Engineers' Forum

Volume 22 • No 3
September 2003

Finding Jack the Ripper

...and many other hidden
secrets of forensic science

Also Inside: Are You As Smart As Einstein?

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Recipe For Expo Success
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Cover Art by Brian McGill

Recipe for Expo Success

written by Kate Feild

You can spend every waking hour watching the TV Food Network, but the recipe I would like to tell you about has nothing to do with sugar, flour, and a pinch of salt, and everything to do with making your future goals within reach of your taste buds.

Ingredients:
One student, medium rare to well done
A pinch of resume to taste
For female recipe:
- One part skirt (pants can be substituted)
- One part suit jacket
- One part blouse (sweater can be substituted)
- Two parts conservative heel
- Top with jewelry to desired taste

For male recipe:
- One part business suit
- Splash of tie to add color
- Two parts conservative shoe

1. Decide what flavor of company you want to taste. This is one of the most important, yet probably the most overlooked, step. Many students probably just think that they can walk up to a recruiter, say, "Hi, I am a <insert concentration here> engineering major," and instantly be handed a $60,000 per year career with great benefits and perhaps a company car. In order to get a job, you should be interested in (or feign interest in) whatever job the company is offering. This leads directly into step two.

2. Find out what companies are attending Expo, and research, research, research. You want to go into a career fair knowing which companies you want to speak with, and perhaps a little something about the company. This step is extremely important if you actually manage to get an interview with the company.

3. Prepare your resume for taste-testing.. By this time, I hope you already have one written. If not, go to the Career Services website (at http://career.vt.edu). It contains plenty of helpful hints and a few examples you can go by. After you're finished writing it, however, make sure you run it by the Career Services Office (walk-in advising is M-F, 11 a.m. to 4 p.m.) and they will help you smooth out your bumps and make sure you sound as palatable to the company as possible.

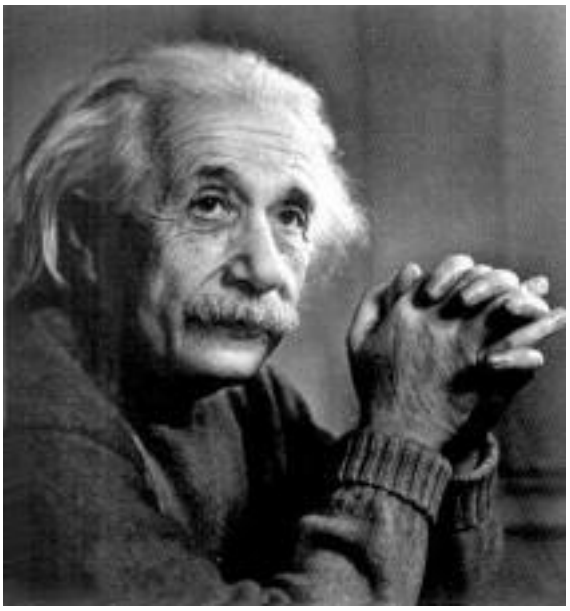
4. Groom yourself for desired effect, and add clothes for good presentation. Business suits are not necessarily required, but make an outstanding effect of recruiters. Remember, your desired outcome from this resume is an interview.

5. To complete your recipe, present to Expo companies with a brief introduction about desired occupation and qualifications. Repeat as desired.

6. Enjoy your success!

You Must Think You're So Smart

written by Frank Sell



Albert Einstein had an I.Q. of 160. The I.Q. of the average human being is between 85 and 114.

The idea that intelligence could be tested originated from 19th century British scientist Sir Francis Galton. His research was sparked in the late 1850s by the publishing of Darwin's The Origin of the Species. Explaining his theory of evolution, this book proved controversial by testing the historical accuracy of the Bible and of Christianity. As a result, Galton spent much of his time trying to find a link between heredity and intelligence.

The common belief at the time was that there were a handful of people with superior intelligence and equally as many inferior people in that respect. The large majority of the population was thought to be of equal, average, intelligence. Any of the "commoners" who were able to succeed could attribute that success to hard work and the will to achieve. Likewise, failure was attributed to lack of hard work.

This explanation did not satisfy Galton, who believed that, like eye color, hair color, birth defects, blood types, and other traits, intelligence was determined by one's chromosomes. The result was his 1869 book, Hereditary Genius, which laid the groundwork for eugenics. Eugenics is the controversial science and study of the progress of the human race by controlled and selective mating. Galton's book is regarded as the first scientific look at the idea of intelligence.

French psychologist Alfred Binet became very impressed with Galton's research. He, like Galton, was also interested in testing human ability. Working with students of varying capabilities, he was able to calculate what could be considered "normal" for children at each age. From his work, he devised a test whose results would help separate average students from those requiring special attention.

German psychologist Wilhelm Stern expanded on Binet's ideas of "mental age" to include a ratio of mental age to actual age. This scoring system is what we refer to today as "intelligence quotient," or IQ. The test, as we know it, takes the ratio of mental age to actual age and multiplies the result by 100. Therefore, a child with a mental age of 10 and an actual age of 8 would have an IQ of 125. Despite the reservations of both Stern and Binet, the Binet test became very popular in America in the early 1900s.

The first real test for the intelligence quotient came in 1917. With America's entrance in World War I, the United states Army was forced with the daunting task of sorting large numbers of draftees for positions. Because the Binet test had been primarily used for testing the abilities of children, the army constructed a committee,

made up of seven psychologists, to come up with a modified intelligence test to be given on a large-scale basis. The result was a test that was given to nearly two million people over the course of the next two years.

After World War I, the purposes of the IQ test expanded to include companies, who would test present and potential employees for job positions and promotions. They were very widely used in the school system as a means for recognizing the educational needs for individual students.
By the late 1960s, the popularity of the IQ test began to decline, as claims of culturally specific questions began to increase. Lawsuits from people who were denied jobs as a result of their performance on the test also began to surface.

Resulting from the studies of these early psychologists are the standardized test given to students today. Many colleges refuse to accept students who do not have a high enough score on their SATs of ACTs. IQ tests are also a popular way for people of all ages to compare their levels of intelligence.

Although there are many different scales of scores for IQ tests, the Stanford-Binet, Wechsler, and Cattell to name a few, it is still possible to get a reasonable estimate of your intelligence quotient without spending too much money. Iqtest.com is one such source. Simply submit your email, be sure to time how long it takes you to finish the test, and you receive your score instantly.

The problem with online IQ testing is that they are notorious for their overestimates. The results that are reported are by no means official, and as with all standardized tests, an official should be consulted for the most accurate results.

Ranges of I.Q. Scores	
085-114	Average
115-124	Above Average
125-134	Gifted
135-144	Highly Gifted
145-164	Genius
165-179	High Genius
180-200	Highest Genius
>200	Immeasurable Genius

Frankenstein's University

written by Kate Feild

Burruss Hall, where a research institution comes alive.

Virginia Tech, in its ongoing struggle to become a top-30 research institution while battling the crippling effects of budget cutting, is restructuring its colleges. One of the main goals of the restructuring movement was to cut down on the number of colleges in the university.

Before the restructuring took place, we had eight colleges: College of Agriculture and Life Sciences, Pamplin College of Business, College of Engineering, College of Arts and Sciences, College of Architecture and Urban Studies, College of Human Resources and Education, College of Veterinary Medicine, and College of Natural Resources. After restructuring, we keep eight colleges; however, some have different names and different departments within them.

Many of the colleges remain relatively the same. The College of Agriculture and Life Science, Pamplin College of Business, the College of Architecture and Urban Studies, the College of Veterinary Medicine, and the College of Natural Resources have minute changes.

The largest changes deal with the College of Human Resources and Education and the College of Arts and Sciences. The main reasoning behind this is the large number of students in the College of Arts and Sciences. Arts and Sciences is now split into two colleges: the College of Liberal Arts and Human Sciences and the college of Sciences. Human Resources and Education has been dissolved, and the College of Liberal Arts and Human Sciences is picking up most of their curriculum.

Inside the College of Liberal Arts and Human Sciences, however, many of the education programs are being cut, or have already been cut. The process of phasing out education began twelve years ago, but the slow process doesn't make the cuts any easier to swallow. The undergraduate education programs will be completely phased out by 2006, allowing those currently in the program to graduate. Education graduate and doctorate classes will still exist, however.

A major change affecting many students in the university regards

the College of Sciences. Due to budget cuts, lack of professors, and lack of clasroom space, General Biology lab sessions have been cut. Many students who are required to take four hours of a science are caught in a bind by this decision, and must instead take another of the natural sciences (chemistry, geology, or physics) in order to fulfill core requirements.

So, what happens to the College of Engineering? In short, almost nothing. Engineering gains the Computer Science Department, which was in the College of Arts and Sciences. Having computer science in an Engineering Department is nothing new. About two-thirds of the colleges and universities across the country have computer science within their respective engineering departments, according to Dean Aref of the College of Engineering.

This fall, as CS majors will note, not much has changed; however, the freshman class of 2004 will be coming in as engineering majors, if they want to pursue a CS degree. According to Dean Aref, it will become tougher to become a CS major, but that will allow for stronger applicants in the future.

The biggest change incoming computer science majors may possibly face is having to take EF (or Engineering Fundamentals), which may be a little intimidating. Although the first semester of EF will stay the same, the College of Engineering may offer a "digital" track of the second semester EF for the benefit of computer science majors. Another change that may occur, according to Dean Aref, is that computer science majors may eventually need more credit hours to graduate. Currently, CS majors need 120 credit hours, but most of the engineering departments require more than that. Both of these changes to CS, however, are tentative.

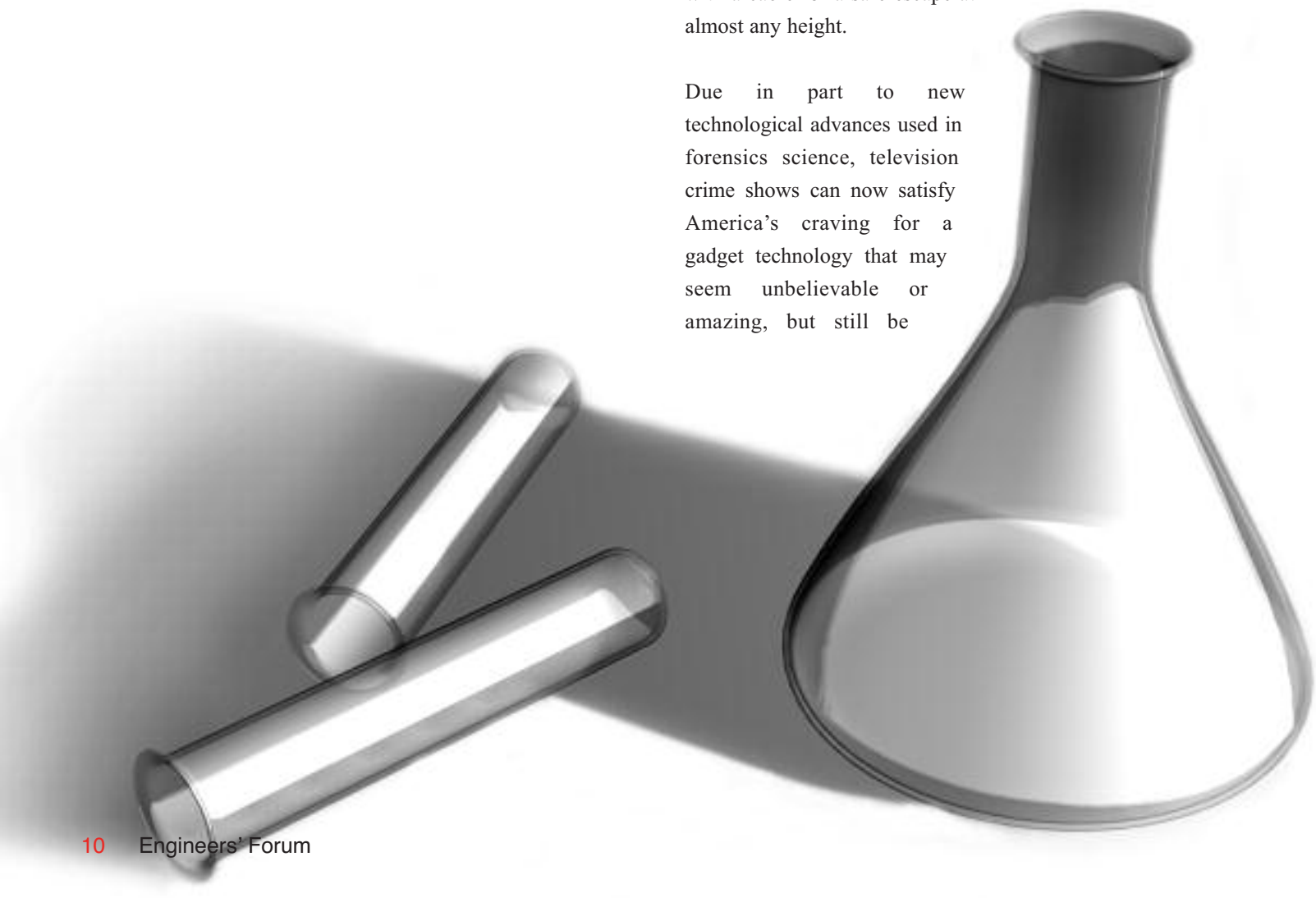
Finding Jack the Ripper

written by Sarah Lewis

One of the most popular themes in television and movies today seems to revolve around crime investigation. High speed car chases and sit-on-the-edge-of-your-seat gun battles, however, don't receive as much attention from T.V. viewers and movie patrons anymore. With crime investigation shows, such as "C.S.I." and its offspring, grabbing the high ratings, it seems that viewers are attracted more to what happens after the crime than the crime itself.

Forensics has become a new outlet of entertainment for American television viewers. One of the main attractions of forensics science satiates America's fascination with high-tech gadgets. In every James Bond movie, the character named Q (and now R), outfits 007 with hot new gadgets, thing-a-ma-bob, and doo-hickeys, from fast cars with torpedoes in the headlights to a belt with a cable for a safe escape at almost any height.

Due in part to new technological advances used in forensics science, television crime shows can now satisfy America's craving for a gadget technology that may seem unbelievable or amazing, but still be



realistic in its props. Thanks to the speed, accuracy, and imagination of modern technology, amazing gadgets and scientific discoveries revolutionize investigative practices from its origins.

The forensics science field changes as fast as the technology it uses. New discoveries appear as fast as a CPU can process or a heart can beat. Who needs James Bond as 007 when forensics scientists can solve a murder with one piece of evidence through DNA profiling, or tell how long a body has been dead by the amount of carbon remaining in the body?

These two examples are only two of the more well-known methods of forensic deduction used today. There are numerous other ways for investigators to find their "perp" through use of computers, chemistry, and "indubitably, my dear Watson", a good dose of Sherlock Holmes' logic.

As the investigation itself suggests, thee remarkable methods of criminal and crime scene investigation are extremely new, yet continuously evolving. The practice almost seems to come alive in its own right, living and growing with the world around it.

Early uses of Forensic Science

The first documented use of forensics was dated 3000 years ago in ancient China. The early Chinese investigators examined the unique shapes of fingerprints to locate and distinguish their quarry, according to Thomas T. Noguchi in David Owen's "Hidden Evidence: Forty True Crimes and How Forensic Science Helped Solve Them."

During the ancient, medieval, Renaissance, and colonial periods, several discoveries were made on the scientific front that aided in the study of forensics. For example, in 1590, Zacharias Jansen constructed the first microscope. This microscope had the capacity to magnify an object up to ten times its original size. This discovery was followed by a microscope made with a more precisely ground lens that could magnify up to three-hundred times, followed by one that magnified by two-thousand times by the late 1800s.

Another important scientific advancement that would revolutionize forensic science was the photograph. Johann Heinrich Schultze, a German inventor, realized the properties of photographic film. The process was refined by a French army officer, Joseph Nicephore Niepce, who succeeded in creating a permanent image of the subject being photographed in his daguerreotype. A daguerreotype was a process which created an image on an area of copper which had a thin layer of silver over it. The technology became further refined with the invention of the negative, then wet plate, and finally dry plate photography, which made taking a photograph cheaper, easier, and duplicable.

Another well-used form of investigation developed in 1835, when Henry Goddard matched a bullet to the gun that had fired it. He discovered a similar defect in the bullet mold as well as the bullet, which matched up to the prime suspect… <insert eery music here> the butler! The practice continued to improve as bullets became mass-produced. Once the ammunition was more precise and consistent, investigators matched the rifling grooves on the bullet to the gun to find a match.

This practice was first discovered in 1889. Twenty years earlier, however, a fatal shot was traced, by a French investigator, to the matching weapon, through chemical analysis of the bullet compared to others belonging to the top suspect. This useful technique continues to be developed and fine-tuned at the Bureau of Forensic Ballistics, founded in 1923.

One of the less-respected practices in crime investigation of the 1800s involved face shape, cranial bumps, and measurements. Of the three, the measurement technique, developed by Alphonse Bertillon, proved the be the most reliable because it could match descriptions of criminals to criminals already measured using Alphonse Bertillon's process, known as "Bertillonage."

Cesare Lombroso began a study that found that all criminals tended to possess specific features, such as a narrow field of vision, large hands, wide jaws, high cheek bones, large square-shaped ears, and long arms. He developed this theory by studying over 6000 criminals. His findings, however, are more likely attributed to the genetically common features of people in Northern Italy, where he conducted his research.

One of the earliest and most well-known modern investigations involved a typical murder scene that has found fame in novels, movies, and the human imagination: a dark alleyway and a murdered prostitute, the distinctive trademark of Jack the Ripper in London's East End.

This case baffled the London Scotland Yard during the late 1880s and ended one fatal night in 1888 with the horrific death of Mary Jane Kelly. This case remains unsolved today and continues to

an early daguerrotype, used for forensic investigation

invite a following of curious investigators, both professional and amateur, today. This unanswered mystery is a tribute to the limitations of the forensic investigative process.

These limitations, however, shrink as technology grows. Unfortunately, as precision grows, the measurement and examination of clues becomes fine tuned and easily subject to human error or tampering.

Determining Time of Death

Some of the more modern investigative techniques that help examiners to determine time and cause of death, include changes in body temperature, muscle stiffness, coloration, blood type, DNA, semen, and microbes found in the body. Using these methods, investigators can more accurately and conclusively solve a crime. Different causes and times of death alter certain constants found in the body, as well as items found around the crime scene.

Time of death may be found through several methods. First, after death, the internal temperature drops by increments directly related to time. Second, coloration changes due to different toxins in the blood. For example, a cyanide poisoning may be recognized by a red hue in the skin. Additionally, when a body is found in water, the amount of microbes measured inside allows an investigator to determine if the victim was alive or dead when the body entered the water.

DNA Analysis

One of the newest and most conclusive pieces of evidence gathered today is DNA. A person's DNA, left at a crime scene, cannot just be wiped clean like a fingerprint. Forensic scientists can then begin the process of attempting to match the DNA recovered to that of the victim of the suspect. This process, however, contains inherent problems. Due to the sensitivity of the physical evidence, it is prone to human error, as well as manipulation. DNA testing is extremely conclusive, but it is not the absolute solution to a crime. There are always other factors to consider. On the other hand, several inmates on death row have applies for appeals using DNA evidence and been found to have been falsely accused.

One method of DNA examination divides a sample of DNA into different lengths by an enzyme using RFLP (Restriction Fragment Length Polymorphism). The DNA strands divide into different lengths depending on the presences or absences of certain components to the sequence. Of the DNA analyzing methods, this is the oldest and does not find as much use now, as more accurate and less temperamental methods have been developed.

Another method, PRC Analysis (Polymerase chain Reaction) involves using a small and/or degraded sample of DNA to manufacture a larger amount with exact copies. This process, however, also has its limitations. The scientists using this technique must be extremely careful not to mix the specimen with other biological contaminants prior to the process.

STR Analysis (Short Tandem Repeat) analyzes specific parts of the DNA sequence and matches one profile to another. The FBI uses this technique cross-linked with the CODIS national database of convicted criminal offenders to find matches using a set of 13 standard parts of the sequence. This method, is performed correctly, has only a one in one billion chance of matching two criminals with the same code.

Mitochondrial DNA Analysis works on samples that cannot be examined otherwise. The DNA needed is extracted from the mitochondria of a cell. Frequently, bones, hair, and teeth serve as contributors for this process. Old cases may be solved through this method if the trail has gone cold otherwise. Additionally, mothers and daughters share the same Mitochondrial DNA; because of this, the mtDNA approach is often useful in missing persons cases and identification.

Other Uses of Forensic Science

Forensic methods are not only used in murder or robbery cases. It is also used for corporate, computer, and technology crimes. Computers today are an easy tool to exploit an entirely new medium or a new route to old exploits. When computers come under examination, investigators look for any signs of file tampering, employee profiles, or any other file or information that would support legal action.

Crimes using computers are more prevalent today and cover a broad range of criminal activity. They can be a medium for sexual harassment, copyright infringement, invasion of financial privacy, or trade secret theft. Computer investigation includes examination into computer virus and worm origins.

The most recent attack of the blaster worm in August of 2003, shut down government agencies and over 250000 computers worldwide, according to Brian Krebs, a Washington Post reporter. The worm caused the Federal Reserve branch of Atlanta to shut down most of their computers. The nature of these programs make it extremely difficult to track its origins because the path starts over at each new site of infection. The FBI is currently investigating the attack.

As technology improves, it enhances our world; however, as each new technology emerges, someone finds a way to exploit it to his or her advantage, using inherent weaknesses. Because of this, investigators must continually keep up-to-date with technology. The field of forensics has changed dramatically over the years. However, old forensic methods continue to be used in conjunction with, or as improved versions of, many of the same methods used by investigators in the past.

E-Mail Bag

Why Engineers Don't write Recipes

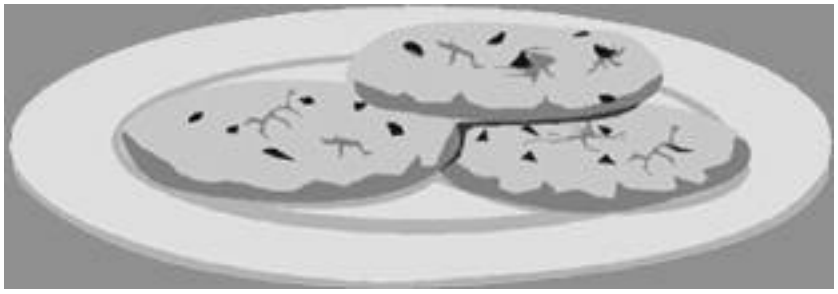
Chocolate Chip Cookies:

Ingredients:

1. 532.35 cm3 gluten
2. 4.9 cm3 NaHCO3
3. 4.9 cm3 refined halite
4. 236.6 cm3 partially hydrogenated tallow triglyceride
5. 177.45 cm3 crystalline C12H22O11
6. 177.45 cm3 unrefined C12H22O11
7. 4.9 cm3 methyl ether of protocatechuic aldehyde
8. Two calcium carbonate-encapsulated avian albumen-coated protein
9. 473.2 cm3 theobroma cacao
10. 236.6 cm3 de-encapsulated legume meats (sieve size #10)

To a 2-L jacketed round reactor vessel (reactor #1) with an overall heat transfer coefficient of about 100 Btu/F-ft2-hr, add ingredients one, two and three with constant agitation. In a second 2-L reactor vessel with a radial flow impeller operating at 100 rpm, add ingredients four, five, six, and seven until the mixture is homogenous. To reactor #2, add ingredient eight, followed by three equal volumes of the homogenous mixture in reactor #1. Additionally, add ingredient nine and ten slowly, with constant agitation. Care must be taken at this point in the reaction to control any temperature rise that may be the result of an exothermic reaction.

Using a screw extrude attached to a #4 nodulizer, place the mixture piece-meal on a 316SS sheet (300 x 600 mm). Heat in a 460K oven for a period of time that is in agreement with Frank & Johnston's first order rate expression (see JACOS, 21, 55), or until golden brown. Once the reaction is complete, place the sheet on a 25C heat-transfer table, allowing the product to come to equilibrium.



There are four engineers travelling in a car; a mechanical engineer, a chemical engineer, an electrical engineer and a Microsoft Windows computer engineer. The car breaks down.

"Sounds to me as if the pistons have seized. have to strip down the engine before we can get the car working again", says the mechanical engineer.

"Well", says the chemical engineer, "it sounded to me as if the fuel might be contaminated. I think we should clear out the fuel system."

"I thought it might be a grounding problem", says the electrical engineer, "or maybe a faulty plug lead."

They all turn to the Computer Engineer who has said nothing and say, "Well, what do you think?"

"Ummm - perhaps if we all get out of the car and get back in again?" says the computer engineer.

A Hokie at Heart

An ongoing photo spread, we find students around campus fitting a certain theme for each issue. The first half of this journey asked students the following question:

Q: What is the significance of the tee shirt?

(clockwise from the left)

Mike Fanelli
Major: ISE, *Year:* Senior
Duke? My sister went there.

Andrew Ball
Major: CS/Math, *Year:* Junior
JMU? Considered going there, but little significance overall.

Kelly Demayo
Major: Marketing, Year: Junior
Harvard? Roommate got it when she visited Harvard.

Rebecca Rieman
Major: Business, *Year:* Sophmore
Georgetown? Parents graduated from Georgetown.

Erin Anderson
Major: English, *Year:* Junior
Longwood? Went there last year and needs to do laundry.

Todd Thomasson (playing tennis)
Major: Landscape and Turf Managment *Year:* Sophmore
A: Women
David Hart (playing tennis)
Major: Landscape and Turf Managment Year: Sophmore
A: Women

Greg Longstaff
Major: AOE Year: Sophmore
A: Being able to throw ball

Garrett Bredenkamp (with the dog)
Major: ISE, *Year:* Sophmore
*A: F*ootball (playing with dog)

Byron Baptist (with the dog)
Major: Biology, Year: Junior
A: Sailing

Maggie Beal (on bench)
Major: Ag Econ, Year: Junior
A: Break from campus life
Mary Hendricks (on bench)
Major: Photography/Graphics
Year: Senior
A: So nice out

Matthew Shivickas (see-saw)
Major: GE, *Year:* Junior
A: it's fun being outside
Minh Le (see-saw)
Major: BIT, *Year:* Junior
A: everyone's active "young and productive"

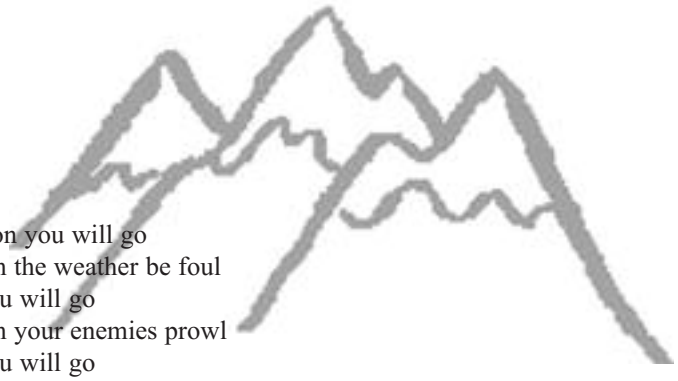
Summer Fun

Fror the next setion we asked students:

Q: What do you like best about being able to be outside?

Editor's Letter

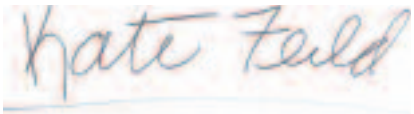
written by Kate Feild



Now that the school year has begun again, and those graduating in the spring (or even in December) are searching exhaustively for jobs (or internships or co-ops), students look back through their years (as many or few as they have), at Virginia Tech, and they find out one thing: whether or not they lack any determination. How? It normally depends on how much of your resume you have to "exaggerate."

It is times like these where we should all take a step back and look at what we have accomplished (or not accomplished) over our college years. Have you wanted to study abroad but never thought you could? All you need is a healthy dose of determination. Wanted to join the Engineers' Forum? You just need a little determination (and to e-mail forum@vt.edu). Please disregard my shameless self-promotion. It's merely an example of my unending determination! Have you wanted to get straight A's? A spoonful of determination (and a few sleepless nights) can help you accomplish this goal.

I'd like to take this opportunity to quote Dr. Seuss, a man of brilliance and determination, and the writer of "Green Eggs and Ham."



editor-in-chief

"But on you will go
though the weather be foul
On you will go
though your enemies prowl
On you will go
though the Hakken-Kraks howl
Onward up many
a frightening creek,
though your arms may get sore
and your sneakers may leak.

On and on you will hike
and I know you'll hike far
and face up to your problems
whatever they are.

You'll get mixed up, of course,
as you already know.
You'll get mixed up
with many strange birds as you go.
So be sure when you step.
Step with care and great tact
and remember that Life's
a Great Balancing Act.
Just never forget to be dexterous and deft.
And never mix up your right foot with your left.

And will you succeed?
Yes! You will, indeed!
(98 and 3 / 4 percent guaranteed.)

KID, YOU'LL MOVE MOUNTAINS!

So...
be your name Buxbaum or Bixby or Bray
or Mordecai Ali Van Allen O'Shea,
you're off to Great Places!
Today is your day!
Your mountain is waiting.
So...get on your way!"
- Dr. Seuss, "Oh, the Places You'll Go"

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Michelin

would be out of business. Instead, we

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we build. We push the limits.

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- **Mechanical Project Engineer**
- **Electrical Project Engineer**
- **Tire Research and Development Engineer**
- **Reliability Engineer**

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