



Women in Science Learning Series

SCIENCE CAN BE FOR YOU.

This series of learning kits introduces you to women who have made science their career. The kits are produced by the University of Nebraska State Museum in Lincoln, Nebraska. The entire series has been funded by the Howard Hughes Medical Institute.

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hen you eat French fries, you probably don't think anything about them other than that they look good, smell good and taste good. When Fatimah Jackson eats French fries, she enjoys them, but she also thinks about the chemicals that potatoes naturally contain, and wonders what effect they may be having on her body.

"Plants are storehouses of chemical weapons," says Fatimah, a biologist and anthropologist at the University of Maryland at College Park who studies how plants and people affect one another. She's not talking about chemicals that are sometimes sprayed onto plants. The ones she studies are "just the God-given chemicals in the plants. One thing about plants is that plants can't run very fast," Fatimah says with a wide smile. "They can't even run at all. So what they have developed are chemicals to draw insects and humans and animals that would help them survive toward them or to keep other animals away from them. So, the chemicals that keep you away are called repellents and the chemicals that draw you toward the plant are called attractants."

Before fruits and vegetables ripen, they are often green and bitter. These are signals to stay away from them. Not only will they taste bad, at that stage, the fruits or vegetables contain chemicals called repellents that are harmful to eat. Repellents are nature's

way of getting you to leave the plant alone until it is ready to be eaten.

And, Fatimah points out, the appearance and taste also protect the plant until it is ready to have you assist in its survival. "It needs to be picked in order to disperse its seeds, but it doesn't want to have its seeds dispersed before they are really mature. So, the fruit on the outside, the soft flesh, is really a mechanism to get the seed scattered all over the place to



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produce more trees or bushes to produce more fruit," she explains.

Fatimah enjoys studying human-plant interactions. "It's a way of understanding human biodiversity," she explains. Fatimah Linda Collier Jackson, as her name suggests, is herself a product of diverse cultures. She is an African American with Native American and European ancestors as well. When she was a graduate student she converted to the Muslim religion. She and her husband, Robert Jackson, who is a professor in the department of nutrition at the University of Maryland, and their six children follow the Muslim customs and beliefs.

A sign in the foyer of their large suburban home says that this is a Muslim home and invites guests to please remove their shoes. A room in the front of the house is set aside for saying prayers several times a day. In public, Fatimah always covers her thick dark hair with a large scarf, also a Muslim custom, and wears long dresses. She refers to the head covering as "my restraint—it's a reminder to stay on the straight and narrow."

But if you're thinking Fatimah is a prude who walks around frowning, you're completely wrong. A colleague says she always has a smile on her face. Typically, it's a big smile. "You can tell when something may be bothering her when it's only a little smile," says Aubrey Williams, a University of Maryland anthropologist. Fatimah has an infectious laugh which often peppers her conversations. Her family appreciates her sunny disposition too. "My mom's an inspiration because she does a lot of work but she can still come home cool and not have an attitude," says her 10-year-old son, Hasan. "Even if she did have a bad day at work, she can come home and not act like it."

Fatimah has devised a schedule for distributing her time and energy between work and family. She gets up at 4 a.m. and works on grants or papers. Then, as the family starts waking up, she helps get the children off to school. She leaves by 9 a.m. for the short drive to work. She returns home by 2:30 p.m. to be there when her two youngest children get home from school. Later in the afternoon she returns to work and then she's back home by 7 p.m. to fix dinner for the family. Often the family goes someplace together on the weekend. The children say they were each other's best friends as they were growing up, and the family remains very close-knit. "All the children are raised in the East African tradition: Family is forever," says Fatimah. "They invest in being with the family. Each one helps the next youngest." They are given no allowance, but if they need money, they know they can ask for it.

Fatimah brings a deep sense of purpose to her work as a scientist. She says all her work is directed toward the larger issue of "improving the way my fellow humans look at variation. I have a responsibility to all the creatures on this planet," she says. "I want to foster an appreciation for diversity." Fatimah hopes her work will help people "get along better and appreciate the variation that exists and get to know each other better, and see this variation as part of our collective wealth, rather than our collective burden."

She gives some examples of what the word "biodiversity" means. "We think of biodiversity as the variation, the biologically based variation that exists within a species or a genus (group)," she says. "An example of human biodiversity would be diversity in the ability to drink





milk. We have some groups of adult humans who can consume milk without any problem, and then other groups of humans for whom milk causes all kinds of gastrointestinal upset." Another genetically based difference is an ability to eat wheat products, Fatimah points out. Some people, especially in western Ireland and Scandinavia, can become very sick if they eat foods containing wheat. Other people in the Near East, for example, "have had a long and positive relationship with wheat" and think of it as "the staff of life."

Through her research, Fatimah tries to understand how certain plants eaten by people who live in one region of a country help prevent them from getting diseases.

"Each human group in different parts of the world has its own unique set of plants that it is interacting with. It's that uniqueness that I am trying to tap into," she says. "What I think is that we are all very similar, but the foods that we eat can magnify the differences. Plants that we eat can also influence how tall we become, as well



Cassava plant and root

as how resistant we are to certain diseases," Fatimah says.

She does much of her research on one plant in particular, a root similar to a potato, called cassava. Cassava is a staple food in the diet of 400 million people who live in Africa, Latin America and tropical Asia. Cassava also contains a poison called cyanide. When it is prepared properly by soaking it for days and cooking it, enough cyanide is removed that it is not harmful to the person who eats it. But Fatimah believes it may still contain enough poison to be harmful to certain parasites that can cause diseases in people.



Fatimah Jackson stands in a field of tea in Uganda, East Africa

Fatimah says she has found that people in the West African country of Liberia who eat large amounts of cassava are protected against some diseases. They have less sickle cell anemia and a lower incidence of malaria than people who don't eat as much cassava. In sickle cell anemia, the blood cells become curved in the shape of a sickle or crescent. Fatimah says that it's hard for the malaria parasite, which lives inside blood cells, to survive and reproduce inside sickle-shaped cells. So, sickle cell disease is probably a natural protector against malaria.

Casssava may be another protector against malaria. "We think that people who eat cassava at high levels on a regular basis, generation after generation, may be able to control their malaria effectively without having to maintain a sickle cell gene in their population," Fatimah explains.

"We think that the chemicals in cassava are providing protection against having really, really severe malaria," she says. "This is done by the chemicals interacting with the proteins of the malarial parasite and inhibiting the parasite's action."

"So, the second part of our finding is: where you have high cassava consumption, you have low frequencies of sickle cell. And the people get their protection against malaria from the cassava diet rather than from sickle cell."

So far in her research, Fatimah has visited half a dozen African countries, including Liberia. She has talked with many people to find out what they eat and how they use local plants. She has come back with records about how much malaria and sickle cell disease these countries have had. Now she designs laboratory tests to see if she can show that cassava has a direct effect on the sickle cell and the parasite that causes

malaria. One thing she does is bring back samples of cassava in various stages from raw to fully cooked and tests them for the amount of cyanide they contain. "We go into the laboratory and simplify things and make models of what we think we saw going on in the field (in the African countries) and then test those models," she says. "And then we're forced back into the field. So it's a constant give and take between the field environment and the laboratory."

Fatimah is trying to make some useful products from cassava and sorghum. Sorghum is a grain used to make cereal. Like cassava, it also contains naturally occurring cyanide. She extracts cyanide from both cassava and sorghum to make insecticides, animal fodder (a coarse food for livestock) and a human nutritional supplement. She hopes to make and sell the products in countries where cassava and sorghum are grown.

Working with plants came naturally to Fatimah, who has been interested in them since she was a child. She grew up in Denver, Colorado, when it was just a "cow town," in a family that had little money but strong values. Her father's family were "dirt farmers." Her father was a mechanic who worked three jobs. He died when Fatimah was six. But, Fatimah says, "There was never an absence of love."

She grew up around an extended family and thinks her own children are "deprived" because they are not growing up with close relatives nearby to help nurture them. Her parents, grandmother, aunt and cousin lived in the same house. One of her father's brothers and his family lived across the alley. Down the street were more cousins and uncles.

From her mother's side of the family she learned to value education. Her mother grew up in Cambridge, Massachusetts, and earned a master's degree. Her aunt earned a master's degree in public health from Harvard University.

"I spent quite a bit of time in the Rocky Mountains,"

Sorghum

Sorghum illustration courtesy of the Nebraska Grain Sorghum Development, Utilization and Marketing Board.

Fatimah remembers. "I spent time away from the distractions we have today—radio, TV, video games. So I had a lot of time to think and look at the horizon and listen to my grandmother." Her grandmother passed on to Fatimah some of the legacy of her



mother, Fatimah's great-grandmother, a Choctaw Native American of the Bell clan who was well known in Atlanta, Georgia, as a traditional herbalist and midwife. Fatimah learned from her grandmother how to make poultices and liniments used to treat sore parts of the body.

Her grandmother also told her stories about people fleeing from the South to the North after the Civil War and during the Reconstruction era. Fatimah listened intently. She came away with two points that she still retains and believes in: "One point was that we all are individually responsible for our actions and if you are living in a place and it's not acceptable, try to leave. Two, while she (her grandmother) would recount some of the horrors of the Reconstruction era, she would never castigate a whole people. She would say there was some good and some bad in all groups. That kind of egalitarian, even-handed approach very much impressed me."

Her father's family felt the same way. They believed they should be able to marry anyone they pleased, regardless of the person's colour or cultural background. And they did. "So, on my father's side I have all kinds of relatives who are not African Americans," Fatimah says. "While we have kept the African traditions, we have also incorporated other backgrounds."

One of the traditions in Fatimah's family is that one female child in



each generation will become involved in some aspect of traditional medicine. Fatimah fulfills that role by doing research on plants and their relationship to disease and health. "I guess what I am trying to get people to see is that we all have these multiple lenses," Fatimah says. "We all are connected in many ways, and my connection to plants has been through all of these multiple lenses."

Fatimah can't pinpoint when her interest in science began. When she was a child, people talked more with each other than they do now, she says. She would have long talks with older members of her family about how things worked, what a shooting star was, what Jell-O was. Her aunt talked with her about biology. Her mother got her a chemistry set when she was eleven. Fatimah's family was poor and she didn't have a lot of things to play with as a kid. Her mother took her to the library regularly to check out books.

"We had holes in the carpet, but we had books on the shelves," Fatimah says. "The idea was, sit down and read, or sit down and think," she reminisced.

She loved biographies, and would try to imagine what the life of the person she was reading about was really like, and imagine herself as a character in that person's life. She put on plays with neighborhood friends and relatives. She worked in the garden. Her cousins dug underground tunnels that they used as a clubhouse, and she would play with them. She played kick ball and hop scotch and other outdoor games.

In high school, Fatimah loved chemistry. When she first entered the University of Colorado, she thought she would become a teacher. She liked anthropology and liked studying diversity. But Fatimah found her anthropology professor very irritating. He said things in class that were offensive to African American and Jewish students. She decided right then the only way she could combat someone like him effectively was to have her own Ph.D. and her own microphone.

An African-American mentor who was an anthropologist told her she should transfer to either Berkeley or Cornell University to complete her undergraduate degree. Cornell called and invited her to come to Ithaca, New York, to visit, and she enrolled. She immediately met the man who would become her husband. He had just graduated from Cornell. She was 19 years old. Two years later they were married.

Those first years at Cornell were very lonely and a little scary. "I wasn't East Coast sophisticated," Fatimah said. She remembers that period of her life somewhat painfully. Cornell was more competitive than any environment she had been in previously, and she had no money. "My grandmother said, 'Well, it sounds like you have to either root hog or die poor," Fatimah said. The expression relates to a hog who has to work hard digging for roots to eat. Fatimah had \$19 a month from her father's social security. "That was it," she said.

"I went to someone in financial aid (at the university). I said, 'I only



Fatimah examines some cassava leaves

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have 25 cents in my pocket.' This guy was a conservative Republican white American," she recalls incredulously. because she was surprised by his



Fatimah said she viewed her challenge at Cornell as though she had gone to battle. Except for a few part-time jobs, she sank all her time and effort into learning. At the start of a new class, she would walk up to the professor, introduce herself, say that she expected to be an A student, and ask if there was any extra reading she should do. She got good grades and was awarded a scholarship at Cornell. But she didn't know until graduation day, when she saw the words "cum laude" on her diploma, that she was graduating with honors and distinction in all subjects.

Fatimah and her husband spent several years in Africa working toward their Ph.D.s and began their family of six children. While in Tanzania in 1974, Fatimah came down with a severe case of malaria. She lost her eyesight and couldn't walk.

"I was sure I was going to die," she said, recalling that dreadful time. "I asked God, 'If you let me live, I will go back to school and study malaria." Fatimah got well and she did go back to graduate school and studied malaria.

Then, while doing field work in Liberia, interviewing residents, getting their medical histories, and taking and testing blood samples, she began to see a relationship between eating cassava and the number of cases of sickle cell disease and malaria. From the pattern she saw, she

came to believe that "cassava was protecting against malaria as much as sickle cell was."

As she continues her research, Fatimah also teaches. She gets high marks on her teaching from students, colleagues and the University of Maryland administration. She was one of five faculty members honored with the university's Distinguished Scholar-Teachers award. The provost introduced her as "a teacher of rare dedication and a pioneering scholar."

"She's just a remarkable human being and phenomenally creative individual," says William Kirwin, president of the University of Maryland at College Park. "I have the greatest admiration for her intellect. She's a wonderful teacher, particularly popular with talented students because she does require a lot."

"She's really captivating," said Andrew Tobiason, a senior anthropology and biology student who was her teaching assistant the previous summer. "She can get you interested in anything."



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GLOSSARY

Anthropologist - A scientist who investigates the physical or cultural changes that have occurred in humans since their beginning.

Attractants - Naturally occurring chemicals in plants that make them tempting to be picked and eaten — for example, chemicals that make a peach soft with a red and yellow skin.

Biodiversity - Variation among members of a group or species. Also, the existence of many different kinds of plants, animals, insects and very tiny organisms in a community.

Biologist - A person who studies the science of living things.

Cassava - A starchy root plant, similar to a potato, that grows in the tropics.

Cum laude - With distinction or honor.

Cyanide - A very poisonous substance.

Disperse - Scatter.

Egalitarian - Promoting a belief in equal rights for all people.

Fodder - Coarse food for livestock.

Genetically - Dealing with heredity and variation within a group.

Herbalist - A person who grows or uses herbs.

Legacy - Something handed down by an ancestor.

Liniment - A medicated liquid applied to the skin to relieve pain.

Malaria - A disease caused by a parasite that is transmitted to a person during a mosquito bite. Symptoms include bouts of fever and chills.

Parasite - An organism that lives on or inside another living thing called the host. The parasite gets its food from the host and often harms it.

Poultice - A hot, soft, moist mass, usually medicated, that is applied to a sore part of the body.

Repellents - Naturally occurring chemicals in plants that serve to keep people and animals from picking them or eating them until they are ripe.

Sickle cell anemia - An inherited disorder in which a person's red blood cells are curved in the form of sickles or crescents, causing problems with circulation and development, pain, and increased infections.

Sorghum - A grass grown for grain, cereal, fodder and syrup.

Unique - One of a kind; having no equal.