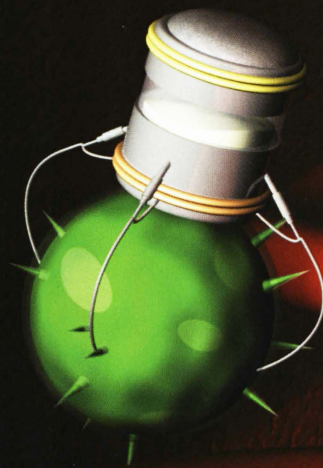




# Engineers' Forum

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## **NanoTechnology** and the Quest for Immortality

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Brian McGill  
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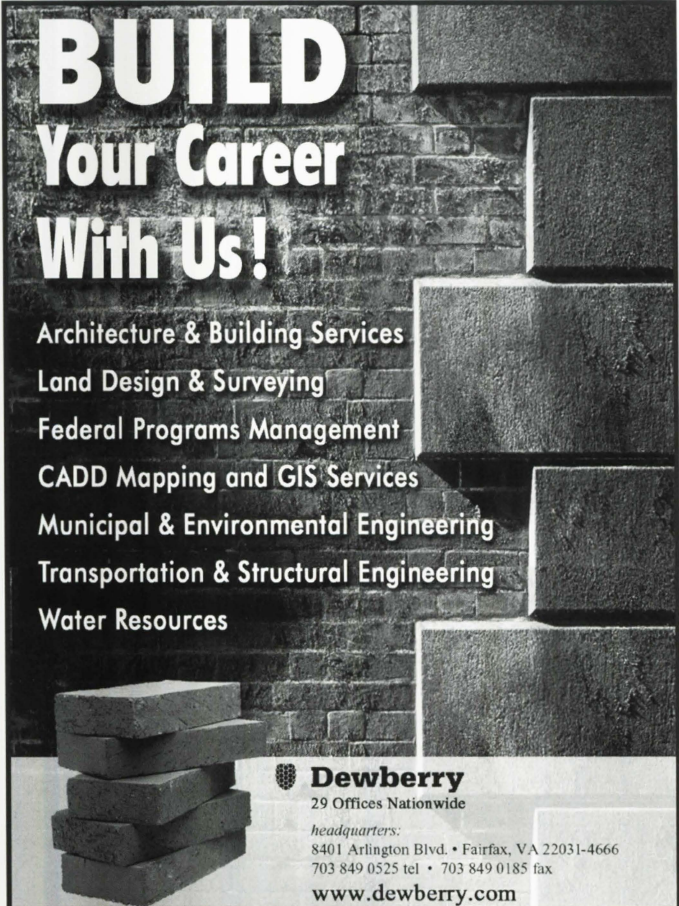
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223 Femoyer Hall  
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Email: [forum@vt.edu](mailto:forum@vt.edu)  
URL: <http://fbox.vt.edu/eng/forum>

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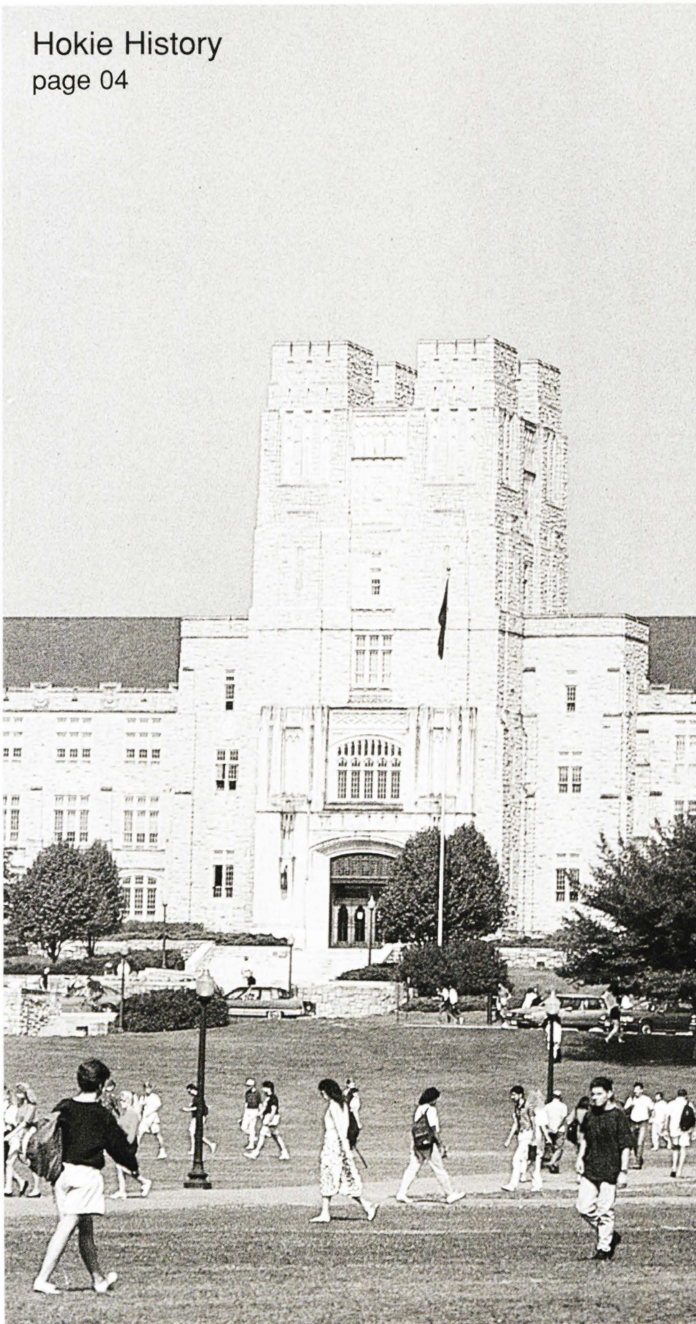
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*Cover Art: Conceptual image of a nanobot for medical use  
by Brian McGill*

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One thing that has remained constant throughout Virginia Tech history is that orange and maroon have always matched!  
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# Hokie History

written by Sarah Lewis

Nestled in Virginia's Appalachian mountains, Virginia Polytechnic Institute and State University, colloquially referred to as Tech, Va Tech, or VPI, boasts one of the leading engineering schools of the country. Today, Tech ranks number 10 for accredited public universities, according to The U.S. News and World Report survey "America's Best Colleges 2003".

To be held in such high esteem, the school has gone through many years of change and development. Virginia Tech was originally founded as the Virginia Agricultural and Mechanical College, as a land grant school, in 1872, offering its students degrees in Architecture, Agriculture, and Engineering. As printed in the course catalogue of 1872, students could enter departments of Agriculture, Ancient Languages, Chemistry, English and Literature, Geology, Mathematics, Mineralogy, Mechanical, Modern Languages, Moral Philosophy, Natural Philosophy, and Zoology.

Within the Mechanical Department, students could study drafting, machinery, mechanical engineering, and steam engines. From this starting point, the College of Engineering developed into what it is today with a plethora of choices just within the College of Engineering, such as: Aerospace and Ocean, Biological Systems, Chemical, Civil and Environmental, the newly

added Computer Science, Electrical and Computer, Engineering Science and Mechanics, Industrial and Systems, Materials Science, Mechanical, and Mining and Minerals, Engineering. Only after decades of change did the Tech College of Engineering evolve into what it is today. Not until 1932 did Tech form the Department of Engineering Science and Mechanics, according to Dan Pletta in *Memoirs of the First Forty Years*.

When Tech first opened in 1872, it was not divided into the different schools or colleges that compose it today. Thirty-one years later, in 1903, four deans were appointed to each of the four academic departments: Academic, Agriculture, Engineering, and Scientific. The same year, Ellison A. Smiyth became the original Dean of the Faculty. At the time, however, this position equated to an administrative position of Vice President for Academic Affairs.

Extracurricular opportunities for students of engineering, as well as other majors, have also changed since Tech opened. One of the main differences, though it still remains an integral part of the school and its character, is the Corps of Cadets. It was not until after World War I that the number of civilians on campus outnumbered the cadets. Some of the other original student organizations as listed in the 1872-1972 Historical Data Book, include: the Debate and Literary Society (1872), Pi Kappa Alpha (1873), publication of The Gray Jacket (1875), Engineering Club

***“Through the years, one constant that remains true, engineers are proud to call themselves Hokies”***

*Continued on page 08*

# Netherweb

written by Kate Feild

A hot web hosting company, called Netherweb, has been slowly attempting to make its mark on the online community over the past five years. And, one of its founders is throwing off the curve in my Advanced Business Computing and Applications class.

If you delve into Netherweb's website (<http://www.netherweb.com>), you may never have guessed that two of the three founders, Ben Congleton and Kevin Ferguson, are Virginia Tech students. The other founder, Roland Osbourne, attends UVA. (I am doing my best not to make any UVA jokes)

Netherweb is actually a child company to a bigger, "umbrella" corporation known as Nethernet. Nethernet includes such "children" as Netherweb, Nethersoft, which offers web development, and Nethernic, which offers domain name registration services.

## Hosting Plans

Netherweb offers, according to the website, "managed hosting solutions" and offers web hosting plans for anyone from the webpage beginner to full-fledged e-commerce businesses.

For those of us who use the web as a veritable "global soapbox," where we rant and rave about everything from politics to the best 80s cartoon, Netherweb's Entry Plan is for you. Instead of going with other free sites, such as Angelfire or FreeWebz, which offer about 20 to 30 MB of space but have multiple pop-up ads, an entry-level price of \$4.95 per month with Netherweb will provide

you with 50 MB of space and your own domain name, completely pop-up free!

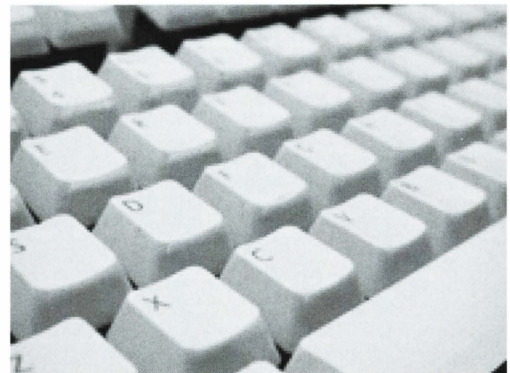
E-Commerce entrepreneurs can utilize the functionality of the Commerce Plan, which includes 250 MB of space, 100 e-mail aliases, as well as an integrated storefront, PHP and CGI support, and your own Mysql database, for only \$24.95 per month.

There are also a variety of other plans to choose from, depending on the individual needs of the customer.

## Support

Netherweb has plans catered to pretty much everyone's needs and budget, but can they

deliver on service? If a server collapses or for some reason your FTP site won't work, will the Netherweb founders and employees be conveniently out of the office?



*make your keyboard a global soapbox with Netherweb*

*Continued on page 08*

# The Quest for Immortality

written by Sunny Chang



Damage, destruction, and death: three stages through which all human beings, all living organisms, all cellular structures, eventually undergo. When it comes down to it, humans ultimately die because of cell degradation and the loss of control of cellular reproduction. The body cannot sustain life after it is unable to endure the multitude of internal and external skirmishes bombarding it on a daily basis. What if an army of assistance could be created to help repair dilapidated cells, target disease enhancing agents, and deliver medicine to localized areas of injury? What if this army is well on its way of being developed? The advent of this technology would be phenomenal. It would be revolutionary. It would be immortalizing.

The agency of immortality is nanotechnology, which is the study of physical operations of nanoparticle and nanostructure entities at a range of 1-100 nanometers (nm). Nanotechnology involves the collaboration of solitary studies, such as biology, chemistry, computer science, electronics, aerospace, and medicine. Nanotechnology researches the capability of building structures out of individual molecules. The structures can be created on such a precise level that the engineering has complete positional control over each molecule when the construction is complete. This concept, which considers refurbishing and maintaining human bodies at the cellular level, was first formulated by Eric Drexler in 1986, described in his book, *Engines of Creation*.

## Obstacles to Nanotechnology

In order to achieve the creation of nanomachines and nanostructures, the following obstacles must be cleared, paving the way for efficient manufacturing and integration into common scientific procedures:

- 1) Raw material must be produced at nanoscale
- 2) Materials must then be processed into required components at nanoscale
- 3) Processed components must be interconnected with molecular structures
- 4) Interface the system components with a macro environment for control
- 5) Create the capability of controlling a massive collection of unnatural parts and systems in a biological environment

## Breakthroughs in Nanotechnology

Research has been making breakthroughs in order to accomplish the first step, isolating and gathering raw materials at nanoscale. Molecular surgery, a procedure known for molecular manipulation and modification using microtechnology, is utilized to target immobilized DNA. Molecular surgery has paved the path for micromachining, electrostatic manipulation, laser tweezers, micropositioning, scanning probe microscopy, molecular building patterns, and visual technology like fluorescent microscopy. Advances in molecular science result from discovering several ways to isolate specific positions on unraveled DNA molecules.

The conventional practice of isolating DNA involved treating broken-down molecules in a solution; however, the end result was that one could not specify a particular molecule section from superfluous material. Only unidentifiable strands of DNA could be recovered. The newer refineries make the conventional process look archaic.

In molecular surgery, scientists first immobilize DNA using a high frequency electrostatic field created in a micro fabricated structure. Then, a few different methods can be implemented.

One method uses a laser mechanical stylus, which is an enzyme immobilized probe that cuts stretched DNA at targeted positions. The outcome proves that characteristics of enzymes are maintained when both the batch enzyme and target molecule are immobilized. This makes it easy to compare, identify, and record pinpoint locations on the strand.

Another method involves laser surgery. This practice calls for irradiation from a focused

ultraviolet laser. The laser then cuts at a position unique to an N2 laser (337 nm UV, 100 nm J / shot). The cut the laser makes has a precision of 1  $\mu\text{m}$  when measuring the diameter. This pinpoint cutting produces a consistent and unique section of DNA making it readily identifiable.

Microsurgery can also be achieved with the use of high resolution dissection by employing an Atomic Force Microscopy (AFM) tip. It operates by pressing the sharp stylus against stretched and positioned DNA. It is the most precise in cutting and locating, provided that the position on the DNA is already branded.

Research regarding the harnessing of molecules is even being conducted in the Virginia Tech Chemical Engineering Department in collaboration with the Center for Biomedical Engineering. Dr. Kevin E. Van Cott, an Assistant Professor of Chemical Engineering, is currently researching a new design for the water-soluble block copolymer that aids in differentiating between organic and inorganic particles with diameters of 5nm – 10 microns. This water-soluble block is being designed and

synthesized to absorb specific particles, allowing easy separation. Dr. Van Cott is working together with Dr. Rick Davis from the Department of Chemical Engineering and Dr. William Ducker from the Department of Chemistry in the School of Science.

## Nanomedicine

If chemical engineering advances as an integrated science because of nanotechnology, then other fields will as well, particularly medical science. The transition from nanotechnology to medicine is known as nanomedicine, possessing the premise of improving therapy and diagnostic skills. Currently, modern medicine is unable to use external devices to contain Programmed Cell Death (PCD). In order to prevent this occurrence, nanomedicine focuses on the creation of molecular devices to carry out artificial healing processes with the assistance of nanorobots, also known as nanobots. The medical machinery would serve as molecular sized vehicles which deliver drugs in localized areas to bind or target a damaged area. Nanobots can also be used as therapeutic agents, detectors of early disease, and repairers of metabolic or genetic defects. As homing devices, they could also be able to seek out and pursue cancer cells or invading viruses within the body.

The theory of manufacturing microscopic machinery may sound unreal, but many research facilities are finding the truth is far from it. In fact, the concept of building nanomachines was also coined by Drexler in *Engines of Creation*. Many researchers have envisioned nanomachines and are creating innovations towards manufacturing them a possibility. The first obstacle to conquer is targeting specific cellular structures for precise drug deliveries. Imagine the effectiveness and possibilities of drugs contained in various sized nanoparticles.

## Current Nanomedicine Research

Advectus Life Sciences, using technology licensed from NanoPharm AG, has proven that nanoparticle-stabilized doxorubicin has the ability to cross the blood-brain barrier in order to treat glioblastoma, one of the most common and aggressive brain tumors. Nanoparticle-based gene therapy is currently being developed at Copernicus Therapeutics in phase I of clinical trials. American Pharmaceutical Partners is testing stabilized nanoparticles to detect metastatic breast cancer. They are in phase III of clinical trials. A calcium phosphate based nanoparticle platform contained in eye drops has been created to

***“With the elimination of detrimental substances and restoration of virtually every cell in the body, who is going to fear death?”***

treat glaucoma. The administration of oral insulin and the augmentation of vaccines have all been developed by BioSante Pharmaceutical Partners. Through Smith and Nephew, NUCREST is currently releasing Silcrest, made from nanocrystalline silver, which is used as a burn and wound dressing.

There are already several products that have received FDA approval. Among the products, there is Estrasorb, a cream that delivers nanoparticle based ethanol soluble drugs to treat hot flashes. Another approval is for VITOSS, a scaffold for bone growth used in orthopaedic surgery. These recent developments are a small fraction of the products and research that is currently flourishing.

One problem acknowledged is the fact that even at the smallest measurements, artificially created materials cannot come close to nanoscale. The only way to combat the issue is to focus on using organic molecules, like carbon nanotubes, to create the required equipment. In essence, a molecular computer must be created by generating wires, switches, transistors and logic circuits out of molecules.

Accomplishments have already been produced, making available another component of the nanobot. In 2001, Doctor Weiss and Doctor Tour's team became the first to demonstrate that a single molecule could serve as a function switch, enabling it to perform as an on/off switch with the use of phenylene ethylene oligomers, as fast curing, hard forming, solvent-resistant film, in a matrix. The rate of switching on and off can be controlled by the composition of the matrix itself. Once the on/off switch is created, devices with similar operations need to be linked together with wires forming circuits. Hewlett-Packard (HP) received a patent for a process which wires devices together using markers that route signals to each individual device. HP intends on creating circuitry with wires made from molecules rather than semiconductors, replacing the need for silicone.

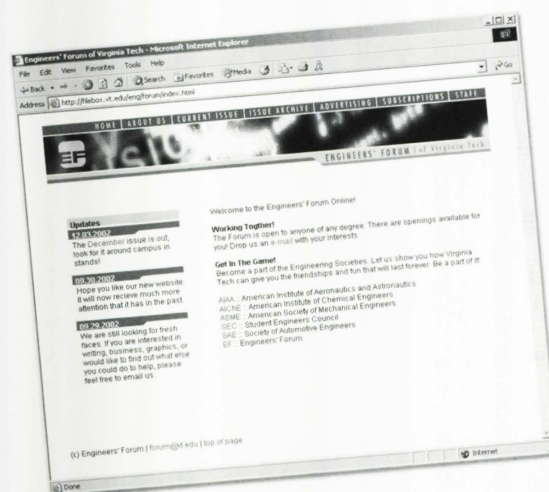
The California NanoSystems Institute at UCLA has another approach where wires will be created using carbon nanotubes to generate circuits. This connects the nanotubes with molecular switches on a grid, very similar to lithographic wires. IBM conducted experiments using carbon nanotubes to operate as a voltage inverter so electronic pulse will register on as '0' and off as '1' and vice versa. An organic transistor has also been created by Bell Laboratories using a single-molecule channel where

transistors act to conduct electronic signals and serve as switches. This type of molecular transistor was created to be a voltage inverter. The components of molecular machines are assembling and a molecular computer is shaping.

The fast pace expansion of nanotechnology has both biological and mechanical influences (as well as everything in between) speeding down a parallel track that will revolutionize every aspect of sustaining human life. Once these medical marvels and speculations cross the boundary into actualizations, carcinogen will be stopped before there is even a chance to reach the body, stunted growth and below average heights will not be concern of elementary school classrooms anymore, and terrible side effects of medicine and physical pain will never need to be acknowledged again. With the elimination of detrimental substances and restoration of virtually every cell in the body; who is going to fear death? The symbiotic relationship between man and machine will be elevated to a new level: one that produces a body that cannot be destroyed, one that encompasses immortality.



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and more!



# E-Mail Bag

## Physics a la Hamlet

(found in the October, 1953 edition of the *Virginia Tech Engineer*)

Oh, that this too, too solid text would melt,  
Thaw, resolve itself into some sense!  
Or that tomorrows problems had been begun  
E'en two days ago! O log; Root!  
How weary, stale, useless, and unprofitable  
Seem to me all the uses of this theorem!  
No erg? Ah dyne! Tis' an unworked problem  
That must be done; things odd and unscientific  
Possess it surely That it should come out thus!  
Eight places off; nay, not so many, not eight:  
So ridiculous a method; that was, to this,  
No Hyperion to the calculus: so loving to poor Prof  
That it should not betem the winds of heaven  
To allow discrepancy here! Volt, Amp and Chem!  
Must I remember? How on Newton he did hang  
As if increase of appetite had grown  
By apples it fed on; and yet, within a joule –  
Let me think not on't! – Frailty, they name is apparatus!  
A little month, or ere those weights were loaded  
Which we used on the inclined plane  
Like physicists, all confused – why, he, even he-  
O ether! A solid substance that wants of subliming  
Would have fumed longer – married with precedent  
He did repeat; give me another "D".  
My warped slide rule! That two trysts and e'en  
Should effect my probation. A plague upon him!  
A shunt would dynamo that wants discourse  
Of alternation would have been fairer!  
The metaphysics of alchemy is preposterous!  
Lead is not, nor cannot come to gold.  
But break my car, for I must hold my co-ed.

## Short Jokes

(taken from the December, 1955 *Virginia Tech Engineer*)

Girl: "My dad is an engineer. He takes things apart to see why they won't go."

Guy: "So?"

Girl: "So, you better go."

\*\*\*\*\*

God made a machine, the machine made men.  
Doctors, lawyers, priests, and then  
The devil got in and stripped all the gears  
And turned out the first batch of ENGINEERS.

\*\*\*\*\*

A person who claims absolute zero isn't possible hasn't taken a Physics test yet.

\*\*\*\*\*

"Professor," said the engineer in search of knowledge, "will you try to explain to me the theory of limits?"

"Well," said the professor, "assume that you have called on a pretty girl. You are seated at one end of the couch and she is seated at the other. You move halfway toward her. Then you move half of the remaining distance to her. Again you reduce the distance between her and yourself by 50%. Continue this for some time. Theoretically, you will never reach the girl. On the other hand, you will soon get close enough to her for all practical purposes."

*Hokie History - continued from page 02*

(1893), Corps of Cadets Student Government (1809), the Phi Kappa Phi Honor Society (1921). In the 1930s, the Virginia Tech Engineer was formed as a predecessor to the Engineers' Forum. The Engineer's Forum did not begin until the late 1970s.

One constant through out most of Tech's history is the tradition of football. Originally, Tech's primary rival was Virginia Military Institute (VMI). Up until the middle of the 1900s Cadets would ride the Huckleberry train to the game. Once Tech outgrew VMI's football talents, the University of Virginia (UVA) posed a new threat. Today, Tech students enjoy the Commonwealth Cup, the traditional Thanksgiving weekend game between Tech and UVA, the Hokies vs. the Wahoos. However, the first football game did not occur until 1892. Since then, however, it represents a large part of the school spirit and Identity.

Through the years, one constant that remains true, engineers are proud to call themselves Hokies and everything that comes with it. Whether men or women, corps or civilian, athlete or academic, we will scoff at anyone who says the Hokie bird is just a turkey or that burnt orange and chicago maroon do not match. It took 132 years to make Virginia Polytechnic Institute and State University into what it is today. In the end, it is the students who make it what it is. It is a source of pride to be an Engineer, or any other major, at Virginia Tech.

*Netherweb- continued from page 03*

The answer, in a word, is no. First, Netherweb's office is at the Corporate Research Center, so if you are having problems, you can always just walk over and yell at them in person. Second, you can bug them on instant messenger if you really want to. (In fact, Ben's screenname is Netherweb, so feel free to bother him. And tell him I sent you.)

**The Founders**

Even though they have their own business, the founders still make time for school, as well as other activities. Ben is Public Relations Chair for Beta Gamma Sigma, a business honor fraternity, and a volunteer for Circle K. Kevin is going to Prague for the International Collegiate Programming Contest for the Association of Computing Machinery (ACM). Roland plays in a band, called Paperface (check them out at <http://www.paperfacemusic.com/>).

Even though one of Netherweb's employees jokes that if you are thinking of starting your own business, don't, I'm sure Netherweb's customers are glad that these students took time out of their studies to create an innovative webhosting company that will be sure to impress even the harshest critics far into the future.



## Want to be our next guinea pig?

Join the  
Engineers' Forum  
staff! It won't hurt,  
I promise!



Note: no guinea pigs were  
injured during production  
of this magazine. We  
promote guinea pig  
awareness.

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[forum@vt.edu](mailto:forum@vt.edu)

Engineers often complain about being forced to take English classes as freshmen at Virginia Tech. Yet, every year, the same thing is said by recruiters: we need engineers who can write! This editorial is to answer all those who charge that...

# English is a waste of time!

written by Kate Feild

Ralph Waldo Emerson once said, "Language is a city to the building of which every human being brought a stone." That seems reasonable when printed on 80# high glossy paper in a twelve page magazine you only picked up because you were bored out of your mind, but what does that really mean for you?

We've all been told at one point or another that English skills were important to recruiters. However, this isn't something new that recruiters have just begun to bring up. In the October, 1957, issue of the Virginia Tech Engineer, recent engineering college graduates who began work at General Electric completed a survey of the most valuable college courses to their career. The second most valuable was English. (The first was mathematics, and the third was engineering) If English is so important to recruiters and to our future careers, and has been since even before 1957, why haven't we learned anything?

English is the building block of our society, and yet the engineering curriculum does not put as much emphasis on it as they probably should. Just because you can make a component means nothing to a company unless you can tell someone (most likely someone not involved with engineering) what the component is and how to use it.

Think of language as Emerson did. Language is your building, and it is your duty, as engineers, to put the blocks together to make a building that fits the design that you want and is also structurally sound. Too bad you can't put this into CAD, isn't it? Why is it that some engineers don't like English anyway?

English is a powerful tool which, when used properly, can not only get you an interview for the job you really want, but can help to persuade the unsuspecting Human Resources personnel that you are the right person to fit that position. It's not manipulation! It's English!

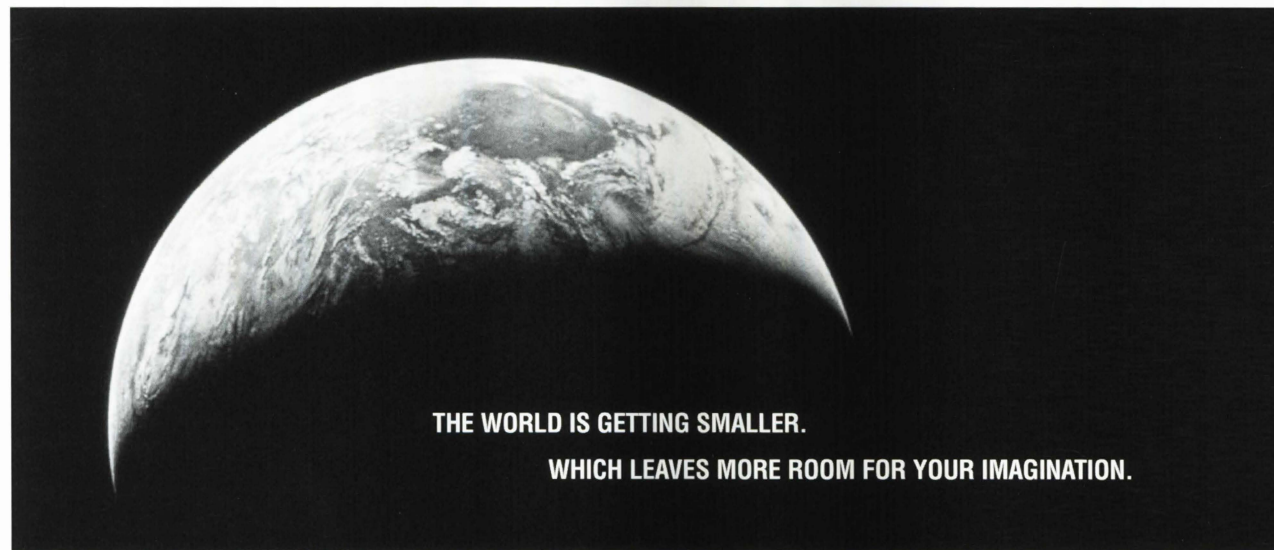
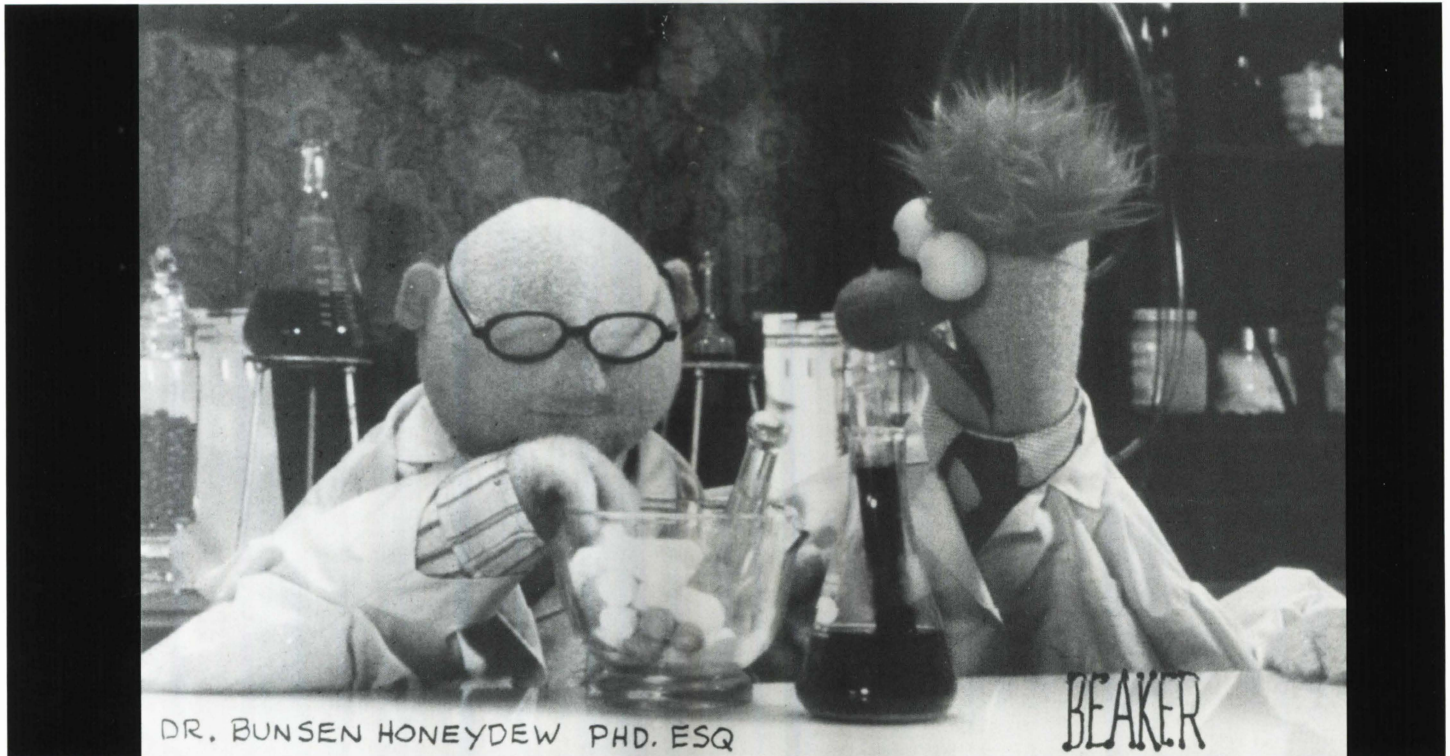
On a side note, I hope your finals aren't hurting you too bad, and have a wonderful Christmas and an excellent New Year!!

Kate Feild



# Do strange, bubbling concoctions interest you? Join the Forum!

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