agriculture in urban cities is beneficial, there are some risk factors. Plants can absorb heavy metals, such as cadmium, from contaminated soil. This can easily be remedied by mixing organic compost in the soil, reducing the uptake of contaminants. But some vegetables, such as cabbages and tomatoes, generate less toxic chemicals in their edible parts. By choosing carefully, the effects can be minimized. Informal slaughtering practices are a factor in the high rate of Echinococcosis, a larval form of canine tapeworm, in human beings. This can be prevented by properly butchering livestock. But, unfortunately, people who rely on their crops or livestock are not likely to abandon unsafe farming practices in the face of more immediate hardships.

Regardless of all the benefits, urban agriculture is still greatly unrecognized and unassisted. Even in years of food shortage, urban agriculturists are often harassed. Some governments are even creating programs to manage the urban agriculture as well as encourage it. With some reassurance, people should be confident of the importance of agriculture in urban areas.

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Name: Angus Macfarlane
Essay Theme: Alternative Fuel Research

State: Utah
School: Home Schooled

Bioenergy—Powering the Future

Bioenergy is the key to sustaining our present American lifestyle. Although the United States is unquestionably the greatest country, with the highest standard of living in the world, long-term sustainability of our basic American way of life is dependent upon bioenergy. Bioenergy research and development is even more important for the creation of an even better future for our children and grandchildren.

The spectrum of bioenergy use and development is very broad. On one side of the spectrum, the long-term viability and sustainability of low-tech bioenergy methods, including conversion of forage and other agricultural products to power, have been proven by Amish, Mennonite, and other plain-people communities in our own country for many years. On the other side of the spectrum, with the great technological advances we have experienced in this country, with even more aggressive research, there is no limit to the bioenergy technologies, methods, and efficiencies that could be developed and employed to power this country and the rest of the world into the future.

As Americans we have placed powerful cars and comfortable homes at the forefront of our existence. Unfortunately, the cars we drive and the myriad of household appliances and gadgets we love require a virtually unlimited supply of energy and power resources to operate. Consequently, although we lead the world, for example, in the number of cars per capita and home ownership gadgetry, we are also presently 57% dependent upon foreign petroleum products, and experts predict that this will increase to 67% in the next 20 years unless we do something about it. On its present course our appetite for and consumption of petroleum products and other natural resources will be unsustainable. In light of our growing dependence upon foreign oil, increasing tensions in the Middle East, and a slumping domestic agricultural economy, we need to seriously reconsider our policy priorities and other options. Bioenergy is one of the best solutions to many of these challenges.

Imagine a world where every vehicle is using some form of bioenergy fuel, including biodeisel or blended ethanol, as well as homes and businesses heated by corn and other grain-burning stoves and furnaces, and/or powered by methane-generated electricity, supplemented by solar, wind, and other natural, renewable, and very sustainable generation methods. Imagine what a difference this could make to the environment. Imagine what a difference this could make to our domestic agricultural economy.

Based on this vision, and in light of the other challenges we currently face, our fundamental national policy objectives should be re-prioritized. Although recent political trends seem to be heading the opposite direction, our overall policy objectives should prioritize long-term sustainability, self-sufficiency, environmental responsibility, and agricultural viability. We should be leading, not following, by engaging in aggressive bioenergy research and development to produce, for domestic consumption as well as foreign export, clean, environmentally friendly, sustainable bioenergy, rather than resigning ourselves to endless dependence upon expensive, volatile, and nonrenewable foreign petroleum imports.

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Name: Gregg Farrington
Essay Theme: Ag Science in the City

U. S. Virgin Islands
School: All Saints Cathedral School

The Importance of Agriculture for Urban Areas

From rooftops to roadsides, millions of people in the South of the United States are finding space in cities to produce everything from vegetables and livestock to flowers and fish. Most urban farmers are poor men and women who farm to feed their families and earn a living. In the process, they put marginal lands to good use and recycle urban waste. While governments recognize the contribution of urban farmers to cleaner, healthier cities, many have yet to formulate and implement policies that integrate urban agriculture into sustainable urban management practices.

Millions of men and women in the cities of the United States have become farmers in recent decades, growing vegetables, raising livestock, and practicing many other types of agriculture in urban areas. These urban farmers enjoy benefits that include better diets and a higher income, while making a significant contribution to the urban environment. Urban agriculture also improves local food supplies, puts marginal lands to good use, and recycles wastes as compost and fertilizers.

Urban agriculture does, however, require higher technological and organizational precision than rural agriculture, because it needs to be more intensive, more tolerant of environmental stress, and very carefully monitored to protect public health. Despite the benefits, most urban agriculture remains largely unrecognized and unassisted, if not outlawed, and its practitioners are often harassed, even in years of food shortages. Nonetheless, some governments are creating agencies to manage urban agriculture and actively encourage it.

Some initiative groups or programs undertake activities whose goals are to increase household food security, to combat unemployment and generate income, to support waste and open-space management, and to foster community self-management, particularly for the urban poor.

To improve the well-being and health of urban dwellers who are low-income food producers and consumers, and to make ecosystems sustainable, both political and technical solutions are needed. The current focus is research that concentrates on the development of confined-space technologies for low-income food producers, supporting safe urban agricultural practices or organic recycling, reducing human and environmental health risks, and promoting receptive policy and regulatory frameworks for land tenure, zoning, and use planning.

Urban agriculture has the potential to provide many benefits to cities in the areas of nutritional improvement, hunger reduction, income generation, enterprise development, and environmental enhancement. The poor and unemployed can grow their own food. Farming converts degraded and unkempt vacant lots into healthy, green areas. Waste, such as grass, leaves, trees, sawdust, manure, and food wastes, can be composted and used on the farms.

In young people's thoughts, the solution to youth problems today is "WORK." Through events like this essay contest, youths can relate to special activities. Through this event, you can teach young and older adolescents to learn about the importance of agriculture. By learning, youths can use their spare time to do something educational. Also, by receiving and contributing to events, they can gain interest in that subject.

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Name: Sarah Hazard
State: Virginia
Essay Theme: Dynamic DNA
School: Harmony Intermediate School

Boosting Agricultural Bounty with Genetics

Biotechnology improvements in crops have been in use for thousands of years. The most common ways of altering a plant to produce better crops have traditionally been selective breeding and cross-breeding. Selective breeding is when genetic materials are exchanged between two parent plants to give the resulting plant desired traits, such as better yields, disease resistance, and increased quality. Cross-breeding is when two of the same or similar species are crossed to create superior crops. Beginning in the 1970s, advances in modern science have been made in which plants can be genetically engineered between much more distantly related species for specific traits. Such plants are called transgenic organisms.

Although such alterations to seemingly regular plant species could seem almost science fiction, genetic manipulation has many positive results. For example, traits can be passed on more precisely. One gene can be placed into the receiving plant as opposed to selective breeding where many unwanted or unnecessary genes are also passed along. Also, the trait being transferred in the recipient is known. Such plants have faster development. The most amazing thing about genetic engineering is that any trait from any organism can be passed into any other organism. Vegetable shelf life could be boosted to cut down on waste by as much as 40%!

Common traits being created today are insect resistance in corn and cotton, herbicide resistance in soybeans, and delayed fruit ripening in tomatoes. Such traits are being developed for chili peppers, melons, papayas, and rice. The use of corn, potatoes, and bananas are being tested for the creation of vaccines and biodegradable plastics.

Currently, there are two commonly used methods of transgenic DNA introduction into crop plant genomes. The first is used in dicot plants such as soybean and cotton. These plants can become naturally infected with *Agrobacterium tumefactions,* which actually inserts some of its own DNA into a plant. Scientists have discovered that by taking out the unwanted traits of Agrobacterium and inserting helpful genes into it, the plant will take DNA traits that it has been infected with. For monocots such as corn, wheat, and rice that are not affected by the bacteria, the desired genome is coated onto very small tungsten balls and shot into the plant.

Genetic engineering in plants has many purposeful uses in the environment as well. Crops planted in dry areas could be altered so that they have a higher tolerance against heat and little water, producing larger crop yields in times of drought. Such crops could be planted in a broader range of environments, would need fewer pesticides, and have better rotations, therefore conserving natural resources.

Genetic engineering could also improve the quality of life and the economy; new plants having higher yields and being more nutritious for humans would help keep prices down. It has opened up new economic markets for investment. The global value for transgenic crops grew rapidly from 1995 to 1998, and continues to rise as new benefits are introduced.

Hopefully, the benefits of bioengineering in plants will become more commonplace throughout the world.

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Name: Savanna Griffin
Essay Theme: Cultivating New Technologies
State: Washington
School: Enumclaw Middle School

Producing Wheat in Space

Did you know that scientists are growing food in space? Utah State University developed a crop food and has called it Apogee Wheat. This paper will attempt to describe this plant, the process used to grow the wheat, the results of the tests conducted in the Mir space station, and the future potential of a crop food in space.

Apogee is dwarf hard red spring wheat. It was developed from thousands of segregating lines. It produces branches with abundant sap energy that can be used for grain production. Apogee wheat is about 18 inches tall when fully grown. It also produces a large amount of seeds. Apogee wheat produces the equivalent of almost 600 bushels of grain per acre, three times the amount of wheat from regular fields. It took more than a decade to develop the Apogee wheat for space farms.

To grow Apogee wheat in space, scientists use a matrix solution as a substitute for soil. It is like kitty litter and will retain moisture well. The matrix solution is then placed on a fibrous-type paper with the seeds placed in the material. With no gravity in space, this process keeps the seeds in contact with the water and allows them to germinate.

NASA has developed a machine to automatically grow wheat and other crop foods in space. It is called the Biomass Production System. It is a powered hardware system that has four independent plant-growth chambers, a nutrient delivery system, a temperature/humidity control system, a data processing system, and video cameras for scientists to monitor the wheat growth from the ground.

The whole experiment to grow food in space is called Photosynthesis Experiment and System Testing Operations or PESTO for short. There is not much room to grow food in a space station. Scientists chose Apogee wheat because it doesn't grow as tall as other wheat. Apogee wheat goes through its developing cycle much faster than other species, and of course it produces more wheat per acre than any other wheat does. Scientists have in fact grown this wheat in space, brought the seeds back, and the seeds grew just as well on the Earth.

The PESTO project is now in the process of deciding what benefits will come from growing food in space. On longer missions in space, it will be more economical to provide life-support supplies by growing food. It is not likely the new wheat will make it to the Moon or Mars, but it will be grown on the International Space Station. Plant foods will be used to provide nutrition, produce oxygen, and purify the water to drink during long-duration space travel.

Scientists' carefully studying wheat for a space project today will help scientists of the future get astronauts further into space and will even help the food crops being produced here on the Earth.

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Name: Daniel Sedlacek
Essay Theme: Alternative Fuel Research

State: Wisconsin
School: Home Schooled

Ethanol, A Renewable Fuel

Ethanol is a renewable alcohol fuel made mostly from agricultural resources. It is basically produced from the starch found in grains such as corn, grain sorghum, and wheat. It can also be produced from food and beverage processing wastes. Research is being done that will enable ethanol to be made from cellulose, which includes corn stalks, rice straw, and switchgrass. Ethanol can greatly improve American agriculture, the economy, and the environment.

Ethanol can successfully improve American agriculture by adding value to farm products. Farm owners today lead the way in the ethanol industry growth, which is the third largest market for corn. Many farmers today are investing in ethanol plants and are getting a higher price for their grain and a share in the plants' profits. Plants built around a town can increase the price of a bushel of corn from five to ten cents. The production of ethanol can improve the agriculture of this country in so many different ways, and research is being done on these ways of powering the future with ethanol.

Ethanol and ethanol plants can also improve the economy in several ways. Ethanol plants increased employment by 192,000 jobs in the United States. The production of ethanol from grain increases the value of grains, so that corn for two dollars a bushel is boosted to five to six dollars' worth of ethanol. By increasing employment, the value of grains, and many other ways, ethanol can improve the economy.

Ethanol reduces air pollution and toxic gas emissions because it is a fuel that contains oxygen, which is good for the environment. Combining ethanol with gasoline extensively reduces carbon monoxide that is responsible for as much as 20% of smog formation. It reduces carbon monoxide that produces a threat to people with respiratory illnesses such as asthma. The production of ethanol is a very energy-efficient process. An analysis done in 2002 found that ethanol contains 34% more energy than what is used in the production process.

Ethanol, a renewable fuel resource, is an excellent way to improve American agriculture, the economy, and the environment. Not only does ethanol improve these areas, but the production and research of ethanol has many other uses and benefits that can help the United States and the world. Farmers are ready, willing, and able to lead the United States toward energy independence just as other countries have already done. By these few examples and numerous others, the research, production, and use of ethanol can improve the lives of the citizens in our country.

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Name: Randa May
Essay Theme: Ag Science in the City
State: Wyoming
School: Banner County School

The Importance of Agriculture for Urban Areas

Local governments have been trying to recognize the contribution of farmers to cleaner, healthier cities. When you are going on vacation, do you look out the window and see a landscape of farmland, or do you see land stripped for building?

Local governments need to consider that they have yet to formulate and implement policies that turn urban agriculture into sustainable urban management practices. If that is taken into consideration, this may end the case of urban sprawl. Urban sprawl has a great effect on farmland because of influences that have threatened the family farmer, such as large agribusinesses that can produce farm commodities cheaply and efficiently.

Changes in our society and the technology that we use today have placed most of us in an urban environment. Today small farmers can sell their land for more money than they can raise crops. Between the years of 1960 and 1990, urban expansion claimed 1 million acres per year. Urban expansion has not yet had a major threat on farming, but local governments need to start implementing policies now so that urban sprawl doesn't continue to reduce production of crops.

Local governments sometimes fail to consider the impending growth of urban sprawl and they lack the capacity to develop adequate responses before the growth overwhelms them. The greatest hope for controlling growth of urban development is to keep from having too much development. Some progressive states have adopted the "Smart Growth" strategies that actively direct transportation, infrastructure, and other resources that channel growth into appropriate areas. Also, the Farm Viability Program has helped farmers to be able to keep their land.

People are moving out to the country to get out of the cities. This low-density development costs more than compact development. Prime agricultural lands and wetlands are being converted to meet the urban need. This is when local governments need to manage urban growth. Smart Growth promotes development that benefits both urban communities and farmers. This strategy includes the development of farmers' markets, public markets, community-supported agriculture projects, and farm-to-restaurant initiatives. This gives the city folk a high-quality and affordable food supply. The reason metro farms are able to adopt high-value crops is because local sources of labor are available at peak periods. For example, when it is time to harvest peas, work pools come in to harvest the crops at their peak period.

Farmers and urban communities share the same goal: a good food supply. I ask you, would you like your kids to grow up in a world where there is no green grass to roll down the hills? If not, I say we all put an end to large city sprawl and implement "Smart Growth."

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Congressional District Winners: List of Students by State and District

Alabama
2 Emily Howitz
5 Adam Carpenter
3 Cameron Mulvaney

Arizona
1 Heidi Ma
3 Lauren Griffiths

Arkansas
1 Ryan Wood
4 Frances Ferguson

California
1 Gabriel DeMartini
2 Jason Ross
4 Shouana Vang
6 Regina Fessler
18 Ryan McCoon
19 Alexandria Aiello
20 Levi Paulin
29 Jonathan Ainley
52 Aidan Miles

Colorado
2 Courtney Bowen
5 Cory Weinstein

Connecticut
3 Amira Anuar

District of Columbia
1 Philando Brown

Florida
1 Amanda Lanum
2 Tommy Melvin
2 Nitika Fryson
5 Krista Shiero
8 Daisy Muniz
9 Yin Wu
12 Stephanie DeFreeuw
15 Michael Lee
19 Christina Zarrilli

Georgia
1 Marshall Edwards
3 Jennifer Rivers
6 Claire Underwood
8 Courtland Day
9 Torey Poole
10 Cameron Parker
11 Harold Valentine

Hawaii
1 Sophie Lefcourt
2 Stephanie Danielson

Idaho
1 Kayla Uhlenkott
2 Jamie Lancaster

Illinois
12 Keri McDaniel
15 Reid Walder
16 Kaleb Kennay
17 Heather Pierson
19 Dianna Hatfield

Indiana
2 Julianne Heady
3 Alyssa Rosselli
4 Chelsea Gibson
5 Megan Carter
6 Neil Ahrendt
8 Logan Springstun
9 Justin Herb

Iowa
1 Ian Michel
2 Andy Dalhouser
4 Matthew Vandehaar
5 Andrew Keller

Kansas
1 Garrett Lister
2 Chasity Turner
4 Jennifer Zanardi

Kentucky
1 Colton Givens
4 Corey Hatfield
6 Kelly Barnett

Louisiana
1 Jeremy Wingate
2 Megan Klar
3 Zach Medley
5 Mollie Carroll
6 Krystle Egbe

Maryland
1 Meredith Edwards
2 Peter Bachmann
4 Mercelyn Matthews
5 Randi Sirk
6 Jarrett Remsberg

Massachusetts
1 Levi Bissell

Michigan
8 Tasha Leach
9 Andrew Stein

Missouri
2 Aravinth Karunanandaa
4 Haley Bowles
7 Collin Chenoweth
9 Nick Mertz

Montana
1 Morgan Cunningham

Nebraska
1 Aaron Kempkes
3 Adam Peetz

Nevada
2 Amber Hoogestraat

New Mexico
2 Russell Reeves
3 Kevin Lane

New York
22 Emily Groupp
23 Erik Holmes
26 Fredrika Loew
27 Mike Gould
29 Laura Furmanek
30 April Masters
31 Rochelle Wiltsie

North Carolina
2 Sarah Vines

North Dakota
1 Remington Zacher

Ohio
5 Mallory Rosswurm
7 Zack Ziegler
18 Samantha Jefferis

Oklahoma
2 Coltyn Seifert
6 Sierra Simpson

Oregon
1 Katie Searle
2 Adam Hunt
3 Chandra Wafford
4 Micah Randall
5 Jaycie Loewen

Pennsylvania
5 Amber Mohammed
6 Pamela Trochez
7 Erik Muhlenhaupt
9 Sarah Mae Signore
12 Markie Grant
13 William Woody
14 Carl Hayman
15 Darya Hrycenko
16 Alyssa Coltrain
17 Jerod Lycett

South Carolina
2 Adam Kenny
3 Ryan Smith
5 Ashlee Stroud
6 Devan Mcclary

South Dakota
1 Josie Oakland

Tennessee
1 Tyler Boyd

Texas
2 Samantha Ullrich
3 Jessica Vallery
4 John Mayton
8 Garret Twining
14 Victoria Bissonnet
17 Hallie Wilson
19 Austin Beam
21 Elizabeth McMahon

Utah
3 Angus Macfarlane

Virgin Islands
1 Gregg Farrington

Virginia
9 Emily Simmons
10 Sarah Hazard

Washington
4 Tony Padavich
6 Chris Rurik
8 Savanna Griffin

Wisconsin
2 Matthew Marshall
7 Daniel Sedlacek
8 Megan Stranz

Wyoming
1 Randa May

School Winners:
List of Students by State and School

Alabama

Baldwin Magnet School
  Emily Howitz
Goodwater Elementary
  Torrey Jones
Macedonia
  Jamie Key
Muscle Shoals Middle School
  Adam Carpenter
New Life Christian Academy
  Cameron Mulvaney
Skyline High School
  Marianne Gilliam

Arizona

Ira A. Murphy Elementary
  Lauren Griffiths
Kyrene Middle School
  Heidi Ma

Arkansas

White Hall Junior High School
  Frances Ferguson
Wynne Junior High School
  Ryan Wood

California

Crossroads Middle School
  Jonathan Ainley
Lewis Middle School
  Aidan Miles
Pathways Charter School
  Regina Fessler
Rockford
  Levi Paulin
Sequoia Union
  Alexandria Aiello
Sheridan Elementary
  Shouana Vang
St. John's Catholic School
  Gabriel DeMartini
Home Schooled
  Ryan McCoon
Home Schooled
  Jason Ross

Colorado

Acres Green Elementary
  Cory Weinstein
Monarch K-8
  Courtney Bowen

Connecticut

Harry M. Bailey Middle School
  Amira Anuar

District of Columbia

R. H. Terrell Junior High School
  Philando Brown

Florida

Carter-Parramore Middle School
  Nitika Fryson
Dr. W. J. Creel Elementary
  Michael Lee
Lecanto Middle School
  Krista Shiero
Meadow Woods Middle School
  Daisy Muniz
Powell Middle School
  Michelle Sullivan
Randall Middle School
  Stephanie DeFreeuw
Raymond B. Stewart Middle School
  Yin Wu
Richbourg Middle School
  Amanda Lanum
Home Schooled
  Brent Melvin
Home Schooled
  Tommy Melvin
Home Schooled
  Christina Zarrilli

Georgia

Chestatee Middle
  Zack Bennett
Clements Middle School
  Robby Orr
Ebenezer Middle School
  Marshall Edwards
Hilsman Middle School
  Harold Valentine
Madras Middle
  Jennifer Rivers
Martha Puckett Middle School
  Kayla McBee
Monroe Academy
  Courtland Day
Monroe County Middle School
  Cameron Parker
Pine Mountain Middle School
  Claire Underwood
Stephens County Middle School
  Torey Poole
Swainsboro Middle School
  Chet Sconyers

Hawaii

Christian Liberty School
  Jean Ouye
St. Michael's School
  Stephanie Danielson
Waiau Elementary School
  Sophie Lefcourt
Windward Nazarene Academy
  Jonathan Kaya

Idaho

Canyonside Christian School
  Jamie Lancaster
Eagle Middle School
  Rebekah McConnell
Prairie Middle School
  Kayla Uhlenkott
Vera C. O'Leary Junior High School
  Rachel Trabert

Illinois

Ashton Grade School
Aubrey Kennay
Ashton Junior High School
Kaleb Kennay
Bureau Valley North
Linnea Anderson
Ellis Arts Academy
Travis Dahlhauser
Niantic Junior High
Kelsy Whitney
Orion Middle School
Nick Armstrong
St. Bruno
Keri McDaniel
Wayne City Unit #100
Dianna Hatfield
Home Schooled
Heather Pierson
Home Schooled
Teresa Smith
Hoopeston Area Middle School
Reid Walder

Indiana

Boonville Junior High School
Logan Springstun
Carmel Junior High School
Neil Ahrendt
Crestview Middle School
Chelsea Gibson
Lakeland Christian Academy
Aimee Wilson
North Newton
Denise Hickman
Northwood Middle School
Kayla Smith
Rensselaer Central Middle School
Megan Carter
Smith-Green Middle School
Justin Nicodemus
Home Schooled
Megan Butler
Home Schooled
Judy Frey
Home Schooled
Justin Herb
Home Schooled
Alyssa Rosselli

Iowa

Bondurant-Farrar
Matthew Vandehaar
Clarion Goldfield Middle School
Andrew Keller
East Monona
Brittney Nichols
Hubbard-Radcliffe Middle School
Joelle Schwartz
Mid-Prairie Middle School
Ian Michel
Northeast Community Schools
Ryan McLaughlin
Riverbend Middle School
Laura Fitz
Schaller-Crestland
Mary Foell
Sgt. Bluff-Luton
Luke Saunders
South O' Brien Middle School
Emily Hill
St. Edwards
Andy Dahlhouser
Westwood Community
Mathew Mallett

Kansas

Colby Middle School
Henry Lamm
Decatur Community Jr/Sr High School
Aaron Helm
Dexter
Jennifer Zanardi
Frankfort Middle School
Bailey Bergmann
Hoisington Middle School
Brandee Zorn
Iola Middle School
Ashlee Carr
Marysville Elementary
Garrett Lister
Oberlin Junior High
Rebecca Helm
Riverton Middle School
Chasity Turner
Saints Peter and Paul
Chelsey Crabtree

Kentucky

Bath County Middle School
Kelly Barnett
Butler County Middle School
Colton Givens
Phillip A. Sharp Middle School
Corey Hatfield

Louisiana

A. E. Phillips
Mollie Carroll
John Curtis Christian School
Jeremy Wingate
Lee Road Junior High
Ashley Snyder
Park Forest Middle School
Krystle Egbe

Maryland

Centreville Middle School
Meredith Edwards
Ernest Everett Just Middle School
Mercelyn Matthews
Fallston Middle School
Peter Bachmann
Margaret Brent Middle School
Randi Sirk
Middletown Middle School
Jarrett Remsberg
Sykesville Middle
Brittany Berryman
Thurmont Middle
Casey Hertel

Massachusetts

Herberg Middle School
Levi Bissell

Michigan

Oxford Middle School
Andrew Stein
Washington Middle School
Tasha Leach

Missouri

Mark Twain Junior High
Stephanie Landers
Northeast Middle School
Aravinth Karunanandaa
Owensville Middle School
Nick Mertz
Riverton Middle School
Collin Chenoweth
Sacred Heart School
Haley Bowles
South Shelby Middle School
Cody Watson

Montana
Hinsdale Public Schools
Chad Remmich
Hysham Public School
Morgan Cunningham

Nebraska
Banner County School
Kaitlin Wittler
Barr Middle School
Renae Heuermann
Freeman Public School
Aaron Kempkes
Imperial Grade School
Celeste Pankonin
Ravenna Public School
Levi Valentine
Sidney Middle School
Adam Peetz

Nevada
E. C. Best Elementary School
Marisa Julian
Pau-Wa-Lu Middle School
Amber Hoogestraat

New Mexico
C. V. Koogler Middle School
Kevin Lane
Hermosa Middle School
Breanna Lang
Home Schooled
Russell Reeves

New York
Barker Middle School
Laura Furmanek
Cobleskill-Richmondville Middle School
Erik Holmes
Dryden Middle School
Fredrika Loew
Frewsburg Central School
Rochelle Wiltsie
Pavilion Central School
Mike Gould
Silver Creek Central
April Masters
Home Schooled
Emily Groupp

North Carolina
East Wake Academy
Sarah Vines

North Dakota
Beach High School
Clay Makelky
Parshall High School
Remington Zacher
Rhame Public School
Patrick Fischer

Ohio
Barnesville Middle School
Samantha Jefferis
Mechanicsburg Junior High
Zack Ziegler
Home Schooled
Mallory Rosswurm

Oklahoma
Chisholm Middle School
Sierra Simpson
Garber Junior High School
Justin Strate
Riverton Middle School
Coltyn Seifert
Sweetwater Public School
Shane Boyd

Oregon
Boring Middle School
Chandra Wafford
Dayton Junior High School
Kyle Wegner
Eugene Christian
Micah Randall
Obsidian Middle School
Adam Hunt
Patton Middle School
Katie Searle
Yamhill Grade School
Jacob Cotner
Home Schooled
Jaycie Loewen

Pennsylvania
Cornell School District
Carl Hayman
East Norriton Middle School
Lisa Sene
Greencastle-Antrim Middle School
Sarah Mae Signore
Greenly School
Michele Long
Haverford Middle School
Noor Ahmad
Indiana Area Junior High
Markie Grant
Owen J. Roberts
Alyssa Coltrain
Park Forest Middle School
Amber Mohammed
Purchase Line High School*
Kala Rorabaugh
Purchase Line High School*
Nicholas Sherry
Rosemont School of the Holy Child
Erik Muhlenhaupt
Shanksville-Stonycreek
Karen Keppen
Stewart Middle School
Kivani Luton
Tulpehocken Jr/Sr High School
Pamela Trochez
Home Schooled
Darya Hrycenko
Home Schooled
Jerod Lycett

* Denotes a tie

South Carolina
Alice Drive Middle School
Jessica Gretsch
Andrew Jackson Academy
Justin Weber
Andrew Jackson Middle School
Ashlee Stroud
Pickens Middle School
Ryan Smith
St. Peter's Catholic School
Adam Kenny
Williamsburg Academy
Devan Mcclary
Home Schooled
Kadie Baker

South Dakota

Bristol Elementary
Josie Oakland
Langford Public School
Brittney Traxinger
Milbank Middle School
Jada Athey
Ottumwa School
Cecil Heeb
Wilmot Public School
Chloe Kruse

Tennessee

Newport Grammar School
Tyler Boyd

Texas

Anson Middle School
Hallie Wilson
Bowman Middle School
Amily Chen
Carpenter Middle School
Jessica Vallery
Harper Junior High School
Elizabeth McMahon
Llano Junior High
Cassandra Clifton
Lockhart Junior High
Victoria Bissonnet
Magnolia 6th Grade Campus
Garret Twining
Mance Park Middle School
Samantha Ullrich
Robinson Middle School
Ellie Murtagh
Seagraves Junior High
Austin Beam
Thompson Middle School
John Mayton
Home Schooled
Austin Buschman

Utah

Home Schooled
Angus Macfarlane

Virgin Islands

All Saints Cathedral School
Gregg Farrington
Elena L. Christian Junior High School
JE-Niece Jackson
M. J. Kirwan Elementary School
Annathar Alexander

Virginia

Christiansburg Middle School
Emily Simmons
Harmony Intermediate School
Sarah Hazard

Washington

Discovery Lab School
Tony Padavich
Enumclaw Middle School
Savanna Griffin
Lighthouse Christian School
Chris Rurik

Wisconsin

New Auburn High School
Sasha Lotts
Richland Middle School
Matthew Marshall
Washington Middle School
Megan Stranz
Home Schooled
Daniel Sedlacek

Wyoming

Banner County School
Randa May
Pine Bluffs Elementary
Tate Bauman

Entry Rules and Judging Criteria

1. All students in 6th, 7th, or 8th grade attending public, private, parochial, or home schools in any of the 50 states or five U.S. territories were invited to submit essays.

2. Students were required to select one of seven suggested topics:

   - Ag Science in the City: "The Importance of Agriculture for Urban Areas"
   - Alternative Fuel Research: "Bioenergy Powering the Future"
   - Conservation of Resources: "Working Cooperatively to Ensure a Bounty of Food and Natural Resources"
   - Cultivating New Technologies: "Producing Food in Space" or "Using Lasers, Robots, and Computers in Agriculture"
   - Dynamic DNA: "Boosting Agricultural Bounty with Genetics"
   - Food Science and Nutrition: "Using Science to Create a Safe and Healthy Food Supply"
   - Weather and Crop Production: "The Impact of Atmospheric Sciences on World Food Supply"

3. Essays could be no longer than 500 words and were to include a Reference section listing all sources of information used.

4. Essays were to be submitted electronically. The contest deadline was November 1, 2002.

5. Essays were judged according to the following criteria:

CONTENT	
Originality	70
Creativity	40
Organization	35
Quality of Work	20
Use of New Sources	5
MECHANICS	
Grammar	20
Essay Length	10
TOTAL	200

Appendix A: Contest Judges

Judges at the School, Congressional District, and State levels

Jamey Allen .... Oklahoma Department of Agriculture, Food, and Forestry
Antje Anji .... Kansas State University
Valerie Asken .... University of Kentucky
Tera Auchtung .... University of Illinois, Urbana–Champaign
Jessica Baetz .... Kansas Corn Growers Association
Lance Baumgard .... University of Arizona
Don Beitz .... Iowa State University
Eric Birschbach .... Ag Site Crop Consulting, Inc.
Keith Bishop .... B. W. Bishop and Sons, Inc.
Randi Boleman .... Texas A&M University
Vickie M. Bomba-Lewandoski .... Connecticut Agricultural Experiment Station
Jenks Britt .... Western Kentucky University
Joe Broder .... University of Georgia
Lisa Brokaw .... Quality Liquid Feeds
Anita Brown .... U.S. Department of Agriculture–Farm Bill Liaison
Melanie Brown .... Clay County Cooperative Extension Service
Joan M. Burke .... Agricultural Research Service
Christopher R. Burke .... Ohio State University
Wendy Burton .... University of Florida
Neysa Call .... Virginia Bioinformatics Institute
Erskine Cash .... Pennsylvania State University
Fang Chi .... Renessen
David Coffey .... Western Kentucky University
Chris Cornwell .... Oregon State University
Thomas A. Cors .... Altarum
Thayne Cozart .... AgriOne, Internet Agricultural Marketing Co.
John Cummings .... Clemson University
Mary Elizabeth Davis .... University of Nebraska
Anna V. Demaree .... California State University, Fresno
David L. Doerfert .... Texas Tech University
Dian Althea Dooley .... University of Hawaii, Manoa
Patrick Doyle .... California State University, Chico
Larry Dreiling .... High Plains Journal
Heather Dye .... Nevada Future Farmers of America Association
Sarah Eddy .... Texas A&M University
Kati Elliott .... KEH Communications
Elizabeth Ellis .... Auburn University
Daniel L. Engeljohn .... Food Safety and Inspection Service
Carolyn Ferguson .... Kansas State University
Laura Fick .... MGH Public Relations

Michael J. Fisher	Oregon State University
Hank Fitzhugh	International Livestock Research Institute
Laren Flake	University of Nevada, Reno
Stacey L. Follis	Pharmacia Animal Health
Stephen P Ford	University of Wyoming
Charles A. Francis	University of Nebraska
Sharon R. Freeman	North Carolina State University
Paula M. Gale	University of Tennessee, Martin
Dennis R. Gardisser	University of Arkansas Cooperative Extension Service
James W. Garthe	Pennsylvania State University
Kathy Gaughan	Kansas State University
Matthew L. Gibson	Peak Animal Consulting
Bob Godfrey	University of the Virgin Islands
Lisa Greenspan	Cornell Cooperative Extension of Westchester County
Chris Grieshop	University of Illinois
Elaine Grings	Agricultural Research Service
Wendy V. Hamilton	New Mexico State University
Blanche C. Haning	North Carolina State University
John Hardiman	Cobb-Vantress, Inc.
Susan Hawk	California Polytechnic State
Larry J. Heilmann	North Dakota State University
Kim Henken	University of Kentucky
Tim Hicks	Tennessee County Extension
Arnold Hippen	South Dakota State University
Rhonda M. Hoffman	Virginia Polytechnic Institute and State University, Blacksburg
John Holman	University of Idaho
Matt Hoobler	Wyoming Department of Agriculture
Nan K. Huff	Louisiana State University
Randi Hunewill	University of Nevada, Reno
Juli Hutchins	Valencia County Extension
Travis Idol	University of Hawaii, Manoa
Barry Jacobsen	Montana State University
Steve Jacobson	Compliance Services International
Sandy Johnson	Kansas State University
Keith Karnok	University of Georgia
Mary Ann Kelsey	Oklahoma Department of Agriculture, Food, and Forestry
Denise Kitchell	Warschawski Public Relations
David Knauft	University of Georgia
David L. Kooyman	Brigham Young University
Robert J. Kosinski	Clemson University
M. M. Kothmann	Texas A&M University
Michelle Kramer	Latter Day Saints Singles Live
Lisa Kriese-Anderson	Auburn University
Dave Krueger	Michigan State University
Paul S. Kuber	University of Idaho
Meena Kumari	Kansas State University
Barry Lambert	Children’s Nutrition Research Center

Appendix A: Contest Judges (continued)

Robert A. Lane .... Sam Houston State University
Larry Larson .... Dow AgroSciences
Stan Latesky .... University of the Virgin Islands
K. Dale Layfield .... Clemson University
Yvette Le Clair .... Florida International University
Dave Libby .... North Carolina Agricultural and Technical University
Vernon Luft .... University of Nevada, Reno
Michael MacNeil .... Agricultural Research Service
James R. Males .... Oregon State University
Gregory Martin .... Poultry Science Association
Rich McCaffery .... Cornell Cooperative Extension of Otsego County
Ronald J. McCormick .... Compliance Services International
Rebekah McCurdy .... Ohio State University
Jesse McCurry .... Kansas State University
Bernalyn McGaughey .... Compliance Services International
Todd Mervosh .... Connecticut Agricultural Experiment Station
Calvin G. Messersmith .... North Dakota State University
Lee Meyer .... University of Kentucky
Patrick Mies .... Texas A&M University
Donald Mincemoyer .... Pennsylvania State University, retired
Ed Minch .... Arizona Department of Agriculture, Environmental Services
Roger L. Mitchell .... University of Missouri
Dale Monks .... Auburn University
Don Morishita .... University of Idaho
Jerry Nelson .... University of Missouri
Doug Newcom .... Iowa State University
Martha Noble .... Sustainable Agriculture Coalition
Dan Nonneman .... U.S. Meat Research Center
Stacy Norin .... Elanco Animal health
James A. Ochterski .... Cornell Cooperative Extension of Schuyler County
Frederick W. Oehme .... Comparative Toxicology Laboratories
Diana Panetta .... Iowa State University
Joe Parcell .... Missouri Value Added Development Center
Adam Parr .... University of the Virgin Islands
Neil D. Paton .... Akey
Barbara Paulsen .... Dairy Council of Nevada
Patricia A. Payne .... Kansas State University
T. Wayne Perry .... Purdue University
Kim Ragland .... University of Kentucky
Malcolm R. Rainey .... Abraham Baldwin Agricultural College
Joe Regenstein .... Cornell University
Beth Riffel .... Grass and Grain

John B. Riley .... University of Tennessee
Daniel Rivera .... Texas Tech University
Grady Roberts .... University of Florida
Gary Rohrer .... Agricultural Research Service
Max Rothschild .... Iowa State University
Amy Rowley .... University of Georgia
Bonnie Rush .... Kansas State University
Dan Schaefer .... University of Wisconsin, Madison
Jill A. Scheer-Doerfert .... Educational Consultant
David J. Schingoethe .... South Dakota State University
Lawrence B. Schook .... University of Illinois
Edwin C. Seim .... California Polytechnic State
Dale Shaner .... Colorado State University
Nancy Shappell .... Agricultural Research Service
Jason Shelton .... Louisiana State University
Phil Shuler .... Fort Lewis College
Nan Smail .... Ryan and Sons Realtors
Salvatore A. Sparace .... Clemson University
Phillip W. Stahlman .... Kansas State University
Michelle Starke .... Monsanto
Ellen B. Steen .... Crowell and Moring, LLP
Tracy Sterling .... New Mexico State University
Richard F. Stinson .... Pennsylvania State University
Mary Anne Stoskopf .... Stoskopf Farms
Brandi Thomas .... University of Florida
Katie Thrasher .... International Food Information Council
William Thuemmel .... University of Massachusetts
Leo Timms .... Iowa State University
Michael J. Toscano .... Purdue University
Doug Ullrich .... Sam Houston State University
Emilio M. Ungerfeld .... Michigan State University
William Vencill .... University of Georgia
Eckhard Von Toerne .... Kansas State University
Matthew R. Waldron .... Cornell University
Jerry A. Waldvogel .... Clemson University
James K. Wangberg .... University of Wyoming
Deborah Ward .... Hawaii County Extension Service
Jerry Ward .... Louisiana State University
Kevin Watkins .... Elanco Animal Health
William Watson .... National Watermelon Promotion Board
Stephen M. Webb .... McNeese State University
Micah Wells .... Oregon State University
Tony White .... National Goatgrass Research Program
Travis Whitney .... University of Arizona
Kelly Wilhelms .... Iowa State University
Timothy W. Wilson .... University of Georgia
Judy Winn .... Texas A&M University

Appendix A: Contest Judges (continued)

Judges at the National level

Pamela Ainsworth .... University of Vermont
Mika Alewynse .... Division of Animal Feeds
Dave Austin .... PBI-Gordon Corporation
Daniel Barta .... NASA
Bobbi J. Belknap .... APC, Inc.
John F. Bowe .... Cornell Cooperative Extension of Washington County
Christopher S. Brown .... North Carolina State University
Lorna Michael Butler .... Iowa State University
John Campbell .... Oklahoma State University
Kim Cherry .... First Tennessee Corporate Communications
Tim D. Davis .... Texas Agricultural Experiment Station
Dave Edmark .... Food Safety Consortium at the University of Arkansas
Paul W. Gallagher .... Iowa State University
Diana L. Grohs .... Monsanto
John Haase .... Oklahoma Cooperative Extension
Melinda Hemmelgarn .... University of Missouri
Keith Henderson .... NASA
W. L. Johnson .... North Carolina State University
Mary Ann Kelsey .... Oklahoma State Department of Education
Gus Koerner .... Space Agriculture in the Classroom
Clyde Lane, Jr. .... University of Tennessee
Dale Maronek .... Oklahoma State University
Don Maynard .... University of Vermont
Amy Millmier .... University of Missouri
Brian C. Peterson .... Catfish Genetics Research Unit
Jon W. Ramsey .... Oklahoma State University
Thomas P. Redick .... Gallop, Johnson & Neuman, L.C.
Luke Reese .... Michigan State University
Cheryll Reitmeier .... Iowa State University
Philip Shane .... Illinois Corn Marketing Board
Tom Turpin .... Purdue University
Michael D. Wood .... Michigan State University
Peter Wright .... The Dow Chemical Company
Tom Wylie .... University of Missouri

Appendix B: VIP Days—Host Institutions and Event Coordinators

Auburn University, Alabama	Kelley Terry
University of Arizona	Paul Kohn
University of Arkansas, Pine Bluff	Linda Okiror
University of California, Davis	Richard Engel
Colorado State University	Lee Gray
University of Connecticut	Vicki Bomba-Lewandoski
University of the District of Columbia	Linda Freeman
University of Florida	Emily Sperling
University of Georgia	David Knauft
University of Hawaii	Marlene Hapai
University of Idaho	Kay Maurin
University of Illinois, Urbana–Champaign	Scottie Miller
Purdue University, Indiana	Tracie Egger
Iowa State University	Maureen Stohlmeyer
Kansas State University	Larry Erpelding
Kentucky State University	Noland Williams
Louisiana Tech University	Gary Kennedy
University of Maryland, College Park	Eileen Barnett
University of Massachusetts, Amherst	Patricia Cromack
Michigan State University	Eunice Foster
University of Missouri, Columbia	Donna Vaught
Montana State University	Heidi Hart
University of Nebraska, Lincoln	Rosalee Swartz
University of Nevada, Reno	Sami Hoole
New Mexico State University	Terri Giron
Cornell University, New York	Janet E. Hawkes
North Carolina State University	Barbara Kirby
North Dakota State University	Robert Harrold
Ohio State University	Ray Miller
Oklahoma State University	Linda Martin
Oregon State University	Lonnie Morris
Pennsylvania State University	Robert D. Steele
Clemson University, South Carolina	Barbara Speziale
South Dakota State University	Timothy Nichols
University of Tennessee	Jack H. Britt
Texas A&M University	Cady Auckerman
Utah State University	Noelle Cockett
University of the Virgin Islands	Bob Godfrey
Virginia Polytechnic Institute and State University, Blacksburg	John Crunkilton
Washington State University	Broderick Grant
University of Wisconsin, Madison	Ellen Maurer
University of Wyoming	James K. Wangberg