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SySTEM Alert!

Tomorrow is almost here.

Do-it-yourself genetic testing for **'supertasters'**

You can't always thank or blame your DNA for your gifts and shortcomings, but sometimes you can. Science shows that some people have a natural ability to taste food that goes far beyond most tasters' abilities. These people are called supertasters, and they probably have the ability thanks to a gene called TAS2R38. But this superpower isn't always a blessing. Often picky eaters, supertasters find some common foods too bitter or too spicy (one example is grapefruit, which supertasters often find revolting).

There is a cheap test that can tell you if you are a supertaster. You probably have the stuff already. Needed:

- Blue food coloring
- Piece of waxed paper
- Hole punch
- Magnifying glass
- A lab assistant (anyone from your teacher to your cousin will do)

Use the hole punch to punch a hole in the corner of the waxed paper. Have your assistant put a drop of food coloring on your tongue. Swish it around until it coats your tongue thinly. You'll see that now the tongue is blue except for lots of little bumps. The bumps are called fungiform papilla, and these are where the taste buds are located. Supertasters have more of them. Your assistant will put the waxed paper on your tongue toward the tip. Count the number of bumps he/she can see through the hole. Don't count the tiny, tiny ones. If you have more than 30 of these bumps, you're a supertaster! Next step: Brag to your friends.

Career Fields

- Geneticist
- Food taster

Need food coloring? You can find it at shop.pitsco.com.

Pull out and share *SySTEM Alert!* with your students!

STUDENT CONTEST

Appear in the pages of **SySTEM Alert!**

Expand on an article you read in this newsletter, and you could get published.

Attention young scientists, tech heads, engineers, and math enthusiasts! We'd like to see some articles from you in the pages of this newsletter and on our Web site.

Here is what you need to do: Choose a topic in the pages of this issue or in one of our past issues to write about. After you've picked one, you have a couple of options.

1) Do some of your own research into that topic and write a story about what you discover. Because of space, we always have to leave some juicy tidbits out of the story. Help us by discovering some of them and reporting on them. (You get BIG bonus points if you actually contact a scientist, inventor, engineer, or mathematician to ask them a question.)

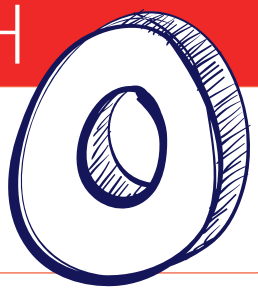
2) Design an experiment or build something based on one of the articles. Write a short explanation of your handiwork and the results. If you do this, be sure to take some pictures.

Use the topics as starting points. Feel free to take your exploration in any direction from there. After you've completed your article, send it to cwhite@pitsco.com. Include your name, age, school, and the name of the article that inspired you. We can't promise to put every article in the newsletter itself, but some will appear there, and others will be published on the Web. **Submit your article as soon as it's ready; the first one will be selected for publication by mid-September.**

Fact

MATH

People haven't always known about the number zero. The idea was probably born in India more than 1,000 years ago. Not only that, but there are present-day cultures that only have words for three numbers: one, two, and many. Are numbers invented or discovered?



Green fuel . . . literally!

The same green stuff that gunks up the pond near your house might one day power your car. Some believe that future fuels made from algae could compete with traditional automobile fuel. Most of the fuel you buy at the gas pump is made from oil that has to be drawn from deep in the ground. Algae, however, grows naturally in bodies of water all across the world and can be scooped out.

If you do scoop up algae in your palm, it might feel like . . . well, glop. But inside the millions of algae cells you hold in your hand are lipids. Lipids are molecules that store energy for their cell (like fat in your body stores energy for you). And what do you need to power a car? Energy, of course.

Obviously it isn't as simple as putting some algae in your gas tank. Complex processes must be used to extract the algal lipids and then turn them into liquid biofuels. (Biofuel is fuel made from living matter.) However, before that can happen on a large scale, many tough problems must be solved.

ALGAE DESERVE YOUR RESPECT

Meet Dr. Val Smith, a scientist at the University of Kansas who is working on the first of those problems – growing and feeding the algae. According to Smith, there are many different plants that can be grown and turned into biofuels. However, one drawback to some of these crops is the amount of arable (farmable) land required to grow them.

Smith explains, "There is only so much arable land on the planet and much of it is already in production. . . . The advantage, in principle, of algae is that algae wouldn't be grown in the middle of a cornfield." See, when arable land is used to grow crops for fuel, that means less land is available to grow food. That is one conflict we'd like to avoid! Algae can be grown in ponds on non-arable land.

Smith is trying to find the best ways to boost algae growth. If we could grow a lot of algae really quickly, that could mean a lot of fuels.

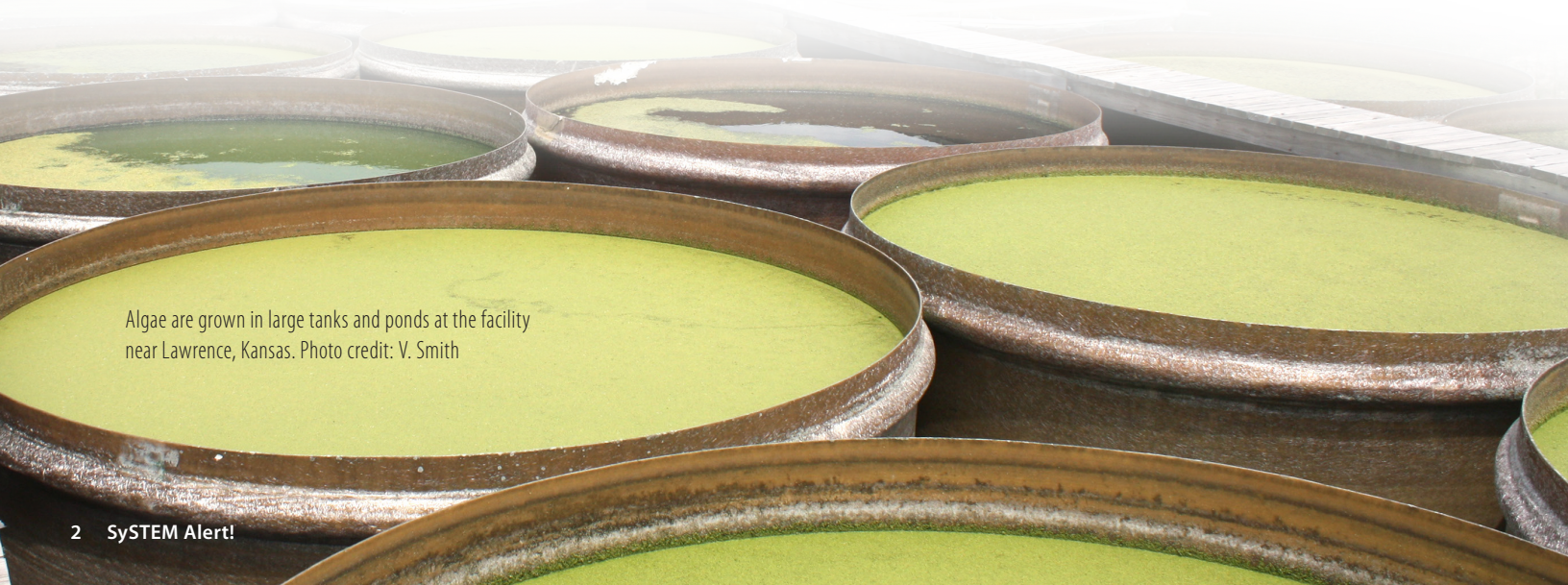
"The little algal cells can divide as fast as once per 24 hours," Smith says. "That means in principle, the biomass can double every 24 hours. So if you took half, the next day that half would be replaced and you could take half again. . . . Algae grow to beat the band."

Compare algae with corn, another biofuel crop. Corn is harvested only once per year. It has been estimated that we could produce more than 300 times as much biofuel each year from an acre of algae than we could from an acre of corn. Just because algae can potentially grow that fast, however, doesn't mean it is easy to make them do it! Growth conditions have to be just right, and discovering those conditions requires scientific research.

A LAB OPEN TO THE SKY

Smith does much of his research at a station north of Lawrence, Kansas, with about 80 large algae ponds. These ponds are plumbed like bathtubs, so water can be drained or added with the turn of a valve. Each of these ponds is potentially a different science experiment. The researchers vary such things as the species of algae being grown, the depth of water, and the amount or type of fertilizer given to the algae.

In the course of this research, Smith and his colleagues might have tapped into a nutrition source for algae that could help solve another problem: polluted water. Wastewater from sewage treatment plants is unappetizing to us, but it might be good eatin' for algae.



Algae are grown in large tanks and ponds at the facility near Lawrence, Kansas. Photo credit: V. Smith

Dr. Val Smith shows off some of the dry algae matter.

KU's Feedstock to Tailpipe team and Dr. Smith work with the local wastewater treatment plant to grow algae using their treated water. The algae absorb many of the remaining pollutants and thus help further clean the treated water. It's a win for everyone: researchers, wastewater treatment engineers, and algae. And it might be a win for cattle too, because when the lipids are removed from the algae, the dry matter that is left can possibly be made into a nutritious food source for livestock.

The search for alternative fuel sources is just beginning. Algae are one of the many possible solutions, and probably several different sources will be useful. Perhaps the best renewable energy source hasn't even been thought of yet. So, do you have any ideas?

The algae-energy process

OK, the article title might be a little misleading. The fuel itself wouldn't actually be the color green. But it would be environmentally friendly. (Sorry, we can't turn down a dumb joke.) So what is the process for turning algae into fuel?

1. Grow a lot of algae. It can be grown in open ponds or in transparent, closed containers.
2. Harvest the algae. The kinds of algae (pond scum) typically used for biofuel float on the surface of the water. Remove the desired amount.
3. Put the harvested algae in an algae press. This squeezes the algae until the cells split and the lipid spills out along with the cells' water. (Ever squeezed a grape really hard?) The oily lipids float on top of the water.
4. Alternatively, mix the harvested algae with a chemical called hexane. This extracts the cellular oil. The chemical separates the last little bit of oil from the pulp.
5. Convert the harvested oil into fuel that can be put in vehicles. One method of doing this is called transesterification. (Don't worry, it won't be on the test). Another method involves "quick-cooking" the oil with special pressure cookers.

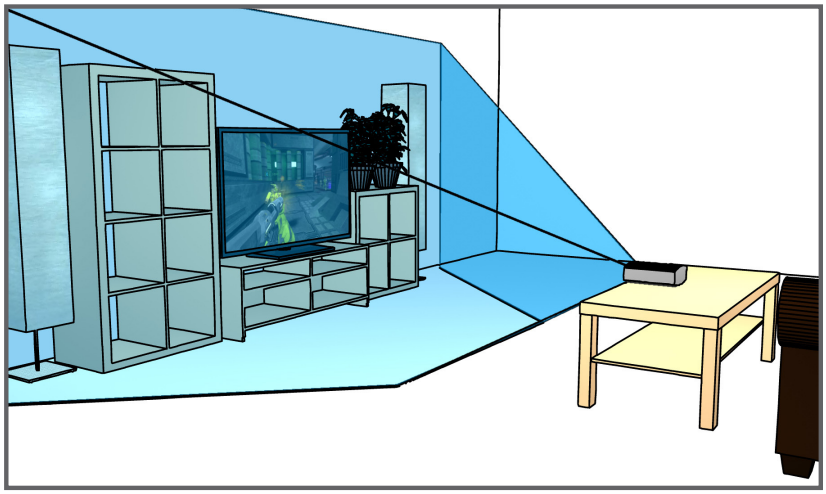
Fact ENGINEERING

You might have heard that Thomas Edison invented electric lighting. Not true. Some have estimated that 22 people invented it previously. But Edison's design was the best! Just because something has been done, doesn't mean it can't be done better.

A whole new **videogame experience**

The best videogames feel immersive. But a grad student at the University of Illinois and his three teammates from Microsoft want games to immerse your living room as well. The student, Brett Jones, worked for three months on the IllumiRoom, a system that allows elements from a video game to be projected into a room onto 3-D objects such as bookshelves and furniture.

The TV is still the center of action, but a projector expands the play area dramatically. Characters can appear to come out of the screen, or the projector can instantly project a cartoon version of the room over the real room. The effect is pretty wild, and no special glasses are needed. Writing the software to make all this work involved some pretty intense math and an understanding of 3-D objects. But this might very well be the future of gaming.



To see a video of the system, check out www.brettrjones.com/illumiroom/ Photo credit: brettrjones.com

Fun stuff has serious use (but is still fun)

You've probably played around with "oobleck" at home or at school, right? It's a classic.

Just a simple mix of water and cornstarch, it has some very strange properties. Push your hand slowly into the liquidy concoction and it forms around your hand like water. But try to move your hand into it quickly and the mixture becomes rock hard. Hit it with a stick, a frying pan, or your foot and you get the same result. Online you can even find videos of people running across its surface.

Oobleck is a type of non-Newtonian fluid, a fluid that flows differently than most. (Newton was the guy who, according to legend, described gravity after an apple fell on his head.)

SAVING LIVES

Very cool, but why are we talking about it here? People have known about oobleck for ages. And we focus on the future here, not the past.

As it turns out, substances like oobleck are becoming pretty important. How important? Think saving-a-life important.

Put a non-Newtonian fluid in the body armor worn by soldiers and police and it might be able to stop a knife or a bullet. The armor that is being developed combines the fluid with layers of Kevlar, a super-tough fiber that was originally engineered to replace steel. The new armor would be lighter and possibly stronger than traditional armor. It would use less Kevlar than current armor.

In the future, such fluids might even be put in cars. This could lessen the damage from a collision.

Note: *The regular cornstarch mixture is NOT for stopping bullets or knives or cars. The researchers making the armor use a more advanced material made with tiny artificial particles called nanoparticles.*

THE WHY OF THE WEIRD

Recently some scientists figured out why oobleck behaves the way it does. Basically, the water in the mixture flows more quickly than the cornstarch. So when you hit it hard, the water rushes away from the impact. But the cornstarch can't move away as quickly so it packs together hard. It forms a tough solid. A moment later, the liquid flows back up into the cornstarch and the substance resumes its liquidity.

Career Fields

- Chemical engineer
- Ballistics expert

Make oobleck at home (seriously, do it)

In a big pan, stir together two cups of cornstarch and one cup of water. You can experiment with the amounts to get a result you like. Or you can double the mixture to get more. Do all kinds of crazy things with it. You'll know it's weird as soon as you roll it around in your hand.

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