

SPECTRUM

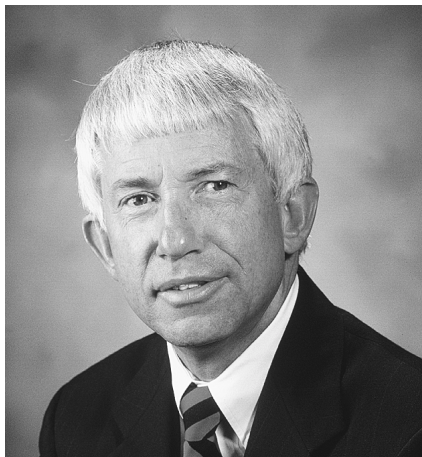


VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

<http://www.unirel.vt.edu/spectrum/>

VOLUME 24 NUMBER 12 FRIDAY, NOVEMBER 16, 2001

TODAY'S EDITION
See page 4 for
information on
university research.



SMOOT

Smoot to focus on business responsibilities

By Larry Hincker

President Charles Steger and Vice President Minnis Ridenour have announced a shift in responsibilities for Vice President Raymond Smoot.

Smoot's title will remain vice president for administration and treasurer, but he will devote significantly more time to working with university-affiliated corporations and strategic partnerships.

"This is another step in repositioning the university to focus the entire infrastructure on the goal of becoming a Top-30 research university. We need to have one person giving unified leadership and daily attention to our considerable affiliated organizations to maximize revenues and advantages for the university. Anderson Consulting, in their analysis of our management structure last year, recommended changes to this effect," Steger said.

The university has over the last few months implemented many of the Anderson Consulting recommended changes resulting in the appointments of Ridenour as chief operating officer, Dwight Shelton as vice president for finance, Leonard Ferrari as vice provost for strategic initiatives, Lenwood McCoy as associate vice president for special initiatives, and Joseph Merola as interim dean of the Graduate School.

Smoot already is involved in various capacities, but will now have the lead responsibility within central administration to bring together the business and financial affairs of the university-related corporations to maximize their financial and operating resources in support of the university. Those corporations are the Virginia Tech Foundation, Virginia Tech Services, VT Corporate Research Center, VT Intellectual Properties, Hotel Roanoke Foundation, VT Real Estate Foundation, VT Athletic Fund, VT Alumni Association, VT Corps of Cadets

(See SMOOT on 3)

VBI's \$6.6-million collaboration to create jobs

The Virginia Bioinformatics Institute (VBI) at Virginia Tech has announced a new \$6.6-million collaboration that will bring the Institute for Computational Genomics (INCOGEN), a high-tech company currently based in South Carolina, to New Town in James City County.

Attracted by joint research interests with VBI and the College of William and Mary, the relocation of INCOGEN will eventually result in 60 new high-level jobs for Virginia. The Governor's Commonwealth Technology Research Fund facilitated the partnership with a \$3.2-million grant.

VBI, established at Virginia Tech in 2000, serves as the state-wide resource for

bioinformatics research. INCOGEN develops and markets software for bioinformatics and genomic research and performs related research, consulting, and data analysis. VBI will partner with INCOGEN and William and Mary to develop more reliable statistical models for the analysis, communication, and interpretation of data in the life sciences; to develop software that enables the efficient mining of life science databases throughout the country and world; and to understand the dynamic phenomena of cell biology.

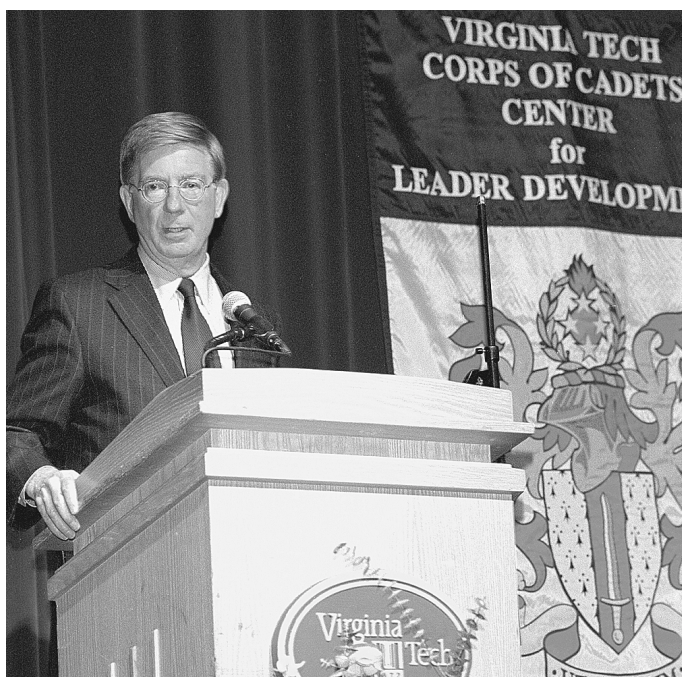
"This new partnership is another clear example of VBI's commitment to spur economic development in Virginia via bioinformatics. We are pleased that this partner-

ship will bolster both Virginia's biotechnology and information-technology sectors, and we look forward to playing a role in attracting other high-tech companies to the state," said Bruno Sobral, director of VBI.

INCOGEN will begin the relocation process from Clemson, SC immediately and hopes to be fully established in New Town by the end of the current calendar year. The firm will be one of the first permanently housed in New Town's Discovery Center. The arrival of the firm will offer a range of opportunities for scientific collaboration with faculty members and students at Virginia Tech, William and Mary, and at other Virginia institutions.

WILL SPEAKS
Pulitzer Prize
winner and
nationally
syndicated
columnist George
Will spoke on
campus last
week as part
of the Cutchins
Distinguished
Lecture program.

(J. McCormick)



NASA technical expert joins Tech program

By Susan Trulove

"Research and technology development (RTD) are of critical importance to the education, economy, and security of our nation. In particular, there are immediate and long-term challenges in enhancing homeland security, health care, energy production and consumption, and defense through RTD," said Kumar Krishen, chief technologist for the Technology Transfer and Commercialization Office at NASA Johnson Space Center (JSC).

Krishen joined the university's faculty in early October under an IPA (interagency personnel act) agreement initiated by Leonard Ferrari, vice provost for special initiatives. As a technology-transfer fellow, Krishen will lead an entrepreneurship program for Virginia Tech with the private sector, develop a working consortium of members for a Critical Technology Transfer Program, and work with technical programs at the NASA-Langley Research Center. He is also an adjunct professor, teaching in the Department of Electrical and Computer Engineering.

"The federal and state governments will spend approximately \$95 billion in 2001 on RTD. There will be nearly as much spent in the private sector. One way to increase the benefits of these investments is to foster partnerships among academia, industry, and government agencies," Krishen said. "Among the many advantages that can be realized through these partnerships are avoiding duplication, pooling resources to address multi-faceted RTD areas, and realizing commercialization of new technologies in the shortest possible time."

"Now more than ever, we need to expedite the successful transfer of technologies critical to defense and economic develop-

(See NASA on 3)

Scientists adopt new techniques to get better view of San Andreas Fault

By Susan Trulove

Tools never before used at an active earthquake site—including a technique adapted from oil exploration—are providing new and more detailed information about the San Andreas Fault (SAF).

The results will be presented in today's issue of *Science* in the article, "Steep-Dip Seismic Imaging of the Shallow San Andreas Fault near Parkfield," by Virginia Tech Professor John Hole, Rufus Catchings of the U.S. Geological Survey (USGS), Virginia Tech student K.C. St. Clair, Michael Rymer of USGS, David Okaya of the University of Southern California, and Virginia Tech graduate B.J. Carney, now at Columbia Natural Resources, Inc. of West Virginia.

The researchers learned more about the properties of the rocks near the surface in the fault area, and that the fault line deep underground is not directly under surface trace line,

said Hole, geological scientist at Virginia Tech.

The study site—halfway between Los Angeles and San Francisco and a 45-minute drive plus a short hike from the nearest highway—is where a future Big Science project is planned. Scientists have proposed drilling a hole through the SAF. "We are looking down about one kilometer or .625 miles—not very deep. "Our primary survey goal is to look at near-surface geologic structures to help plan the drilling. We also want to image and better understand the fault," Hole said.

Seismometers record echoes, such as from a blast, to reveal how seismic waves, similar to sound, move through rock. Seismologists can interpret such attributes as wave speed and positions of rock boundaries. Being used as a basic research tool for the first time at an active fault site was a computer-based technique for collecting and processing energy reflections from un-

(See SCIENTISTS on 4)

ACTIVITIES

EVENTS

Friday, 16
Pay Date for Faculty and Staff Members.
International Club, details TBA.

Saturday, 17
Football, 3:30 p.m.: At UVA.
Guest Artist Recital, 8 p.m., Squires Recital Salon.

Sunday, 18
YMCA Hike, 1:30 p.m., YMCA Parking Lot.

Wednesday, 21
“With Good Reason,” 7 p.m., WVTF.

Thursday, 22
Thanksgiving Holiday for Faculty and Staff Members.

Friday, 23
Thanksgiving Holiday for Faculty and Staff Members.

Tuesday, 27
Bloodmobile, noon to 6 p.m., Squires Commonwealth Ballroom.

Wednesday, 28
Bloodmobile, noon to 6 p.m., Squires Commonwealth Ballroom.
Family, Work/Life Resources Program, noon to 1 p.m., DBHCC room A.

Thursday, 29
On-campus Bloodmobile, noon to 4 p.m., Squires Commonwealth Ballroom.
YMCA Slide Show, noon, Cranwell Center.
VTU Program, 7:30p.m., Burruss auditorium: “A Christmas Carol.”

Friday, 30
Pay Date for Faculty and Staff Members.
International Club, details TBA.

SEMINARS

Friday, 16
Highlands in Chemistry, 11:15 a.m., 3 Davidson: Cathy Murphy, South Carolina.
MCBB, 12:20 p.m., 102 Fralin: Fred Cross, Rockefeller.

Monday, 26
Biochemistry, 4 p.m., 223 Engel: Max Di Ventura.

Wednesday, 28
History Teaching, 12:15 to 1:15 p.m., 427 Major Williams.
ESM, 4 to 5 p.m., 110 Randolph: Mohammad Noori, N.C. State.
Human Development, noon, Wallace atrium: Rosemary Blieszner.

Thursday, 29
Natural Resources, 3 to 4 p.m., 315 Cheatham: Jon Caulfield, Timber Vest.
Geological Sciences, 4 p.m., 4069 Derring: Chris Fedo, GWU.

Friday, 30
Highlands in Chemistry, 11:15 a.m., 3 Davidson: Paula Hammond, MIT.
MCBB, 12:20 p.m., 102 Fralin: Paul Dent, MCV/VCU.
Philosophy, time, location TBA: Stephen Turner, South Florida.

BULLETINS

Planning begun for Women’s Month 2002
The Women’s Month Committee has begun planning for Women’s Month 2002. Those who would like to propose an event for inclusion on the calendar should contact the Women’s Center for a form. Deadline for submissions is December. 7.
Women’s Month recognizes, affirms, and showcases the achievements, concerns, and diversity of women. A feminist perspective—one that encourages and advances women of all races, political affiliations, national origins, religions, ages, abilities, sexual orientations, and income levels—underlies the programming. Events to be included in our calendar must be aligned with this philosophy.
The theme for the year’s program, “For Every Body,” brings focus to the collective voice of women—their presence, politics and interactions—as well as the physical aspects of women’s bodies such as their health, safety, and beauty. For more information, contact Denise Collins, assistant director of the Women’s Center at Virginia Tech, Price House, 0270, or call 1-7806.

Summer Program in Riva San Vitale offered
International Studies will again offer a summer program centering around the university’s campus in Riva San Vitale, Switzerland from Monday, May 13 to Friday, May 24. The itinerary includes two nights in Venice, two nights in the German-Swiss Alps at Thun, as well as bus and train trips in the Ticino part of Switzerland and in northern Italy (Lago Maggiore, Bellinzona, Lugano). The comprehensive price (all transportation from and to Washington, D.C., all lodging, most meals and admissions) is \$2,100. Interested individuals are asked to contact the International Studies Office at 1-5874 or come by 119 Major Williams and get an application form.

Natural History Museum program set
Tamim Younos, senior research scientist and associate director, VWRRC at Virginia Tech will present “Watershed Management, Protection, and Research in Virginia” Thursday, Nov. 29, at 7 p.m. at the Virginia Museum of Natural History, 428 North Main Street.

The objective of the presentation is to introduce the audience to watershed water-quality-management issues in Virginia. The presentation will include brief background information on Virginia’s climate, topography, major basins, and other factors that affect watershed management. Federal and state laws and regulations pertinent to watershed management, the role of state agencies, watershed-management programs and strategies (such as TMDL), and an overview of watershed research in Virginia will be presented. Call 1-3001 for more information.

Timber expert to lecture
Jon Caulfield, vice president of Research and Investment at Timber Vest, LLC, will give a public lecture on “Forest Certification and the Future of Family Forests” in 315 Cheatham from 3 to 4 p.m. Thursday, Nov. 29, as part of the seminar series on certification issues in natural resources.
Information and a schedule of upcoming lectures are available at <http://calendar.vt.edu/week.phtml>.

Human-Computer Interaction Center sponsors Summer Fellows program

The Center for Human-Computer Interaction will sponsor a Summer Fellows program in 2002. Fellows will be appointed in the center to carry out research projects with the goal of developing interdisciplinary research proposals in human-computer interaction.
For 2002, the focus of the Summer Fellows program is computer-supported cooperative activity. This includes requirements identification and engineering for collaborative systems and software, design and software engineering, application domain studies, usability evaluation, measurement and analysis of social and organizational impact, and policy studies.
Fellows will receive one month of summer salary to support their research and proposal

development projects. All Virginia Tech faculty members are eligible for this program. The program is funded by the College of Arts and Science, and preference will be given to proposals from Arts and Sciences faculty members.
To apply, submit a pre-proposal not more than five pages long, describing (1) the plan or vision that will be developed into a research program, (2) the specific activities that will be carried out during the period of summer funding, and (3) the motivation for carrying out this research program in the Center for Human-Computer Interaction. A letter of endorsement from the faculty member’s department head should be submitted. These materials are due March 1.

Holiday Schedule Announced

The holiday schedule for the Thanksgiving, Christmas and New Years holidays is as follows:

Thanksgiving: State offices will close at noon on Wednesday, Nov. 21. State offices will remain closed on Thanksgiving Day, November 22, and Friday, Nov. 23.

Christmas: State offices will be closed on Monday, Dec. 24, and remain closed on Christmas Day.

New Year’s Day: State offices will be closed on Monday, Dec. 31, and remain closed on New Year’s Day.



EMPLOYMENT

CLASSIFIED POSITIONS

The following classified positions are currently available. Position details, specific application procedures/position-closing dates may be found on Personnel Services web site <http://www.ps.vt.edu>. Positions are also listed on the Job Line, a 24-hour recorded message service. For information on all job listings, call 1-5300. Some positions include state benefits. Positions with numbers beginning with "W" are hourly and do not include state benefits. Individuals with disabilities desiring assistance or accommodation in the application process should call by the application deadline. Closing date for advertised positions is 1 p.m. Monday. An EO/AA employer committed to diversity.

FULL TIME

Two full-time food-service positions available.

Administrative Assistant, 002043J, PB 3, Marketing.

Administrative Assistant, 007872S, PB 3, VTIMR.

Applications Analyst, 001080S, PB 4, ISC.

Coordinator of Administrative Affairs I, 007879R, PB 4, Executive VP's Office.

Data Entry Operator, 002527F, PB 2, University Controller.

Executive Secretary, 002099R, PB 3, CEUT/AA.

Financial Planning Manager, 007567F, PB 5, BFP.

Graduate Advising Assistant, 004249B, PB 3, ECE.

Grants Administrator, 004298R, PB 4, Sponsored Programs.

Grounds Lead Worker, 000059F, PB 3, Physical Plant.

Housekeeping—Night Crew, 007814H, PB 1, RDP.

Housekeeping Manager, 006926H, PB 3, RDP.

Housekeeping Supervisor, 000269H, PB 2, RDP.

Housekeeping Worker, P002005C, PB 1, Physical Plant.

Hvac Installation/Repair Technician, 000634F, PB 3, Physical Plant.

Junior Deployment Engineer, 007246S, PB 4, Middleware.

Laboratory Specialist, 007707B, PB 3, CE.

Large Animal Veterinary Technician,

001996M, PB 4, VTH.

Meat Lab Manager, 003273M, PB 4, FST.

Medical Technologist, 002596M, PB 4, VTH.

Multimedia Systems/Applications Specialist, 002054A, PB 4, VBS.

Police Officer, 001246Y, PB 3, Police.

Program Support Technician, 006763B, PB 3, Engineering Development.

Security Guard, 001357Y, PB 2, Police.

Shopleader, 007125H, PB 1, RDP.

Shopleader Supervisor, 007797H, PB 1, RDP.

Sous Chef, 000940H, PB 3, RDP.

Transportation Planner, 007498F, PB 4, OT.

PART TIME

Animal Care Technician Large Animal, W020066M, PB 2, VTH.

Animal Care Technician/Small Animal, W022675M, PB 1, VTH.

ICU Veterinary Technologist Large Animal, W022218M, PB 2, VTH.

Laboratory Specialist, W023305M, PB 3, APS.

Office Services Specialist, W023332B, PB 2, ECE.

Pharmacy Assistant, W022097J, PB 2, Health Center.

Program Support Technician, W023335M, PB 3, FST.

Radiologic Technologist, W022238J, PB 3, Health Center.

Research Applications Programmer, W023334R, PB 4, VTTI.

UNIVERSITY ONLY

Information Systems Administrator, U007669M, PB 4, CVM.

Plumber Steamfitter Supervisor, U000762F,

PB 4, Physical Plant.

OFF CAMPUS

Adult Program Assistant, 006604J, PB 2, Prince William County.

Agricultural Supervisor, 000319M, PB 3, Tidewater AREC.

Efnep Adult Program Assistant, 006103M, PB 2, VCE—Prince William County.

Efnep Adult Program Assistant, 007642M, PB 2, VCE—Fairfax County.

Radio Announcer, W020800S, PB 3, UR/WVTF Radio.

Youth Program Assistant, 005889J, PB 2, HNFE.

Youth Program Assistant, 007464J, PB 2, HNFE.

Youth Program Assistant, 007233J, PB 2, HNFE.

FACULTY POSITIONS

Mathematics. Tenure-track Position(s). Contact: Christopher Beattie, 460 McBryde (0123). Review begins Jan. 5.

Near Environments. Assistant Professors (2), Interior Design. Contact: Dianne Yardley, 103 War Memorial (0317). Review begins Jan. 31.

Near Environments. Assistant Professor/Extension Specialist, Consumer Education. Contact: Kathleen Parrott, 101 Wallace Hall (0410). Review begins Feb. 15.

Near Environments. Assistant Professor/Extension Specialist, Family Financial Management. Contact: Kathleen Parrott, 101 Wallace

Hall (0410). Review begins Feb. 15.

Forestry. Assistant Professor, Forest Economics/Business. Contact: Harold Burkhart, 307 Cheatham (0324). Deadline: Feb. 28.

NON-INSTRUCTIONAL

College of Human Resources/Education. Dean. Contact: Gregory Brown, 324 Cheatham (0324). Review begins Jan. 7.

Center for Housing Research. Project Associate. Contact: Ron Wakefield, 128 Burruss (0156). Review begins immediately.

Virginia Tech Transportation Institute. Hardware Developer. Contact: Cindy Wilkinson, 3500 Transportation Research Plaza (0536). Review begins immediately.

Virginia Tech Transportation Institute. Marketing Associate. Contact: Cindy Wilkinson, 3500 Transportation Research Plaza (0536). Review begins immediately.

Crop/Soil Environmental Sciences. Research Associate, Soybean Breeding/Genetics. Contact: Glenn Buss, 330 Smyth (0404). Review begins immediately.

Optical Sciences/Engineering Research Center. Postdoctoral Associate. Contact: William Spillman Jr., 106 Plantation Rd. (0356). Review begins Dec. 1.

Cranwell International Center. Coordinator of H1B Immigration Program. Contact: Kim Beisecker, Clay St. (0509). Review begins immediately.

Aerospace/Ocean Engineering. Department Head/Professor. Contact: Chris Hall, 215 Randolph (0203). Review begins Jan. 14.

NASA

Continued from 1

ment," said President Charles Steger, who is a member of the Virginia Preparedness and Security Panel. He invited Krishen to attend the panel's meeting here. "Having Dr. Krishen's expertise at Virginia Tech for the next year is a good example of the benefits of interagency cooperation," Steger said.

"We are developing several programs to identify university research and technology solutions that have a potential for commercialization," Ferrari said. "We want to implement innovative programs, including new start-up incubators in Blacksburg and in the Washington, D.C. region, which develop products that can be readily manufactured by industries. Dr. Krishen can help achieve the interaction with state and national organizations necessary to a successful technology transfer program. NASA JSC has been successful in the transfer of space technology to the private sector and we believe the

processes they have developed will help us realize our goals."

Krishen said that in only three weeks, "I have interacted with many knowledgeable and visionary officials of this institution. These discussions have inspired me immensely. More importantly, I have realized that Virginia Tech is a powerhouse of RTD. The depth of expertise and advanced facilities in numerous fields are of international scope."

The special initiatives he has reviewed include technology transfer and commercialization, information technology, biomedical RTD, homeland security, defense training and research, and sensing systems. "In these and several other areas we will be seeking long-term partnerships with industry and government agencies. In this regard, I have already initiated discussions with NASA."

The IPA was finalized over the summer. Has there been a re-focus since the September 11 attack on America, in terms of what are

considered critical technologies? "Not really," says Krishen. "Critical technologies are those that have a tremendous impact on defense and the economy. I'm staying firm on looking at technology R&D, expertise, and facilities here, and then relating them to national needs, particularly where industry wants to go. And industry wants to go where national needs are profound, which is health care and defense right now," he adds.

"Defense received a new scope after September 11. We have to concern ourselves with different strategies in terms of homeland security, but these are still the extended elements of defense," he said.

"I believe that Virginia Tech has the potential to play a major role in developing key technologies that will have positive impact on our nation's economy and security," Krishen said. "I plan to support the efforts of this institution to realize this vision."



VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

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SMOOT

Continued from 1

Alumni Association, WPI, Inc., and the Olivio Ferrari Foundation in support of the European Studies Center.

Additionally, the university is involved with various outside agencies that support the university or operate services that the university would otherwise have to run itself. Smoot will have responsibility for university relationships with the Hotel Roanoke Conference Center Commission; Hotel Roanoke LLC; Virginia Tech/Montgomery Regional Airport Authority; Blacksburg-Christiansburg-VPI Water Authority; Blacksburg-Virginia Polytechnic Institute Sanitation Authority; Montgomery Regional Solid Waste Authority; Fifth District Planning Commission, and for issues related to the Town of Blacksburg and Montgomery County.

On the scope of the operation and the need for full-time oversight, Smoot said, "Our allied businesses are about equivalent to a medium-

sized university in terms of assets and revenues. Their efficient operation is a key element to the success of the university and the overall university infrastructure."

Smoot will continue to report to Ridenour, executive vice president and chief operating officer. Ridenour said, "This new emphasis will allow Ray to devote more time to the growth and development of our related corporations, give attention to the business and financial management of the corporations, and ensure the corporations are generating support that will benefit the university. With this organizational structure and Ray's strong leadership skills, we will further advance the strategic agenda of the university."

Steger said, "It is clear that these affiliated corporations, commissions, and unique partnerships will play a significant and increasingly important role as we implement the strategic plan and climb to our goal to be one of the nation's leading research universities. Their

growth, development, and management are key components that support our mission of teaching, research, and outreach."

Ridenour said many of the university's non-academic ventures have required the leadership or involvement of affiliated corporations. "The most visible and successful venture is probably the Corporate Research Center. But another example on the horizon is the new Via College of Osteopathic Medicine. The VT Foundation initially will handle payroll, business affairs, and other support services for the Via college."

The university will re-activate a position reporting to Smoot, that of associate vice president for administration, with direct responsibility for Environmental, Health and Safety Services; university architect, and Facilities. The Police Department, Real Estate Management and Investments and Debt Management will continue to report directly to Smoot.

Discovery of sub-cellular processes could lead to medical applications

By Stewart MacInnis

One of the key processing sites for proteins in cells is fundamentally more dynamic than scientists have traditionally believed, opening the possibility of harnessing cellular processes to benefit human health, according to biochemist Brian Storrie.

Storrie and three other Virginia Tech researchers report in an article published this week in the *Journal of Cell Biology* that the proteins making up the Golgi apparatus in all cells are constantly being renewed. The research upon which the article is based was funded by the National Science Foundation (NSF).

"This is a central finding," Storrie said. "These recycled proteins are portals to the inside of the cell. These portals could be very useful."

Along with biochemists Suzanne Miles and Heather McManus and chemical engineer Kimberly E. Forsten, Storrie reported that the Golgi apparatus is not a fixed structure, but that every component of it is recycled through the endoplasmic reticulum. This recycling allows the replacement of frayed proteins, acting as a kind of quality control to ensure the structure can perform its function.

Potential practical applications of the finding include delivery of medicines to very specific locations in cells, and as a tool available to researchers to modify the cells to produce compounds for use in pharmaceuticals and for other uses. Reaching a practical use for the discovery is still a far step from this fundamental finding, Storrie said.

"But just eight years ago no one would have thought the Golgi apparatus is recycled

and renewed," he said. The Golgi apparatus is a complex organelle. It is involved in the processing of proteins destined for either secretion or for the outer surface of the cell. Traditionally, scientists have looked on the Golgi apparatus as a fixed structure that processed proteins in an assembly-line fashion.

The organelle is an arrangement of layers of flattened sac-like membranes that's located in a characteristic place near the cell's nucleus. Proteins are processed through the layers of the Golgi apparatus, with enzymes in each layer causing modifications as the proteins proceed through the layers, finally to be shuttled into vesicles that take them to the cell's surface.

Vesicles are bubble-like containers that bud from the Golgi apparatus and transport proteins to the cell's surface membrane. The vesicles themselves are made of proteins, which are absorbed by the surface membrane when they have completed their mission.

Proteins are delivered to the Golgi apparatus for processing in vesicles that bud from the endoplasmic reticulum. Therefore, Storrie said, there is a constant flow of materials from the endoplasmic reticulum through the Golgi and to the cell's outer surface.

Storrie said Tommy Nilsson, a scientist with the European Molecular Biology Laboratory in Heidelberg, Germany, helped the Virginia Tech researchers develop a method to block the flow of proteins into the Golgi apparatus. As expected, that resulted in the depletion and eventual disappearance of the Golgi structure. Traditional wisdom held that the proteins making up the structure traveled to

the cell's outer surface, where they were absorbed.

But by using sophisticated technology to mark the proteins in the Golgi apparatus, the scientists discovered that the proteins from the structure itself were dispersed to unexpected areas of the cell. The article says the finding "suggests that the entire Golgi apparatus...is continuously being assembled and disassembled...."

Storrie is now pursuing research in conjunction with the Carilion Biomedical Institute in Roanoke to see if compounds can be attached to the dispersing proteins for delivery to specific areas of the cell. If practicable, the procedure could be used to deliver precise amounts of medicines to precise locations.

In some applications, biotechnologists

depend upon the secretion of compounds by cells to obtain materials for pharmaceuticals or for industrial applications. Storrie said this new understanding of the Golgi apparatus might in some cases allow scientists to develop cell secretions that more nearly fit their needs.

Storrie said he observed the first hint of this process in the mid-90s when he was helping a doctoral student put together a thesis problem. It was just in the last year, however, that the concept crystallized that the entire Golgi apparatus was constantly assembling, disassembling, and reassembling.

"I now know how to take it apart," Storrie said. "But I can't put it together. I would like very much to continue this research to learn how to put it together."

Geologists study evolution of continents

By Sally Harris

When looking at the physical and chemical evolution of continents through time, geologists are faced with thousands and thousands of pieces of information that might fit together to describe the process better.

John R. Wilson, a former graduate student at Virginia Tech, and his advisor, A.K. Sinha, professor of geological sciences at Virginia Tech, are experts on the subject of plutons, or bodies of rock such as the rock that hardens far beneath a volcano. Even with that specialization, looking at the place of plutons in the evolution of continents involves so much

data that it can be difficult to find and plot it all in any timely manner. So the two have developed, using a geographic information system (GIS), the template for a database of attributes of plutons that allows geologists to interpret in new ways the tectonic history of a region.

Wilson, who is now laboratory coordinator for the Department of Geology and Environmental Geosciences at Lafayette College in Pennsylvania, said that, with the new system, geologists can more easily interpret large amounts of data.

"In the past," Wilson said, "scientists had to go from memory or look through publications and theses and make a list. The information was not easily accessible or queried." The new database system within a GIS allows scientists to look at and interpret data over a large area in new ways and in a variety of ways at once, he said. That allows them to ask new questions of the data.

"We can query the data to show us all the plutons of one type and all the plutons within a certain age range, and we can see new spatial relationships of plutons and the regions they are in. We have a cascade of scales," Wilson said.

The GIS allows the scientists to look for spatial relationships within the data. For example, they can zoom into an outcrop (any rock formation in the woods or fields or on road sides) and determine its attributes—the minerals present, the properties of the rock, and so forth. "At the same time, we can zoom in on the minerals and their properties or zoom out to a more regional scale and compare that outcrop with one far away."

"Everything has a location," he said. That provides information on spatial relationships. Using the GIS, the attribute data (what is at the outcrop) from the new database can be applied to the spatial data so scientists can look at more data with greater ease. They can better manage the data and use it to plot relationships between locations. For example, if they have data on plutons in Virginia and someone else has data on plutons in Massachusetts, they can then compare the chemistry, ages, and other characteristics of the rocks.

"This helps scientists understand the regions of the Earth, why they are as they are now, and how they got that way," Wilson said "This advances our science."

Wilson and Sinha have created the template or framework that will allow them to include attributes of plutons in a database format. They also designed the database template to be used in conjunction with databases developed by geologists whose expertise is in another area, such as sedimentary rocks.

SCIENTISTS

Continued from 1

derground vertical structures. The reflection imaging system was developed by the petroleum industry to locate oil pooled along the steep, vertical sides of salt domes. Hole worked with the U.S. Geological Survey to collect the field data and received funding from the National Science Foundation (NSF) to process the reflection image at the San Andreas Fault.

The reflection images Hole captured, published in *Science*, are the first such captured and published of an active vertical fault. The pictures are helping geoscientists understand the subsurface.

In the seismic image, the most important geology is immediately to the west of the fault, an area previously discovered to have high electrical conductivity. The new seismic image revealed that the same volume of rock has low seismic velocities. "Most likely, the rock has a lot of spaces—10 to 30 percent porosity—filled with salt water."

The porous rock continues below the area of measurement. "The high conductivity, low velocity of the nearby rock tells us something is weak, broken. It's too bad we couldn't see deeper, where the earthquakes are," Hole said.

The reflection image included high-resolution vertical lines corresponding perfectly with the SAF, Hole said. "Because of the high-resolution result, we are learning something geologically interesting. The reflector is vertical in the upper half kilometer, then slopes steeply to the southwest. This is interesting because the location of earthquake faults in the subsurface are not precisely known. The earthquakes define a vertical plane that does not quite line up with the surface trace but, by drawing a thick line representing errors, seismologists define the fault as still being somewhat under the surface trace. The reflector image suggests the fault has enough of a bend

to the southwest that it is several hundred meters southwest of the surface trace," Hole said.

"Actual misalignment of the surface with the deeper fault seems unlikely as the surface rock is too weak to generate an earthquake and should break vertically above the stronger, deep fault. However, the reflection image of the actual deep fault line makes a difference if you are trying to drill into it," Hole said.

Scientists know where the fault is because it is actively moving. It is slipping an inch per year. A decades-old, well-photographed fence line that is cut by the fault has a zag of four feet.

A 1966 earthquake emboldened scientists to predict another major earthquake in 1988, give or take five years. The prediction was based on six previous major quakes that were about 22 years apart. As a result, a great deal of equipment has been placed at the site. The predicted earthquake hasn't happened, but the site is well studied. (The major Coalinga earthquake in 1985—only 30 miles away along a previously unknown fault—may have released the pressure.)

Because the site has been so well instru-

mented, there is excellent documentation of several small, very shallow earthquakes—magnitude 1-2, 3 kilometers down—that repeat every one or two years.

"That is why this site was selected for a proposal to drill through a fault and record what happens in a bore hole. The plan is to drill two kilometers down from 1.5 kilometers away, then angle toward the fault through a small, repeating quake site. The researchers working on that project will measure samples along the path of the drill to understand the physics of the site," Hole said.

Hole has received NSF funding to repeat his measurements to a depth of five kilometers below the depth of the drilling target. That will require a 50-kilometer or 31-mile line on the surface to give the sound waves elbow room to echo and reflect off a vertical surface 5 kilometers underground.

The San Andreas Fault Observatory at Depth (SAFOD) is part of Earthscope, a project that has received NSF and National Research Council approval. SAFOD is phase one, but is not yet funded.

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