Engineers' Forum

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February 2003

Ghosts in the Storm

ball lightning is one of the most mysterious and fascinating phenomena in nature

Also Inside: Math and Mating Rabbits, E-Week, PhotoSpread

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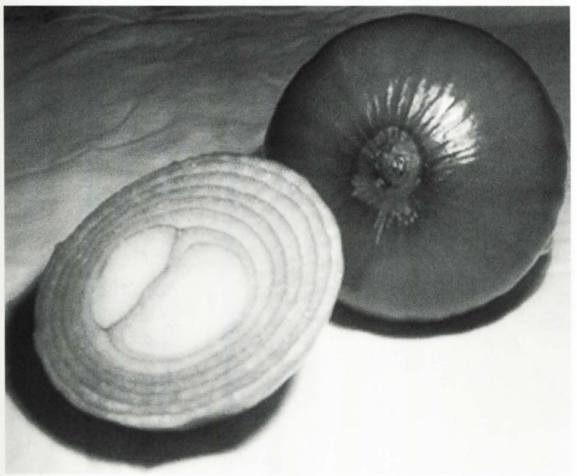
Cover Art by Brian McGill

Feild's Effects

written by Kate Feild

>> Warning: Onion Enzyme Armed and Dangerous

Everyone knows the scene: an innocent human being is standing over a cutting board, eyes welling with uncontrolled tears. What could cause this random showing of depression? As we all know, it can be caused by only one thing: the spraying, nay, the attack, by one called Allium Cepa, a.k.a. the onion. A naive person can easily be seduced by the pungent aroma and tangy taste of this bulbous plant, only to suffer dearly with their own salty tears.



Have no fear! Food researchers in Chiba, Japan have come to our aid. The onion, as a whole, is not the culprit in this food mystery. An enzyme, now dubbed lachrymatory-factor synthase, can be blamed for all our wasted tears.

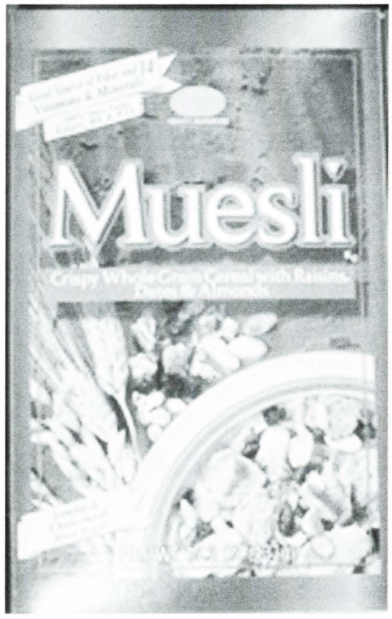
In a report featured in Nature magazine, the scientists, led by Shinsuke Imai of the House Foods Corporation, stated that when they mixed the enzyme allinase with a certain chemical, both found in onions, but left out lachrymatory-factor synthase, the tear reaction was lessened. The scientists believe that genetically altering the onion would be the best way get rid of the enzyme. They also believe that, by taking out this enzyme, the flavor of the onion would be strengthened. Of course, this theory hasn't really been tested.

Another factor lies in the taste. At this point in time, a genetically modified onion, without this enzyme, has a distinctly different taste, say researchers.

>> Sometimes you feel like a nut...

I am sure all of us, at one point or another, have been sitting over the last bowl that can be obtained from a box of Muesli, wondering, "What the heck happened to all my Brazil nuts?" I know that this has been weighing heavily on my mind lately.

Luckily, I need not worry, because researchers, led by Ingo Rehberg, in Germany, at the University of Bayreuth, have been investigating just this point. The Brazil-nut Effect, in which big pieces, such as Brazil nuts, can be found near the top of the box, has been investigated. No one is really sure why this happens. Some theorize that larger objects force the smaller ones down, while others believe that friction forces the larger objects up the walls of the box.



A wrench was thrown into this Brazil-nut theory, however, when scientists in the United States and Germany found out that, strangely enough, in some cases, the larger Brazil nuts fell to the bottom. This is known as the reverse Brazil-nut Effect, as dubbed by the scientists in an article in the Physical Review Letters, and happens at a certain density and ratio of large to small objects.

Fear not! We have scientists around the world putting their brains together, genetically altering onions and trying to make sure that everyone who partakes of a box of Muesli finds enough Brazil nuts to suit their palate. However, with all the diseases in the world, such as AIDS, cancer, and diabetes, that threaten people's lives daily, I am beginning to wonder whether crying over an onion or losing a Brazil-nut or two is such a big deal. That's just my opinion, though I may be a nut to admit it.

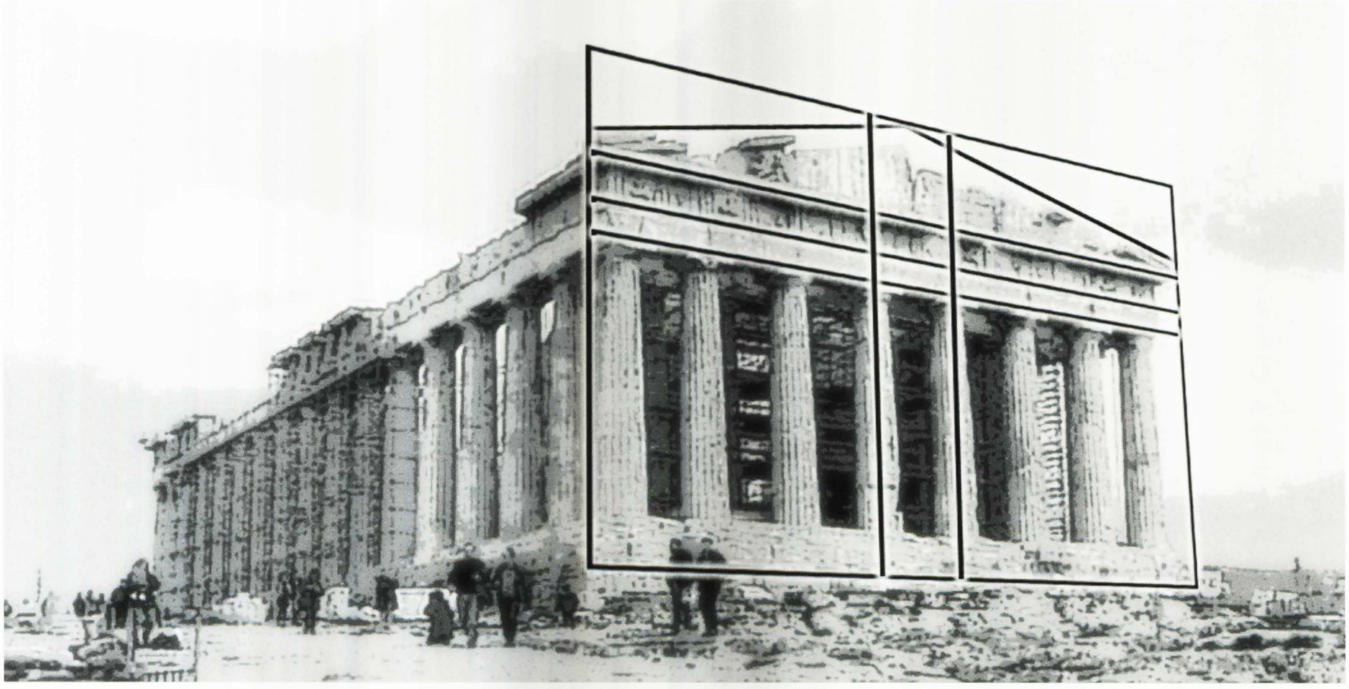
Math and Mating Rabbits

written by Sarah Lewis

Patterns can be found everywhere around us. They appear as flower petals, seeds, pinecones, snowflakes, fingers, toes, and even rabbit populations. One of the most famous patterns, also called a sequence, is the Fibbonocci Sequence. The Fibbonocci Sequence is a set of numbers that continues infinitely many times in a predictable order. The first five terms in the sequence are relatively famous and simple: (1 1 2 3 5).

They are defined recursively in that they continue subject to the number previous; the third and following numbers are the sum of the previous two in the ordered sequence. The formula for this sequence is based on a discovery called the golden section, a unique ratio that is found in many natural properties.

When all of these properties are put together in this famous sequence in a building or painting, the result is very aesthetically pleasing to the eye. It is also pleasing to the ear when transferred to a piece of music. There are numerous other examples



The Parthenon: a display of the beauty in numbers

where Fibonocci's famous sequence appears...art, architecture, anatomy, and music, just to name a few.

Leonardo Fibonocci originally discovered the sequence while working on his famous rabbit problem. In this problem, he assumed that a pair of rabbits, one male and one female, are released to mate. He also assumed that the rabbits were able to mate after one month, and produced one more pair of male and female rabbits. He asked this question: what would the rabbit population be in one year? The result of this problem is what is known today as the Fibonocci Sequence. He found that as the months progressed, the number of rabbit pairs followed the sequence 1 1 2 3 5...until it reached 144 on the twelfth month.

Fibonocci's numbers created a shroud of mystery about themselves, and later, other mathematicians began to study the intricacies of this simple, but yet extremely complex pattern of numbers. It was discovered that the ratio between the numbers produced reached a limit of phi when the sequence continued to infinity. Phi (also known as the Golden Section or ratio) is defined as being +1.61803 (+(1+sqrt(5)/2)).

Phi is found by dividing a line into two distances, x and 1+x. These two distances are then again divided in the same way. The division creates the accurate guesses to finding a minimum or maximum of a function in the least number of repetitions. This is just one of the many uses for the series and its properties.

Many old pieces of architecture bear the mark of the Fibonocci Sequence and the Golden Section. For example, the Parthenon in Greece is divided into sections that follow the pattern of the Golden Ratio and the Fibonocci Numbers. Also, the Acropolis was built on a rectangle with sides such that the length of the rectangle is sqrt(5) times the width (a square-root-five rectangle).

The Golden section not only appears in ancient architecture, but

in the works of some of the most famous painters and artists in history. For example, Leonardo da Vinci's *The Last Supper* is proportioned in the style of the Golden Section. The distance of the disciples to Jesus is phi. It can also be seen in the works of such artsits as Albrecht Durer, Georges Seurat, and Paul Signac, to name only a few. A good technique in art, used by these famous artists, is to not just throw the subject of the work in the center of the canvas, but about a third of the way to one side.

The pattern is also found in music, poetry, nature, and within ourselves. Is it just coincidence that humans possess five fingers on each hand and two hands?

It has also been found by Derek Haylock that Beethoven's 5th symphony used phi within the symphony, however, the question remains if this was a coincidence or if Beethoven possessed and used the knowledge of the Golden Ratio to compose his symphony. The Golden Ratio and the Fibonocci Sequence can most often be found in the spiral of the sea shell, the areas of its compartments equaling 1 1 2 3 5…

The question left to answer is what else can this strange ratio and sequence describe? It reaches up to the heavens and down to the bottom of the sea and into the very inner workings of our bodies and minds, molding our imagination.

"Engineering is the art of modeling materials we do not wholly understand, into shapes we cannot precisely analyze, so as to withstand forces we cannot properly assess, in such a way that the public has no reason to suspect the extent of our ignorance." - Dr. A.R. Dykes

E-Mail Bag

Analysis of Engineers

1. Social Skills

Engineers have different objectives when it comes to social interaction. "Normal" people expect to accomplish several unrealistic things from social interaction: stimulating and thought-provoking conversation, important social contacts, and a feeling of connectedness with other humans. Engineers have rational objectives for social interactions: get it over with as soon as possible, avoid getting invited to something unpleasant, demonstrate mental superiority and mastery of all subjects.

2. Fascination with Gadgets

To the engineer, all matter in the universe can be placed into one of two categories: (1) things that need to be fixed, and (2) things that will need to be fixed after you've had a few minutes to play with them.

Engineers like to solve problems. If there are no problems handily available, they will create their own problems.

Normal people don't understand this concept; they believe that if it isn't broken, don't fix it. Engineers believe that if it isn't broken, it doesn't have enough features yet.

3. Dating and Social Life

Dating is never easy for engineers. A normal person will employ various indirect and duplicitous methods to create a false impression of attractiveness. Engineers are incapable of placing appearance above function.

Fortunately, engineers have an ace in the hole. They are widely recognized as superior marriage material: intelligent, dependable, employed, honest, and handy around the house.

While it's true that many normal people would prefer not to date an engineer, most normal people harbor an intense desire to mate with them, thus producing engineer like children who will have high-paying jobs long before losing their virginity.

Male engineers reach their peak of sexual attractiveness later than normal men, becoming irresistible erotic dynamos in their mid thirties to late forties. Just look at these examples of sexually irresistible men in technical professions: Bill Gates and MacGyver.

4. Ego

Ego-wise, two things are important to engineers: how smart they are, and how many cool devices they own. The fastest way to get an engineer to solve a problem is to declare that the problem is unsolvable. These types of challenges quickly become personal -- a battle between the engineer and the laws of nature.

Nothing is more threatening to the engineer than the suggestion that somebody has more technical skill. Normal people sometimes use that knowledge as a lever to extract more work from the engineer. When an engineer says that something can't be done (a code phrase that means it's not fun to do), some clever normal people have learned to glance at the engineer with a look of compassion and pity and say something along these lines: "I'll ask Bob to figure it out. He knows how to solve difficult technical problems." At that point it is a good idea for the normal person to not stand between the engineer and the problem. The engineer will set upon the problem like a starved Chihuahua on a pork chop.

Ghosts in the Storm

Bright lights in the sky. It's a warm summer afternoon and a thunderstorm has rolled in. The sky flashes and the thunder booms. Then suddenly, a huge flash of lightning hits the ground and just as your heart slows down you see something. You see a glowing sphere about the size of a soccer ball, moving towards you, slowly. It approaches and you are frozen. It seems to have a mind of its own and it circles you twice before darting off to your left and then disappearing silently. The small orb you just saw, known as ball lightning, is one of the most mysterious and fascinating phenomena in nature. Sightings of these floating apparitions date back hundreds of years and come from all over the world. But, what is ball lightning?

The answer to that question depends on whom you ask. There are those in the world that believe that ball lightning could be the manifestation of aliens probing our planet. Others believe that this phenomenon is a form of divine communication. However, the scientific community believes that there is nothing magic or paranormal about ball lightning; it is a natural occurrence. But, they are still fuzzy about the mechanics behind the whole thing. The primary problem with explaining the mechanics of ball lightning is that almost all of the information about ball lightning comes from personal accounts of encounters with these glowing orbs. And the reports are conflicting. Some reports indicate that the balls are cool and give off little to no heat while other people report receiving severe burns from encounters. Some even have reported that the balls seem to burn holes right through windows and walls. Still others report that these spheres seem to pass through solid objects like doors and airplane bulkheads, leaving no trace of their existence on the material. However, there are some properties that seem common throughout the reports. Ball lightning almost always appears during a thunderstorm and many of the appearances occur after a strong lightning strike. The phenomenon manifests as a glowing ball of light, spherical in shape, ranging from red to blue to white in color, and range from a few centimeters to a couple of meters in diameter. These balls also have some characteristics that add to the mystique that seems to surround their existence. The movement of these objects can be erratic, but they tend to move horizontally and have been known to bounce off walls and stairs like a big rubber ball. They also are reported to be unaffected by external turbulence and can hold steady in the presence of strong wind.

But, the original question still remains. What is ball lightning and

written by Alison Lazarevich images by Brian McGill

how does it work? The most honest answer to that question is that no one really knows. There are several theories that seem to explain many of the characteristics of ball lightning, but none of them addresses all of the characteristics. However there are two leading hypotheses that show promise in unraveling this mystery. The hypotheses can be classified in two major categories; the plasma model and the aerosol model.

The plasma model hypothesizes that ball lightning is a small amount of plasma contained by a magnetic field. The current running in the plasma causes electric fields and magnetic fields to be formed. The really cool part of this theory is how these fields interact to contain the plasma during the lifetime of the ball lightning. The thought is that due to the nature of plasma, the electric and magnetic fields are parallel (in free space they are orthogonal). The parallel fields create a condition where power does not flow out of the plasma surface, but rather directs the power of the fields in a circumferential direction and creates a spherical containment field. Chandrasekhar and Woltjer, who were working in the field of astrophysics, first proved the idea of this "force-free field" back in 1958 and their work is the basis for current work in antimatter and fusion reaction containment using magnetic fields. However, there are problems with this theory. First and foremost is the phenomenon's ability to pass through conductors, such as airplane bulkheads. If the plasma is contained by an electric or magnetic field, then the conductor should dissipate any electrical energy, but this does not seem to be the case. Eyewitness accounts describe balls passing right through the skin of the plane and appearing intact on the other side.

John Abrahamson and James Dennis published the second hypothesis in a 2000 issue of Nature magazine. Instead of plasma, Abrahamson and Dennis propose that the center of the ball is made of small filaments of silicon, which are created by a strong lightning strike hitting the ground. These filaments rise into the air, much like loose cotton candy and form "fluff balls", which explains the spherical shape of the phenomenon. These silicon filaments then react with the oxygen in the air and oxidize, creating the glow within the ball shape. And the whole reaction requires just the right mix of silicon dioxide and carbon in an aerosol form to exist at just the right time, which explains the infrequency of the event. However, like the plasma model, the aerosol model has its problems. First, the two scientists who documented this idea have not given compelling evidence that these silicon filaments

There are pages on the internet that claim to give directions on how to make "ball-lightning" in your microwave...

form ball shapes. Second, if these filaments are made of silicon, then they have mass and should be affected by wind currents and can not travel through solid objects, leaving the material unharmed.

The overlaying problem with both of theories that no one can reproduce ball lightning in a lab. There are pages on the Internet that claim to give directions on how to make "ball-lightning" in your microwave using a piece of silly putty and a match. But these experiments (which I don't suggest you try at home) mimic some of the characteristics of ball lightning, but not nearly all of them. This experimental limitation makes it difficult to study ball lightning under controlled conditions. The limitation also proves that no one really understands the mechanisms behind the creation, life and extinction of ball lightning. And so science and engineering struggle on. And hopefully the problem of explaining ball lightning will remind us that we are not nearly as smart as we think we are...

A Week Aside

written by Michael Carr

It is time again to celebrate what we are. No, I'm not talking about race, sex, or creed. During the week of February 16th we will be celebrating the Engineering profession. Across the country engineers will be in the midst of what is commonly known as Engineers Week or E-Week.

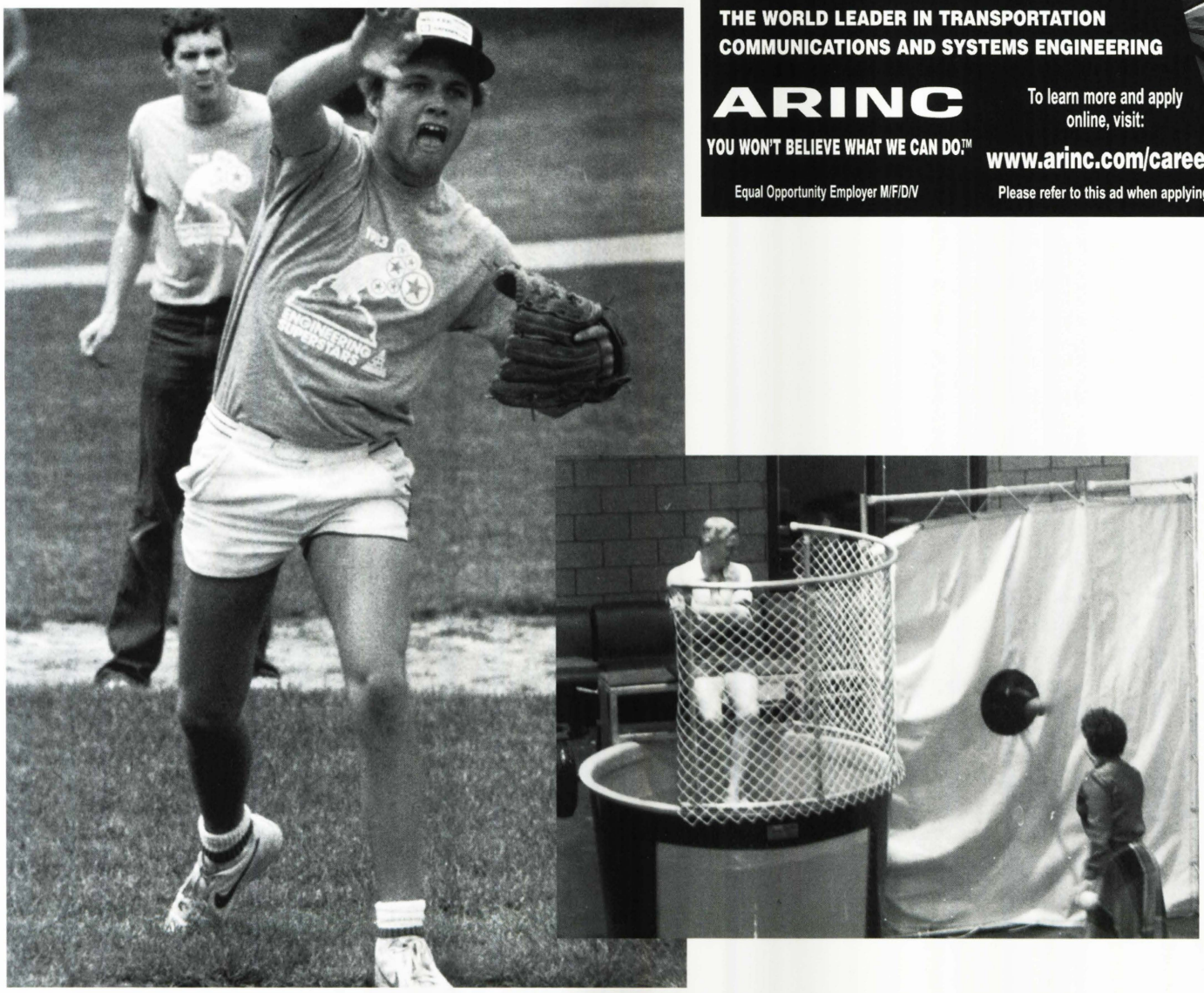
E-Week is a national program created by the National Society of Professional Engineers to make the general public more aware of the profession. Beginning in 1951, the program has grown and created several very important programs to educate America. Some of the bigger programs include 'Discover "E"' and the 'Future City Competition.' Another popular event that gets a lot of local support is 'Introduce a Girl to Engineering Day' on February 21st of every year.

Discover "E" is a program where engineers go into K-12 classrooms and talk to the students about what they do. The engineers spend the majority of their visits showing the practical aspects of math and science through experiment and demonstrations. On top of drumming up support for engineering these events also help the kids understand why they need to do their math homework. Heck it might even get a few students excited about their homework. Scary.

The Future City Competition is an event that has burst on to the E-Week scene just in recent years. In this competition, groups of seventh and eighth graders build computer generated 3-D models of what they see as the 'City of Future.' These students go on to compete at one of thirty regional competitions, where they will present their vision. The regional champions go on to compete in the Nation's Capitol for the title of National Champ. This is a great event that boasts the students' computer and communication skills as well as basic math and science abilities, all of which are skills used every day by engineers. Media coverage on this event is extensive, getting the kids and America in general pumped up about engineering.

One of the most important programs is the 'Introduce a Girl to Engineering Day.' As we all are aware, engineering is a heavily male-dominated field. Across the Nation there has been a small increase in the number of women in engineering colleges. Unfortunately East Coast colleges are seeing fewer and fewer women in their programs, and it's just unacceptable. In an effort to boost the number of women in the field, numerous groups in industry and around college campuses, like The Society of Women Engineers (SWE), have taken to the event. Come the 21st, you may see middle and high-school girls shadowing current women engineers around campus, giving them a feel for what its like to be an engineering student.

Around the country, there are numerous other events that occur to pump up us engineers. Tech is no exception.



Some things I'm glad have disappeared from E-Week, but others may need a revival

Sponsored by the Student Engineers Council (SEC), E-week is celebrated in full fervor. Throughout the week there will be fun and informative events. Once again you can look forward to Penny-Wars being staged around campus to see which department has the most supportive students. The money collected will be given to charity with a matching contribution from the SEC.

Another long time favorite is the SEC Olympics. All the engineering societies will compete against each other in various sporting events to prove their superiority on the field. Though, I'm not really sure if Dizzy-Bat counts as a sport. Always a lot of fun and a good laugh, be sure to participate or support your team.

You can also look forward to that event that took last year's E-Week by storm, the Duct Tape Competition. Using the most beloved engineering tool of all time, teams of students are given five minutes to duct tape one of their friends onto a window, seeing how long they can remain suspended off the ground. Last year ended in a tie, it didn't look like the winners were ever going to fall down. Professors should be proud, it shows we learned some truly useful stuff here at Tech.

Some other popular events are the industry presentations given each year. These are great venues to see what industry is looking for in new engineers as well as to see what industry has in store for you. I suggest that you attend these events, especially if you are looking for a job.

Look out for a full listing of E-Week events. They should be plastered across bulletin boards in the near future. I know I can't wait to find out when 'Pie a Professor' day is. If you have questions about volunteering or participating in any of the events contact the SEC *(www.sec.vt.edu)*.

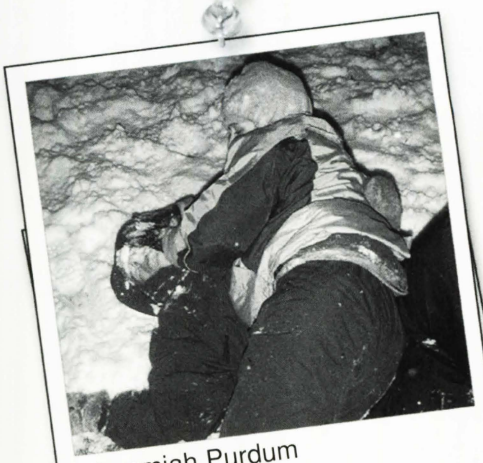
In the end I hope that you all enjoy your week, after all we only get one a year. It just goes to show that even engineering can be fun and games.

PHOTOSPREAD

Fun in the Snow!

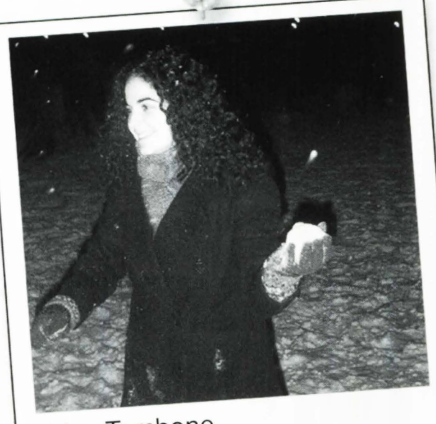
A continuing feature, the photo section introduces VTech student around campus.

Here are students playing in the snow. We asked them their name, year, major, and why they like the snow so much.

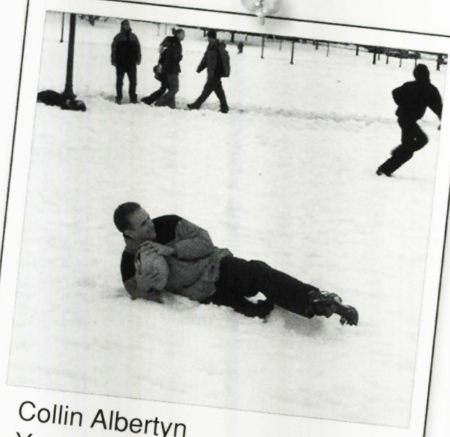


Jeremiah Purdum
Year: Freshman
Major: Wildlife Science
"Mess around..."

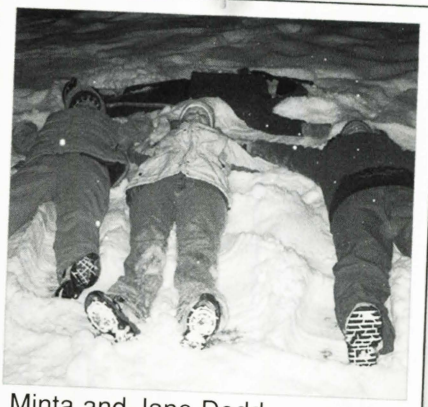
Colleen Musterman
Year: Freshman
Major: Building and Construction
"...and play!!"



Lisa Tambone
Year: Freshman
Major: Chemistry
Likes to play, such a kid!



Collin Albertyn
Year: Senior
Major: Agriculture
"Beautiful"

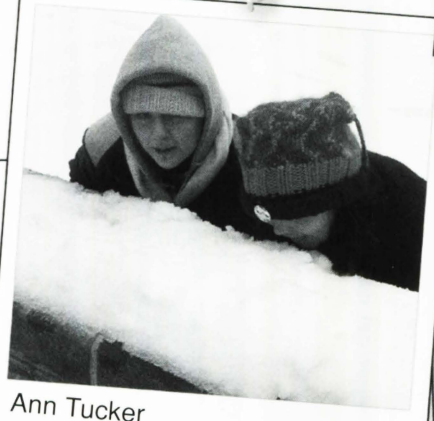


Minta and Jane Dodd
Year: Freshman
Major: Architecture
"Throwing snow at people"

Stephanie Woolwine
Year: Senior
Major: Human Services
"Rolling down hills"

Vanna Roberts
Year: Freshman
Major: University Studies
"Clean"

Lisa Talley
Year: Freshman
Major: Math
"Sledding"

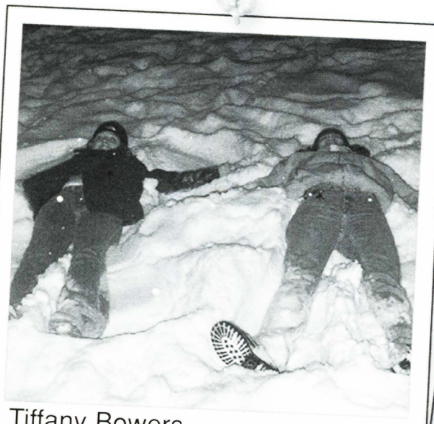


Ann Tucker
Year: Sophomore
Major: Chemistry, Theater, English
"The way it tastes"

Genivieve Price
Year: Sophomore
Major: Theater
"The way it makes everything quiet"

Kevin Reza
Year: Freshman
Major: Business
"All the girls"

Brian Padlik
Year: Freshman
Major: Engineering
"All the girls"



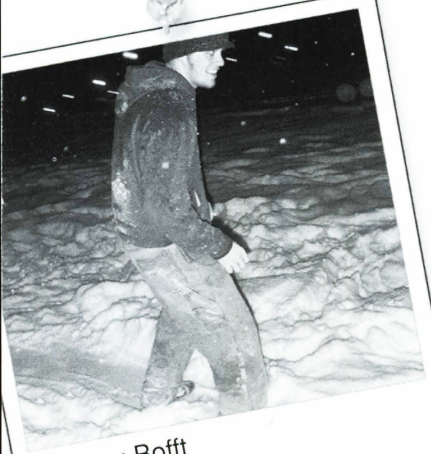
Tiffany Bowers
Year: Sophomore
Major: Animal Science
"Sparkly"

Tara Godlove
Year: Freshman
Major: Economics
"Skip class"

Ben Jackson
Year: Freshman
Major: Engineering
"Makes everyone happy"

Kyle Jernigan
Year: Freshman
Major: Engineering
"Makes everyone happy"

Maria Novak
Year: Freshman
Major: Sociology
"Makes everyone happy"



Jeremy Bofft
Year: Freshman
Major: HNFE
"Don't get snow in VA Beach!"

Tyler Herrion
Year: Freshman
Major: Communications
"It's fun to roll around in!"

Andrea Dine
Year: Freshman
Major: Animal Science
"It's fun to play in!"

Holland Youngman
Year: Freshman
Major: Wildlife Science
"Fluffy"

Nalani Fraser
Year: Junior
Major: BIT
"Love playing in it!"

Editor's Letter

written by Kate Feild

While I was working at Burger King in Johnson Student Center (no jokes, please, I've heard them all) one Sunday night, I heard one guy say to his friend, something along the lines of: "I am so glad break is over. I can't stand being with my family. They set rules for me. They don't understand me."

Many, if not most, of you are probably nodding your head in assent to this statement. At one point in freshman year, I would agree with you. I was finally independent, out on my own, but I was afraid to go home. I was afraid I was changed, different. I was afraid of the rules. My parents didn't understand me, my brother continued to beat me up even though I was 18 years old. Plus the fact that my dad and I never seemed to get along.

And then, a few months into my freshman year, I was attempting to partition my hard drive and I screwed up. My programs, files, stolen music? Kiss 'em goodbye. I didn't know what to do or who to call. I called home. I took it like a woman, called my dad, and told him that I was dumb and didn't read the directions. I awaited the yelling, the calling of names, the disowning, but I received none. It was fixed.

I never realized how lucky I was, though, until I met my boyfriend. He knows his father, but only through the occasional gifts, phone calls, and/or letters he has received over the years. He doesn't know what it's like to have a father who would coach his basketball or soccer team. He is also an only child. He doesn't know what it's like when your older brother actually lets you hang out with his friends at a Counting Crows concert. On the other hand, he has an amazing mother, who fills both the position as mother and father very completely.

As for not understanding, I think we all forget that parents were our age once too. I know it is difficult to think about, because of the receding hairlines and growingly apparent crow's feet around the eyes, but they once went through pretty much the same thing we are going through. Do you think your parents didn't have hormones or didn't know what marijuana was? Do you think they passed every class they ever attempted? Why don't you ask them? You may be surprised. After all, many, if not most, of our parents were teenagers during the sixties and seventies.

my brother and I... a long time ago.

My dad knows exactly what I am going through because he went to Virginia Tech. In fact, for all you engineers out there, he graduated in 1973 with a bachelor's degree in Industrial Engineering. Trust me, if he can do it, so can you. He knows what it is like to hibernate in your room for days on end due to a class like EF. If you don't believe me, I'll give you his number. He knows what it is like to walk across the drillfield after it just snowed (only when he walked across, there were no pathways).

One thing I have learned through all this is that the reason I argue with my dad is because we are almost exactly alike. He and my mom can predict the next dumb thing I am going to do, which is probably why they set rules for me when I come home. And it is also probably why your parents set rules for you during break, if you go home.

I probably just sound like a daddy's girl telling the world about how great my father is. You know what, though? It took twenty years and, I can honestly tell you, a lot of mistakes, to realize that I have an awesome family. Who would've known that my mom's constant complaints about the post-tornado status of my room would turn out to be sage advice? I have learned that a clean room allows me to study better. If only I had listened before.

Try not to think of what you don't have. Whether you were brought up by two parents, one parent, guardians, step-parents, or even wolves, your family has instilled in you the qualities that make you who you are. Virginia Tech is not an easy school, and yet, here you are, studying and achieving goals that you have set for yourself. In most cases, you have your family to thank for that. Also, in some cases, never forget that you have your family to thank for paying the ever-growing tuition rates to go here.

So say thank you once in awhile. Even if you can't think of anything to thank them for. Call them sometimes. Make an effort to be less hostile. And start listening to what they have to say. If they tell you not to put red socks in with your white wash, there's probably a reason for it. They've probably had their fair share of pink clothes throughout their lives. After all, your family is stuck with you. They didn't pick you just as much as you didn't pick them, so you better appreciate everything they do for you.

Kate Feld

editor-in-chief