The College [of Science] proposes to address … issues through integration of the best among traditional disciplines, which transcends mere interdisciplinarity.
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Executive Summary

Most of what transpired last year consolidates developments that have taken place over the last 10 years of the College’s existence. From inception, the College has seen as its primary goal to reform science education and research to effectively answer the STEM-H challenge that is the subject of much discussion and debate. Along the way, it has become apparent that the institution of higher learning is facing a crisis in its funding model. State and federal support are dwindling. Students are getting more selective in choosing where they would like to go to school. And prospective employers are demanding expertise in areas not addressed in existing curricula.

The College of Science proposes to address these issues through integration of the best among the traditional disciplines, which transcends mere interdisciplinarity. It is widely recognized the key problems we confront today, and will face tomorrow, demand input from multiple fields. True progress requires a careful blending of current and evolving elements into something new, without compromising the essence and continued advancement of the underlying disciplines. We started with the idea of cluster hiring, and moved on to the launching of four-degree programs, Computational Modeling and Data Analytics (CMDA), Nanoscience (NANO), Neuroscience (NEURO), and Systems Biology (SYSBIO). Along the way, we put in place the Integrated Science Curriculum (ISC), which introduces a new form of pedagogy for science, and delivers skills through projects, teamwork, and the ability to ask questions and formulate strategies and tactics. And we initiated the Science, Technology and Law minor program that amalgamates scientific perspective with social sciences, ethics, and other areas more usually associated with arts and humanities. All of these have resonated with students, potential employers and a large segment of our alum support base, who have responded with much needed financial support.

The above then is the context in which what follows should be viewed. I will touch upon various parts that impact significantly on the College, including enrollment, advising, basic and applied research; mentoring of faculty—junior and mid-career; outreach; and diversity.

There were some changes in the operation of the College of Science last year. The most significant was the relocation of the Dean’s office from the temporary modular building (for 17 years) on the Upper Quad to the North End Center, Suite 4300. For the first time, all of our operations are together, both academic and the advancement activities. This has
immeasurably increased our efficiency. We are truly grateful to the University for making this move possible. There have also been a few changes in personnel. The position of Assistant Director of Development is currently vacant, as is the Director of Alumni Relations, and searches are underway to fill these vacancies. Tim Long, Associate Dean of Research and International Outreach, stepped down at the start of the Fall Semester, 2014, to pursue opportunities that would enhance progress in his career path. No changes have taken place among the Department Heads; we are still looking to recruit someone to lead the Economics Department.

Lay Nam Chang
Dean, Virginia Tech College of Science
September 4, 2014
College Goals and Outcomes

Goals from last year and Measured Outcomes

Three goals listed in last year’s report. Their outcomes are summarized below.

1. Continuance on projects from previous year.
   
   i. Graduate curricula for the new degree programs.
   
   ii. Completing solid infrastructure, both intellectual and physical, for faculty within the programs under the auspices of the Academy of Integrated Science.

Five new graduate courses were established last year. The MA in Data Analysis in Applied Statistics is under review by the Commission on Graduate Studies and Policies.

Much progress on infrastructure has been achieved on programs of the Academy of Integrated Science. The BS programs in Computer Modeling and Data Analytics and in Nanoscience have been approved by SCHEV with a start date of Spring 2015. The BS program in Neuroscience is under review by SCHEV. The program in Systems Biology is under review by the Commission on Undergraduate Studies and Policies.

The Academy of Integrated Science (AIS) was initiated in July, 2013 and is now functioning as the management unit for new degree programs in Computational Modeling and Data Analytics (CMDA), Nanoscience, Neuroscience, and Systems Biology, as well as the Integrated Science Curriculum (ISC) and the Science, Technology, and Law (STL) minor. Policies and procedures have been developed for AIS faculty searches, and executive committees are being formed to guide program development and as primary communication mechanisms with departments.

AIS added one faculty member in the past year, Greg Liu in Nanoscience with tenure line in Chemistry. AIS will launch faculty searches for CMDA, for Neuroscience, and for the ISC, in the coming year. The AIS director, J. P. Morgan, and Dean Lay Nam Chang, led faculty meetings with each COS department during AY 2103-14 to explain and discuss
AIS operations and progress on all of its programs. Spring 2014 saw the formation of the AIS stakeholders, comprised of the COS department heads, who met throughout the summer to discuss AIS personnel, fiscal, and space requirements.

2. **Large research projects on critical Life and Physical Sciences.** The faculty of the college submitted several large multidisciplinary proposals last year. While the proposals reviewed well, they were ultimately declined by the funding agencies.

This outcome has not dissuaded the faculty from embarking on multidisciplinary proposals. Two large proposals, collectively totaling $10M are currently under review. A $12M proposal in sustainability is also under review. There are another 14 proposals (each with requested budgets in excess of $2.5M) that are pending.

The College believes the submission of multidisciplinary proposals is the best use of faculty talents in order to pursue significant funding in this current fiscal climate. The assembly of multidisciplinary research teams is a pivot point in transitioning from single PI submissions to multiple PI efforts. To this end, the College is restructuring the position of the Associate Dean of Research and Graduate Studies from a half time position to a full time position.

3. **Enrollment management.** The burgeoning enrollment among majors in the programs in Science, resulting from the decision to place students interested in Engineering in their second choice for major, has created an opportunity for the College and the University to grow in many initiatives. To take advantage of this opportunity, the College will need help in new resources to build the requisite faculty. But realizing the limitations imposed by current fiscal constraints, some creative tactical steps will have to be devised and implemented. It is the creativity we bring to the challenges we face, in this and in all arenas, which will allow us to move forward. It is the pace of innovation we will focus on as we enter our second decade as Virginia Tech’s purveyor of education and research in science.

The outcome of this change in admission policy has increased the size of the incoming classes of 2014 by nearly 20%. The addition of 200 students has occurred in the first year courses of Physics, Math, and Chemistry. In the case of
the lab-intensive offerings, this increase in Science majors illuminates the great need for undergraduate lab facilities.

Non-majors, from the second choice program have also impacted the College’s teaching mission. Approximately 600 students are on a wait-list for Chemistry and the associated lab.

Goals and Outcomes for 2014-2015

The College has set five goals for 2014-2015. They are in alignment with the Plan for a New Horizon. These goals and their anticipated outcomes are listed below.

Goal 1: Advance the university’s research and innovation mission by developing networked collaborations and new pathways to interdisciplinary success. – *A Plan for a New Horizon*, p. 10

1. Increase enrollment in the integrated science curriculum
2. Create interdisciplinary undergraduate programs in nanoscience, neuroscience, computational modeling and data analytics, and systems biology
3. Create interdisciplinary graduate programs in nanoscience, neuroscience, computational modeling and data analytics, and systems biology
4. Foster and build teams of interdisciplinary researchers
5. Leverage partnerships with research institutes
6. Increase annual research expenditures

Goal 2: Advance the university’s research mission by creating “meaningful partnerships with businesses and government entities”. – *A Plan for a New Horizon*, p. 11

1. Create networks of scholarship, innovation and economic development by forming domestic and international partnerships
2. Strengthen and expand international programs

Goal 3: Advance the university’s research and educational mission by ensuring “quality, innovation, and results” by developing new academic organizational structures “to optimize efficiency, flexibility, and accountability”. – *Senior Vice President and Provost Academic Implementation Strategy for A Plan for a New Horizon*, p. 22
1. Create new structures that encourages intra- and interdisciplinary teams free from unnecessary barriers which allows the college to nurture interdisciplinary initiatives
   a. Hiring strategies
   b. Degree Programs
   c. Teaching
   d. Research
   e. Promotion and Tenure
2. Recruit top faculty in strategic areas through cluster hiring

Goal 4: Advance the university’s mission to foster diversity and inclusion. – *A Plan for a New Horizon, p. 16*

1. Recruit top faculty in strategic areas through cluster hiring.
2. Develop pipeline initiatives with underrepresented pre-college students.
   a. Collaborating with established university programs in order to develop COS programs that will enhance opportunities for underrepresented pre-college students. Continue in ongoing talks between Franklin Military Institute, the College of Science, and the Corps of Cadets.
   b. Continue the fourth year of the NSF funded Summer Bridge Program for COS.
3. Develop K-12 summer programs for students and teachers.
4. Develop relationships with teachers and administrators in underrepresented communities.

Goal 5: Advance the university’s research expectations by continuing to “build upon existing and emerging research strengths”. – *Senior Vice President and Provost Academic Implementation Strategy for A Plan for a New Horizon, p. 12*

1. Recruit top faculty through cluster hiring in strategic areas of nanoscience, neuroscience, polymers, computation and data analytics.
2. Foster and build teams of interdisciplinary researchers.
3. Leverage partnerships with research institutes, industry, and national laboratories.
Research and Innovation

Research Expenditures
Total research expenditures for the College for FY2014: $23,496,876
Total awards for the College for FY2014: $23,986,958

Notable new research awards 2013-2014
Includes awards of $1M or more and NSF CAREER Awards.


**Kim-Spoon, Jungmeen, Brooks King-Casas, and Michael Friedlander (PSYC)**, Neurobehavioral Determinants of Risky Behavior in Adolescence, $3.5 Million, National Institute on Drug Abuse, 07/13-03/15.


**Webster Santos (CHEM)** PI, three-year $1.15 million total, 09/13, from NIH to improve sphingosine kinase inhibitors discovered in his labs. In collaboration with Prof. Kevin Lynch at the University of Virginia, the team aims to develop drugs against fibrosis.

**Harry Dorn (CHEM)** Co-PI; five-year $1,929,745 total, 10/13, from NIH to investigate a Mentorship and Development Program for Biomedical Trainees.

**Mike Hochella (GEOS)** and Peter Vikesland (CEE) were awarded new installments from the $1,750,000 from the National Science Foundation for the collaborative Center for Environmental Implications of Nanotechnology (CEINT).

**Birgit Scharf (BIOL)** received a five-year NSF CAREER Award entitled, “Novel determinants of motility and chemotaxis in *Sinorhizobium meliloti*” for $896,693.
Camillo Mariani (PHYS) received a five-year NSF CAREER Award entitled, Neutrino Interactions in Matter” for $638,788.

Faculty awards/honors

G.G. Vining (STAT) received a 2013 NESC (NASA Engineering Safety Council) Engineering Excellence Award for collaborations with the NESC.


Thomas Ollendick (PSYC) Lifetime/Career Achievement Award, Association for Behavioral and Cognitive Therapies 2013.

Yuriko Renardy (MATH) was named a Fellow of the Society for Industrial and Applied Mathematics.

Bud Brown (MATH) received the Mathematical Association of America (MAA) 2013 Carl B. Allendoerfer Award for Excellence in Expository Writing for "Why Ellipses Are Not Elliptic Curves" (with Adrian Rice) 85 (June 2012), 163-174.

Tom Burbey (GEOS) Member of UNESCO’s Working Group on Land Subsistence and as a member of the Board of Directors of Environmental & Engineering Geoscience.

Patricia Dove (GEOS) awarded the 2014 Dana Medal from the Mineralogical Society of America.

Mike Hochella (GEOS) Selected as a 2013/2014 Fellow of the International Association of GeoChemistry.

Robert Tracy (GEOS) was elected Fellow of the Geological Society of America.

Michael Fox (BIOL) was recognized with the Jordi Folch-Pi Award from the American Society for Neurochemistry.

Deborah Kelly (BIOL) was elected to the Royal Society of Chemistry.

Robert B. Moore (CHEM) was named to the 2013 Class of ACS Fellows for “outstanding accomplishments in scientific research, education, and public service.”
David Kingston (CHEM) was named a Member of the National Institute of Complementary and Alternative Medicine, National Institutes of Health, (NCCAM) Board of Scientific Advisors; He also became a 50-year member of the American Chemical Society.

Judy Riffle (CHEM) received the ACS Polymer Division Distinguished Service Award, 2014.

Edward Valeev (CHEM) is the 2014 recipient of the Medal of the International Academy of Quantum Molecular Sciences (IAQMS).

Publications (CY2013)
College faculty across all departments were responsible for: 6 books, 75 book chapters with 39 in press, and 770 journal articles, papers, and proceedings and 119 more in press.

Presentations and notable invited lectures (CY2013)
College faculty across all departments were responsible for: 901 presentations, lectures, and invited talks/keynotes.

Notable Proposals with University Research Investment Institutes


Feng Guo (STAT) Co-PI (PI Hickman; Co-PIs Hanowski/Mabry) – Commercial Driver Individual Differences Study, Federal Motor Carrier Safety Administration. $3,000,000 (10% effort), 2010-2015.
Feng Guo (STAT) PI (Co-PI Hankey) – Shanghai Naturalistic Driving Study, *Tonji University*. $121,000 (90% effort), 2012-2015.


Nicole Rylander PI, Carla Finkielstein (BIOL), Pavlos Vlachos, and John Robertson Co-PIs, $300K ($30,000 to CVF), 7/13-6/15, Established Investigator Grant for “Uncovering the role of the microenvironment in cancer progression and therapeutic intervention using a multi-disciplinary tumor engineering platform.”

*Virginia Tech-Children’s National Medical Center Collaborative Pilot Grants*

Amanda Morris and Harry Gibson (CHEM), “Tailoring Metal Oxide Morphology and Interfacial Energetics for High Efficiency Hybrid Bulk-Heterojunction Solar Cells,” ICTAS, $120,000, 2 years, 7/1/13-6/30/15.

Karen Brewer (CHEM), PI and John Robertson, Co-PI, $262,100 from ICTAS to conduct a two-year investigation of “Polymer Supported Light Activated Supramolecular Complexes in Catalysis.”
John Matson (CHEM) PI (80%) and Carla Finkielstein (BIOL), Co-PI, Faculty Collaborative Proposal “H2S-Releasing Micelles for Cancer Therapy” $120,000 over 2 years (7/1/13-6/20/15).

Arlington Innovation Center: Health Research

Faculty - Seong K. Mun, Director; Kenneth H. Wong; Alpay Özcan; Ben Lo

Major R&D proposal wins

Additional funding for US Army MedicPhone project, $857,981 – includes research to develop a handheld mobile health-reporting device for field medics.

Additional funding for Open Source Electronic Health Record Alliance project, $190,000 – includes research on standardizing the Veteran Administration’s electronic health record management system.

Initial agreement with Taiwan University to perform a retrospective reader study with 20 radiologists to evaluate the clinical effectiveness of bone-shadow chest radiographs using 700 cases.

Significant research accomplishments

Hosted workshop with Army on integrating medical efforts into NettWarrior devices (March 2014).

VTIP Provisionary Patent application for InFSExplorer®, USPTO application number: 61983609

Initiation of research projects on renal carcinoma and prostate cancer with Dr. Akin, the director of body MRI at the Memorial Sloan-Kettering Cancer Center, New York.

Affiliation with Virginia Tech Center for Autism Research (VTCAR), March 2014 (Özcan, affiliate of the VTCAR)

Significant publications, honors or awards

Alpay Özcan named editor in *Frontiers in Physiology, Integrative Neuroscience: New Models of Diffusion Weighted MRI Signal for Characterization of White Matter Integrity*
Post-doctoral positions in STEM-H research areas

The college, across four departments, has 35 postdoctoral position as defined by NSF guidelines.

Links with NCR for research into issues of security and resiliency

Patricia Dove (GEOS) is a Founding Member of the Board of Directors, Virginia Academy of Science, Engineering and Medicine, an organization started by Sen. Mark Warner. Dove is organizing the 2014 meeting on the topic of ‘Big Data’ and has set up a steering committee with VT faculty at the National Capital Campus.


John Hole (GEOS) was awarded NSF funding for AIDA (Aftershock Imaging with Dense Arrays) data from the 2011 M5.8 Virginia earthquake, 7/15/12-7/14/13.

Notable Partnerships with external collaborators enabling VT to compete more effectively for external funding

Lara Anderson (PHYS) Invited to work as a collaborator with Harvard University (Center for the Fundamental Laws of Nature) and MIT Center for Theoretical Physics.

Shengfeng Cheng (PHYS) Gordon Research Conference on Soft Condensed Matter Physics, New London, NH, Aug. 18-23, 2013: The GRC is a major bi-annual conference for the soft matter community where Cheng began a collaboration with Dr. Uri Raviv, Hebrew University of Jerusalem, Israel, to work on the self-assembly mechanism and nanomechanics of microtubules.
Jean Heremans (PHYS) Collaboration on magnetoelectric effects in the solid-state and on multiferroic materials for electronic control of magnetic properties, with faculty and students in Materials Science and Engineering, and UT San Antonio.

Giti Khodaparast (PHYS) collaborating with the group of Chris Palmstrøm at the Univ. of California in Santa Barbara to understand the magneto-optical response of InAsP based structures. Collaborates with the theory group of Stanton at Univ. of Florida with close interactions with the Wessels group at Northwestern to study ferromagnetic semiconductors. Continuing collaborations with Ecole Polytechnique in France.

Djordje Minic (PHYS) – Collaborating with Perimeter Institute in Canada, with the Aristotle University in Thessaloniki, Greece, and with the Witwatersrand University in Johannesburg, South Africa. Grant collaborations are also pursued via these synergetic connections.

Vinh Nguyen (PHYS) Collaborating with Ian Ferguson, University of North Carolina at Charlotte, and the William States Lee College of Engineering, Energy Production and Infrastructure Center submitting a letter of intent to the Energy Frontier Research Center, DOE Office of Science in the area of rare earth doped wide band gap materials titled “Center for Multifunctional Rare Earth Enabled Devices (MREED).”

Sara Petty (PHYS) Collaborating with astrophysicists at CUA, Caltech, and NASA/GSFC for Hubble Space Telescope; also collaborating with other members of the department, and external institutes, to prepare a proposal for a Small Explorer class mission to NASA, due in late 2014; and collaborating with members from the Great Observatories All-sky LIRG Survey (GOALS) team (primarily at NRAO/UVA, and Spitzer/Caltech).

Leo Piilonen (PHYS) Collaborating with Pacific Northwest National Laboratory, University of Hawaii, University of Cincinnati, Indiana University, Wayne State University, University of Pittsburgh and University of South Alabama on the US Belle II Project, the detector construction effort for the next-generation Belle II experiment. This project has received CD-0 and CD-1 approvals from the DOE (in 2011 and 2012, respectively). The Virginia Tech portion of this proposal, to construct the new detector elements for the KL meson and muon subsystem (KLM), was deemed complete by the DOE review panels and so was granted CD-2a and CD-3a approvals to begin construction in late 2012. (VT completed the fabrication of the detector modules in August 2013, shipped the modules to KEK, and then commissioned and installed the modules into the Belle II detector’s magnet iron yoke in November 2013.)
Vito Scarola (PHYS) Collaborates with a group at Univ. of Illinois constructing a formalism to explore experiments on ultracold atoms trapped in optical lattices. Also collaborate with Oakridge on Nanophase Materials Sciences, to pair my computational methods with expertise in Dynamical Mean-Field Theory to study disorder in the Hubbard model.

Bruce Vogelaar (PHYS) Currently 13 institutions make use of the Kimballton Underground Research Facility on more than eight projects with three more groups working on using KURF, as well as interest in using the facility for CO2 sequestration. This is a natural extension from an existing MOU between VT and two universities in England, and also an agreement between the NSF and its counterpart in England.

Bruce Vogelaar (PHYS) The GEM*STAR program is multi-faceted and has many fertile avenues. As immediate focus is on the application of GEM*STAR technology to the disposition of weapons grade plutonium to satisfy treaty requirements with Russia. A framework is being developed for VT, ADNA Corp, and Muons Inc. (and others) to work together and results regarding the equilibrium isotopic distributions when burning weapons grade plutonium are being confirmed. The GEM*STAR story line is compelling and has opened doors at the NNSA, CSIS, the Russian National Academy, BARC in India, etc.

Daniel Crawford (CHEM) is working on the next major version of the program, PSI4. This effort involves roughly a dozen scientists from six major institutions, including Virginia Tech, Georgia Tech, U. Georgia, Oak Ridge National Lab, U. Massachusetts, and Bethel University. The new version of the code is substantially different from both its predecessors and all other quantum chemistry packages. We believe we are poised to make a significant impact on the theoretical chemistry community and beyond. We have already released beta versions of the program, and a full release will appear in 2014.

Richard Gandour (CHEM) has been working with BioTherapeutics, a local start up biotech company founded by Josep Bassaganya-Riera, who has recently been successful in obtaining two SBIR grants from NIH and a Catalyst grant from the Commonwealth of Virginia. He serves as the medicinal chemist for the company, which hopes to begin synthesizing molecules in-house under his direction.

Michael Hochella (GEOS) The Center for the Environmental Implications of NanoTechnology (CEINT) explores the relationship between a vast array of nanomaterials—from natural, to manufactured, to those produced incidentally by human activities—and their potential environmental exposure, biological effects, and ecological impacts. Headquartered at
Duke University, CEINT is a collaborative effort bringing together researchers from Duke, Carnegie Mellon University, Howard University, Virginia Tech, University of Kentucky, Stanford University, and Baylor. CEINT academic collaborations include on-going activities coordinated with faculty at Clemson, North Carolina State, and North Carolina Central universities, with researchers at NIST and EPA government labs, and with key international partners. Created in 2008 with funding from the NSF and the U.S. Environmental Protection Agency, CEINT performs fundamental research on the behavior of nano-scale materials in laboratory and complex ecosystems. Research includes all aspects of nanomaterial transport, fate and exposure, as well as ecotoxicological and ecosystem impacts. Additionally, CEINT is developing risk assessment tools to provide guidance in assessing existing and future concerns surrounding the environmental implications of nanomaterials. The VT team has been awarded $1.75M in funding thus far.

John Hole (GEOS) was instrumental in obtaining a university grant software license for exploration geophysics and geology from Landmark Graphics Corporation with commercial value of $60,062,866.
The Life of the Mind

Faculty and departmental teaching awards
Lori Blanc (BIOL) was selected as a 2014 Diggs Teaching Scholars.

Dana Hawley (BIOL) received the 2014 Virginia Tech Alumni Award for Excellence in Teaching.

Brent Opell (BIOL) received a Carroll B. Shannon Teaching Certificate of Excellence for 2014.

Joseph Merola (CHEM) received the 2013 William E. Wine Award for Excellence in Teaching.

Madeline Schreiber (GEOS) received a Carroll B. Shannon Teaching Certificate of Excellence for 2014.

Lawrence Sewell (MATH) won the 2013 Governor’s Award for Innovation, largely for his work on the Math Emporium.

Nahum Arav (PHYS) received a College of Science Certificate of Teaching Excellence for 2014.

Kelly Harrison (PSYC) received a College of Science Certificate of Teaching Excellence for 2014.

Undergraduate student achievements and awards
David Mackanic (CHEM) was awarded a Barry M. Goldwater Scholarship for the 2014-15 academic year.

Kaitlyn Andreano (BIOL) (Finkielstein) and Kristen Fread (BIOL) (Capelluto) received Sigma Xi Undergraduate Research Awards.

Darya Nesterova was named the College of Science Outstanding Graduating Senior 2014.

Graduate student achievements and awards
Camille Harris and Regina Wallace (BIOL) were MAOP Graduate Scholars.
ICTAS Doctoral Fellows in the College of Science for the past year were Zhe Bao, Sarah Foltz, and Laura Schoenle Thomas (BIOL), Taylor Mach and Russel Snead (CHEM), Kyle Ashley, James Dale, and Sebastian Mergelsberg (GEOS), and Chennan Hu, Jeong-ah Lee, and Kelly McCutcheon (PHYS).

Six Biological Sciences graduate students were MultiSTEPS IGERT Fellows: Nicolaas Baudoin, Jingren Deng, Ellen Garcia, Fumio Ikenishi, Renee Pietsch, Jack Whitehead, and Hang Zhang. Tamara Fetter (BIOL) was awarded an NSF Graduate Research Fellowship. Sahnzi Moyers (BIOL) received an Animal Behavior Society Student Research Grant as well as a Sigma Xi Ph.D. Research Award.


Amanda Watson (PSYC) received an American Psychological Association Dissertation Research Award. Marika Coffman, Caitlin Conner, and Andrea Trubanova received Organization for Autism Research (OAR) Graduate Research Grants to support their respective studies. Spencer Ahrenholtz (CHEM), a 4th-year graduate student, received a grant from the American Chemical Society on the basis of scientific merit.

Notable Grants in undergraduate teaching and learning

Cayalen Carey (BIOL) Co-PI (33% responsibility, 100% responsibility for VT subcontract), Catherine O’Reilly, PI, Illinois State Univ, Rebekka Darmer, Co-PI, ISU. National Science Foundation: “Transforming Undergraduate Education in STEM: The use of high-frequency data to engage students in quantitative reasoning and scientific discourse” $199,656, 7/13-6/16.
Dorothea Tholl (BIOL) National Science Foundation: "unPAK: undergraduates Phenotyping Arabidopsis Knockouts: A distributed genomic approach to examine evolutionarily important traits"; Matthew T. Rutter, PI, College of Charleston, $724,878 ($27,276 to Tholl), 8/14-7/17.

Jill Sible and Karen Eley-Sanders (BIOL), Co-PIs, NIH Bridges to the Baccalaureate. The program is designed to work with students from the Virginia Community College System to increase the number of transfer students pursuing degrees and research career paths in biomedical and behavioral sciences by providing research experiences, skills development, activities, and support during the student’s undergraduate career at Virginia Tech, $1,965,401, 9/13-8/18.


C. Ulrich, PI, J. Wilkins, B. Kreye, Andy Norton, and Megan Wawro (MATH), Co-PIs, NSF Robert Noyce Teacher Scholarship, Virginia Teach, Phase II: A Community-Based Approach to Serving Mathematics Students in Need (DUE-1339947), $800,000, 2013-18. 4-VA grant to revise the curriculum of calculus for the life sciences (in collaboration with the Department of Biological Sciences). Math Department portion: $169,968.

The Virginia Tech PhysTEC Project, Physics Teacher Education Coalition (AIP, APS, AAPT), Beate Schmittmann/John Simonetti (PHYS), PIs, George Glasson, Brenda Brand, Leo Pilonen (PHYS), Co-PIs $298,835. 2011-2014, with continuing support from the University in years 4-6 (total support from University: $269,751).

Leanna House (STAT) PI, Scotland Leman (STAT) Drezek, North, and Ramakrishnan, Co-PIs, Critical Thinking with Data Visualization (CTDV), #1141096, NSF, Division of Undergraduate Education (DUE) RFP: Transforming Undergraduate Education in Science, Technology, Engineering, and Mathematics (TUES). $199,997 (35% credit for House and Leman: $139,997). 8/12–1/16.

Notable Grants in graduate education

NSF grant for MultiScale Transport in Environmental and Physiological Systems
PI: Mark Stremler; Co-PIs: Pavlos Vlachos, David Schmale, Rafael Davalos, Shane Ross,
Daniela Cimini, Jeffrey Kuhn (BIOL); participating faculty include Iulia Lazar, John Phillips, Jianhua Xing, and Zhaomin Yang (BIOL). $2,843,830, 8/10-7/15.

Events or programs related to undergraduate education

The College of Science held 9 FYE courses ranging from discipline-specific courses, to living community experiences.

The 4VA-funded Introductory Biology Course Redesign project drove a dramatic change in pedagogy of large-enrollment courses during CY2013. The goal of the project is to convert the BIOL 1105 and 1106 Principles of Biology courses from traditional lecture format to an active class format in which video lectures are provided online prior to class and class time predominantly consists of active learning exercises. The project also involves assessment development and implementation (in collaboration with the Office of Academic Assessment), and collaborative work with Mathematics to incorporate biological examples into the math classes required by most life science majors.

Ann Stevens and David Popham (BIOL) developed a proposal to convert the department’s Microbiology Option to a Microbiology Degree and Major. In 2013 the proposal was revised based on feedback from SCHEV, with expert input from Robin Panneton (Psychology). The proposal was approved by the BOV (on 3/14) and was approved by SCHEV in summer 2014.

New Degrees - Approved

B.S. Nanoscience, Academy of Integrated Science, approved by SCHEV for Spring 2015.

B.S. Computational Modeling and Data Analytics, Academy of Integrated Science, approved by SCHEV for Spring 2015.

B.S., Microbiology, Department of Biological Sciences, approved by SCHEV for Spring 2015.

Under Review

B.S., Neuroscience, Academy of Integrated Science under SCHEV review.

B.S., Systems Biology, Academy of Integrated Science under university review.

New Courses

A total of 36 new course proposals were entered into the course catalogue. They include: 31 undergraduate course proposals; and 5 graduate course proposals.
Graduate recruitment and education

The Interfaces of Global Change Science Interdisciplinary Graduate Education Program proposal (PI: Bill Hopkins of the Fish and Wildlife Conservation Department; co-PI Jeff Walters, (BIOL) was funded in early 2013 and launched in Fall 2013. The Program, which involves 16 core faculty from 10 departments and six colleges, including seven faculty from the College of Science, has already accepted 10 students from 4 Departments.

Dana Hawley (BIOL), developed the Outreach in Biology course and offered it as the educational component of her NSF CAREER grant which aims to improve graduate student communication of science to the broader public. In order to accomplish this goal in a pedagogically rigorous way, Hawley collaborated with colleagues from VT’s Science Education program, one of whom (Jessica Stephensen, a former middle school science teacher) co-led the course. The course covered the components of an effective outreach project, the constraints that K-12 teachers face in incorporating outreach into their classrooms, essential science communication skills, and key methods of inquiry-based teaching. Each graduate student then completed a semester-long outreach project that was directly related to his or her dissertation research and adhered to the Virginia Standards of Learning. The graduate students developed lessons and took them into various local venues, including 9th grade classrooms at Pulaski High School, the Price House Nature Center, Radford University’s undergraduate Parasitology course, and the VT Entomology Department K-12 group tours.

The Geosciences Department held its 19th annual Geosciences Student Research Symposium (GSRS) March 6-7, 2014. GSRS is produced and organized by the graduate students and many faculty invite prospective graduate students to the event. The symposium is designed to allow students the opportunity to prepare and present talks in their current research areas for both professional growth and public awareness. Forty students presented talks. The organizing committee attracted funding from BP, Conoco-Phillips, and Ranger Resources.

The Mathematics Department hosted the Sixth Annual Graduate Student Mini-conference on Computational Mathematics, March 7-8, 2014, with funding from the National Science Foundation.

The Statistics Department hosted its 13th annual Corporate Partners Conference. This conference raises funds for graduate student support, and provides a venue for the partners to recruit Statistics graduate students for internships and for full employment. Partners include
American Credit Acceptance, Capital One, DuPont, Eastman, Google, Lilly, GE, Minitab, and SAS.

The Psychological Services Center was selected as a recipient of a Society for a Science of Clinical Psychology Varda Shoham Clinical Scientist Training Initiative grant. This award is for training programs offering especially innovative, transformative, or impactful proposals to improve scientifically-grounded training of graduate students. Funds will support initiatives designed to more effectively integrate science and practice into the training program.

The Statistics Department made available to its graduate students a workshop offering training in the non-technical skills required for a successful career as a professional statistician. This training, presented by Capital One and their EAGLE Mentoring program, discussed and illustrated such issues as the value of diversity, ethics and integrity in the workplace and the importance of building non-technical skills for a successful professional career.

Research experiences and experiential learning opportunities for undergraduates

Research Experience and Experiential Learning

Each department in the College offers Undergraduate Research courses (4994). In addition to these eight offerings, 15 additional courses incorporating undergraduate research. One experiential learning program in Physics involves training students and is called the Learning Assistant Program. There are four field study courses offered in the College.

Service Learning

Mathematics offers two courses in service learning. Physics offers three courses.

Notable Experiences

Caitlin Van Wickland (BIOL) and a first year ISC student, received an NIH Internship for Summer 2014.

International experiences for undergraduate students

Lori Blanc (BIOL) Research Scientist in Biological Sciences, led BIOL 3954 Hokies Abroad: Antarctica, in fall/winter 2013 (17 students total: 7 from VT, 10 enrolled through SUNY Brockport and from Hampshire College, University of Montana, Adrian College, SUNY Albany,
International experiences for graduate students

Carla Finkielstein, (BIOL), collaborated with Dan Lloyd in the Department of Biosciences at the University of Kent UK to establish a graduate student exchange program. The first exchange of students took place over Summer 2013 and involved the visit of one student from VT (Jacob Graham) for 10 weeks in a collaborative project with Dr. Michaelis at the University of Kent. Two students from Kent (Samuel Kirkham and Michela Barbato) arrived in September and stayed until mid-October in the Finkielstein lab working on their M.S. theses. Funding was provided by the PI's NSF CAREER Award for the VT student and from the Commonwealth for UK students.

Taylor Mach and Harley McAlexander (CHEM), attended the 7th Molecular Quantum Mechanics Conference in Lugano, Switzerland, in June 2013. Taylor presented a poster on “Solution phase coupled cluster response properties using and n-body approach,” and Harley presented a poster on “Circularly polarized luminescence of small chiral molecules with coupled cluster theory.”

As part of the LISA 2020 program and a grant, Marcos Carzolio (STAT), worked as an on-the-ground statistician with a survey team leader in Mozambique for two months.

Graduate students in the Geosciences Department have opportunities to study and/or perform field research in Chile, China, Costa Rica, England, Germany, India, Italy, Nepal, and the United Kingdom. For example, Rick Law’s research programs in the Himalaya (Nepal and India) expose graduate students, through extensive periods of fieldwork, to different cultures and perspectives on global issues. Brian Romans and Ph.D. student Neal Auchter spent time in southern Chile doing field work on the Cretaceous Tres Pasos Formation.

Addressing academic goals in the Plan for a New Horizon

Asim Esen (BIOL) Professor Emeritus, was awarded a Fulbright Research/Teaching grant to support a two-semester lecturing appointment during the 2013-2014 academic year. His host institution was Al-Farabi Kazakh National University in Almaty (Alma Ata), Kazakhstan.
Daniel Crawford (CHEM) developed and continues to extend a publicly accessible on-line tutorial system for teaching electronic structure theory to graduate and advanced undergraduate students, available here: http://sirius.chem.vt.edu/wiki/doku.php?id=crawdad:programming

Tim Long (CHEM) served as an ACS instructor on Biopolymers Scimind course, developed lectures and online delivery; ACS short courses 3X per year at VT for the outreach to industry.

Bob Bodnar (GEOS) participated in the Presidential Global Scholars program and taught a two-week module in Riva San Vitale, Switzerland and Naples, Italy in 2013.

Anderson Norton (MATH) received an Early Career Award from the Association of Mathematics Teacher Educators, 2013.

John Burns (MATH) was elected as a Fellow of SIAM, 2013, and was elected as an Honorary Member of the Argentinean Association for Applied, Computational and Industrial Mathematics, 2013.

PhysTEC is a program aimed at producing better educated high school physics teachers from the ranks of undergraduate physics majors. As part of the program PHYS 2305 and 2306 is taught to physics majors in a Scale-Up approach to promote the transformation of the teaching of physics using physics education research.

Using Computational Science and skills for managing and analyzing complex data sets in an interdisciplinary environment

Chris Lawrence (BIOL) served as a Scientific Advisory Board Member (fungal allergy therapeutics development) and cofounder of Alergenetics SL, an allergy therapeutics company, Tenerife, Spain and Manchester, UK. Initiated collaboration with Leone Bioventures in Roanoke to develop human antifungal therapeutic based treatments.

John Burns (MATH) and other mathematicians associated with ICAM serve as co-PI’s on Advanced Computer Design Tools for Modeling, Design, Control, Optimization and Sensitivity Analysis of Integrated Whole Building Systems, U.D. Department of Energy Energy-Efficient Building Systems Design HUB. ($122,000,000 – Virginia Tech’s share: $5,000,000).

Eric Sokol (BIOL) developed a metacommunity simulation model named MCSIMs (https://sites.google.com/site/metacommunitysimulation/) to simulate metacommunity dynamics and calculate measures of diversity (diversity partitioning and variation partitioning). The
development of this model is supported by an LTER grants from NSF and has as its short-term goal the synthesis of information collected from across the LTER network.

**Esteban Gazel (GEOS)** 4VA Grant Laboratory Techniques in Geology, Redesign of a STEM Course to Prepare Students for Graduate School and Employment, in collaboration with James Madison University. This is a course on analytical methods in the geosciences using the new and established instrumentation at VT and JMU. A group of 12 students from JMU will visit VT during Spring 2014 to be trained in sample preparation and data collection under the supervision of Gazel.

**John Simonetti (PHYS)** continued his work on accommodating a blind female Physics major Chelsea Cook, in course (PHYS 3656 Intro Astrophysics). Numerous discussions and work with other instructors in the department in helping them to work with SSD, Assistive Technologies, and Chelsea Cook worked with **Diane Walker-Green (PHYS)** in coordinating various efforts in this work.

*Teaching and learning through distance education*

**Hervé Marand (CHEM)** pioneered teaching CHEM 4615 (Physical Chemistry for Life Sciences) as a Winter course. It was a blended course and taught mostly online to 12 students. An improved student success rate, over a tradition offering of CHEM 4615, is reported.

Faculty in **Statistics** have developed several online courses for graduate and undergraduate education and plan to start offering these through NRC. The department has proposed a new master’s degree that could be taught as an online program.

Four Derring laboratory classrooms used for teaching the introductory Biology laboratory courses underwent their first renovation since 1969. The rectangular lab tables were replaced by standing-height octagonal tables, which are more ergonomic and allow for better interaction.

The Math Emporium offers 60 hours per week of short-response help, 25 hours per week of long-response help, and one weekly problem discussion section in each of five courses. This help is provided in setting in which e-learning is fully supported via the presence of 537 computers and VT-written online textbooks and online problems, for which student answers get immediate online responses that include links back to relevant lessons.
Examples of STEM related activities fostering entrepreneurship, science and technology policy, and ethics

Robert Weiss (GEOS) participated in the International Faculty Development Program and visited a number of universities in Asia, including Nanyang Technological University, Singapore. This is an initial step in building links with global partners in Singapore.

Quality and availability of academic advising from orientation through graduation

Every MATH student has a faculty advisor with whom (s)he is invited to meet at least twice annually.

Richard (Tad) Seyler and Jack Evans (BIOL) served as a Primary Evaluator for Students in Healthcare Careers. The Office of Healthcare Professions Advising (OHPA) provides guidance for students interested in healthcare areas including medicine, dentistry, pharmacy, nursing, physical and occupational therapy.

Associate Head Richard Walker directed the Biology Department’s Undergraduate Program Office, assisted by Instructor Jack Evans and three staff members. This office is a vital part of the department’s operations, providing expert academic advising to the 1300+ majors and non-majors.
The Virginia Tech Experience

Faculty Service
College-wide, 52 faculty members in seven departments have editorial positions and three additional faculty have been guest editors. Nineteen faculty members in three departments were NSF/NIH program managers or panel members. Six faculty members in two departments held leadership positions in professional societies.

Recognition for outstanding service and outreach contributions

Scott Geller (PSYC) was named one of EHS Today’s 50 Most Influential People in Safety and Health.

Thomas Ollendick (PSYC) received the Lifetime/Career Achievement Award, Association for Behavioral and Cognitive Therapies 2013.

G.G. Vining (STAT) received a 2013 NESC (NASA Engineering Safety Council) Engineering Excellence Award for collaborations with the NESC.

Notable service includes:

Daniel Crawford (CHEM) senior editor for the Journal of Physical Chemistry as well as Secretary/Treasurer of the Physical Chemistry Division of the American Chemical Society.

Patricia Dove (GEOS) Principal editor, Elements; Associate editor, Proceedings of the National Academy of Science; editorial advisory board of the journal, Bioinspired Materials.

Economic development
Randy Heflin (PHYS) Heflin’s company, Virginia Nanotech, continues to work on commercialization of a patented biosensor platform consisting of a long-period grating optical fiber with nanoscale polyelectrolyte coatings. The goal of the project is to develop an inexpensive and rapid (<1 hour) test for identification of infection by meticillin-resistant Staphylococcus aureus (MRSA). More than 10,000 people per year in the U.S. die from MRSA infections and >100,000 per year are hospitalized due to them. The current method for identification of MRSA infection is done at a specialized lab and requires 2-3 days, so a rapid
identification technique could save lives and reduce the duration of or eliminate a large number of hospitalizations.

**Bob Bodnar (GEOS)** leads a program to develop methods for the quantitative analysis of hydrocarbon fluid inclusions. Chevron Energy Technology Company. 18 month project; $49,260.

**John Hole (GEOS)** The department strengthened links with industrial sponsors as he renewed a 3-year Landmark Graphics Corporation University Grant Program software license, with a commercial value of $60,062,866.

**Brian Romans (GEOS)** Industry Consortium: ‘Chile Slope Systems: Architectural Analysis and Modeling of Outcropping Slope Deposits, Magallanes Basin, Chile’, a multi-disciplinary and multi-institution research program with University of Calgary and University of Utah; Proposal sent to companies in December 2012; 13 companies have agreed to sponsor for a consortium total of $1,690,000 with $356,000 of that total delivered to Virginia Tech over three years (2013-2016).

Industrial sponsorship: ConocoPhillips: Graduate fellowship Award for $25,000. Northrup Grumman, $5,000 for education using Geosciences Museum.

**John Burns (MATH)** has developed a promising scientific relationship with United Technologies Corporation.

The DOE Energy Hub grant (J. Burns and other ICAM members, Co-PI’s) was awarded to a consortium of 24 partners, including Penn State, United Technologies, Lawrence Livermore National Laboratory, and IBM.

**Study abroad programs**

College faculty led study abroad programs in Antarctica (BIOL), New Zealand (BIOL) and Australia (BIOL) as well as a winter session course in France and Germany (COS).

**PK-12 STEM programs**

**Carla Finkielstein (BIOL)** hosted five high school students in her lab, meeting twice a week for 10 weeks. One student won first place for her presentation of her work at a regional high school competition.
Mike Rosenzweig (BIOL) Biological Sciences Outreach Program (Bio SOuP) directly supervised 16 highly engaged students and 120 other undergraduate service students; Participated with the VT STEM K12 Outreach Initiative, and with VT Engage. Bio SOuP shares classroom kits (see http://www.biol.vt.edu/oureach) with area teachers.

NSF Robert Noyce Teacher Scholarship, Virginia Teach, Phase II: A Community-Based Approach to Serving Mathematics Students in Need (DUE-1339947), C. Ulrich (PI), J. Wilkins, B. Kreye, Andy Norton and Megan Wawro (MATH) (Co-PIs), $800,000, 2013-18.


The department of Physics continues its outreach efforts to elementary, middle and high school with the VT Physics Outreach Program.

Community and student engagement

Lisa Belden (BIOL) SEEDS Board of Directors (non-profit nature education, 2012-present); Designed and completed science activities with local elementary school students (PreK-1) on "Amphibian life cycles and biodiversity."

Bryan Brown (BIOL) Led the Urban Waterbodies project that works directly with The Columbia Association, the aquatic management agency in Columbia, MD.

Cayelan Carey (BIOL) collaboration with the Western Virginia Water Authority to improve drinking water quality in the Roanoke region and worked with local and regional media creating outreach on this project; organized a Saturday event at the Blacksburg Nature Center with Bryan Brown and Mike Rosenzweig, entitled “What’s in your neighborhood pond and stream?”

Carla Finkielstein (BIOL) Participant, National Breast Cancer Lobby Day 2013; Organized Breast Cancer Advocates’ visit to Virginia Tech as well as “Pretty in Pink”; Guest Speaker at
four local events highlighting breast cancer awareness; Volunteer, Blue Ridge Affiliate, Susan G. Komen.

**Ignacio Moore (BIOL)** met with students from the USFQ in Ecuador to talk about biological research in the cloud forest; led a group of Ecuadorian university students as part of the Mindo Christmas Bird Count in December, 2013.

**Michael Rosenzweig (BIOL)** Advisor to The Virginia Tech Chapter of UNICEF; Founder and Director of SEEDS (Seek Education, Explore, DiScover), which brings informal and K-12 STEM education and community outreach to families in the region through programs, camps and collaboration with Bio SOuP.

Museum of **Geosciences** hosted 9,600 visitors including 1,200 academic, course-related visits from 10 VT courses. Outreach programming served 4,532 people, including 1,408 K-12 youth, and 220 K-12 educators. Provided 56 loans of teaching kits and materials.

**Psychology**: Psychological Services Center and Child Study Center and Autism Clinic provided psychological services to over 200 local community residents.

**International collaborations and programs**

**Daniela Cimini (BIOL)** was a visiting faculty member at the University “Roma TRE” in Rome, Italy for two weeks in June, 2013.

**Silke Hauf (BIOL)** was Planning Group Member for the Japanese-German Frontiers of Science Symposium in Kyoto, Japan, in October 2013, organized by JSPS and the Alexander von Humboldt Foundation, aimed at fostering scientific interactions between the two countries.

**Khidir Hilu (BIOL)** works with Susana Neves, Instituto de Tecnologia Quimica e Biologica, Universidade Nova de Lisboa, Portugal, on a National Geographic Society grant proposal and field work on the islands of Madeira and Corsica.

**Steve Melville (BIOL)** collaborates with Bruno Dupuy, Pasteur Institute, Paris, France, to examine the mechanism of toxin secretion in *Clostridium difficile*; with Dr. Mario Feldman of the University of Alberta, Edmonton, Canada, on glycosylation of *C. perfringens* pilins; and with Dr. Lisa Craig at Simon Fraser University, British Columbia, Canada, to determine the structure of the *C. perfringens* PilB2 protein.
Zack Nimchuk (BIOL) collaborates with Michael Hothorn at the Max Planck Institute-Tuebingen, Germany, and Dr. Teva Vernoux at the Ecole Normale Supérieure de Lyon, France.

John Phillips (BIOL) collaborates with Peter Hore at Oxford University, UK, on “Magnetic alignment behavior, and effect of mercury toxicity on yearling snapping turtles”; with Chris Anderson of the US Naval Academy and Hynek Burda at the University of Essen, Germany, on “Magnetic field involvement in hunting behavior of red foxes.”

Birgit Scharf (BIOL) collaborates with Steven Porter from the University of Exeter (UK) and Orkun Soyer from the University of Warwick (UK) to study the phosphate sink containing two-component signaling systems in bacteria as tunable threshold devices.

Dorothea Tholl (BIOL) has research collaborations with Dr. Mwafaq Ibdah of the Agriculture Research Organization, Newe Yaar, Israel, with Dr. Woei-Jiun Guo at the National Cheng Kung University, Taiwan, and Dr. Phillip Brewer at the University of Queensland, Australia.

Zhaomin Yang (BIOL) hosted a visiting scholar from China, Chengyun Li, in his laboratory; he also co-edited a book on Myxobacteria with Penelope Higgs of the Max Planck Institute for Terrestrial Microbiology, Marburg, Germany.

Lou Madsen (CHEM) collaborates based on a joint IUPAC/NSF grant with Martin Moller, U. Aachen, Germany, and Dimitri Ivanov, U. Mulhouse, France.

Edward Valeev (CHEM) continues his collaborations with Prof. Frank Neese, the Director of MPI for Chemical Energy Conversion Chemie, Mulheim, Germany.

Webster Santos (CHEM) is involved in three-nation research study funded by the NSF, the National Science Foundation of China, and the German Deutsche Forschungsgemeinschaft.

Adam Dominiak (ECON) Visiting Professor at Paris-Dauphine University, June-July 2013.

Aris Spanos (ECON) Sound econometrics in action - Constructing a Macroeconometric Model for the Cyprus Economy, May-July 2013.

Ying Zhou (GEOS) collaborates with Qingju Wu at Institute of Geophysics, China Earthquake Administration on surface wave inversion.

Camillo Mariani (PHYS) collaborates with Italian nuclear theorists Omar Benhar and Davide Meloni on integrating new nuclear models in the GENIE neutrino interaction generator trying to
understand the effect of nuclear models on the determination of neutrino oscillation parameters.

**Vinh Nguyen (PHYS)** collaborates with Olle Inganäs in biomolecular and organic electronics, Linköping University, Sweden, studying the picosecond dynamics of conducting polymers through the use of terahertz spectroscopy; and Ben Murdin, Advanced Technology Institute, University of Surrey, UK, on the study of dynamics of electrons in nano-semiconductor structures.

**Kyungwha Park (PHYS)** collaborates with the experimental group at Delft, Netherlands on oscillations in differential conductance as a function of external magnetic field at the charge degeneracy point in single-molecule junctions of single-molecule magnet Fe4; and Antwerpen, Samsung, Korea on understanding topologically protected surface states in topological insulator Bi2Se3 with magnetic adatoms and impurities; and the Han group at KAIST in Korea on Topological insulator Bi2Se3 in contact to ferromagnetic semiconductor

**Michel Pleimling (PHYS)** collaborates with Malte Henkel, Nancy, France, on various aspects of the physics of systems far from equilibrium, especially aging systems; and Andrea Gambassi, Trieste, Italy, on non-equilibrium dynamics in systems with surfaces; with Jae Dong Noh, Seoul, S. Korea on aging in nonequilibrium growth processes; and Claude Godrèche, Saclay, France, on non-equilibrium properties of a novel class of driven systems; and with Hildegard Meyer-Ortmanns, Jacobs University Bremen, Germany on population dynamics of many-species systems.

**Vito Scarola (PHYS)** collaborates with Matthias Toyer, ETH Zurich, Switzerland, performing ab initio studies of quantum Hall systems; and Algorithms and Libraries for Physics Simulations, a large international group of physicists and computer scientists seeking to collect numerical algorithms to study condensed matter phenomena into one comprehensive framework freely available to researchers and students.

**Eric Vance (STATS)** collaborates with LISA 2020, a program to create a network of 20 statistical collaboration laboratories in developing countries by 2020.

**Ying Zhou (GEOS)** maintains strong collaborations with Qingju Wu at Institute of Geophysics, China Earthquake Administration on surface wave inversion using broadband experiment data in northern China.
Addressing collaborative and service goals in the Plan for a New Horizon

Chris Lawrence (BIOL) served as a Scientific Advisory Board Member (fungal allergy therapeutics development) and cofounder of Alergenetica SL, an allergy therapeutics company, Tenerife, Spain and Manchester, UK. Initiated collaboration with Leone Bioventures in Roanoke to develop human antifungal therapeutic based on existing leads from Joe Falkingham’s (BIOL) group at Virginia Tech.

Webster Santos (CHEM) co-founder of Sphynkx Therapeutics, which licenses intellectual property from the Santos lab, with VT and UVA, received $400,000 grant by Virginia Bioscience Health Research Corporation (VBHRC) to improve lead compounds for the treatment of chronic kidney disease.

Paul Carlier (CHEM) is working with researchers at the University of Florida and Molsoft LLC (San Diego) to devise compounds that would kill disease-transmitting insects by blocking potassium ion channels. He is also collaborating with researchers at New York Structural Biology Center to develop drugs to prevent and treat infections by emerging bacterial pathogens.

Bob Bodnar (GEOS) leads a program to develop methods for the quantitative analysis of hydrocarbon fluid inclusions with the Chevron Energy Technology Company. This is an 18-month project; $49,260.

John Hole (GEOS) renewed a 3-year Landmark Graphics Corporation University Grant Program software license, with a commercial value $60,062,866.


Sallie Keller (STAT) is working on issues related to inventory and sales. This involves massive sets of data from different countries.
Diversity-Related Accomplishments

The College of Science is actively working to achieve a more diverse and inclusive undergraduate and graduate student body, faculty and staff. The College is achieving these goals through active recruitment and retention strategies, which are in alignment with the Diversity Strategic Plan.

In order to frame the progress of the College in these areas, a comparison of data from 2004 to 2013 shows the progress of the College of Science. During this time, COS experienced:

- An increase in full time female faculty from 22% to 29%.
- A decrease in female undergraduates from 58 to 51 percent, despite growth of the female population by 232 students.
- An increase in female graduate students from 38% to 41%.
- An increase in full-time faculty classification from 15% to 22% listing other than white.
- An increase from 25 to 30 percent of undergraduates reported themselves as other than white and similar reporting in graduate student populations increased from 48% to 53%.

Over this 10 year period, the College made significant strides in achieving a more diverse and inclusive academic community. The College’s diversity-related accomplishments are aligned with the four domains of the Diversity Strategic Plan. They are described below.

Alignment with the Diversity Strategic Plan

Access and Success

Summer Bridge Program

The College’s effort to increase retention and diversity in the physical and quantitative science continued with the NSF funded Summer Bridge Program (SBP). This effort is made possible through a $2M NSF STEP grant awarded to Jill Sible, Debbie Wilson, Gary Long, Bevlee Watford and Kathryn McConnel. The SBP was implemented in collaboration with the College of Engineering’s Summer Transition Program. COS hosted its second SBP in Summer 2013 with 19 incoming freshmen that had selected majors in the college. All of these students lived in on-campus learning communities for the year (Da Vinci, Curie, Honors, or the Corps).
The 2013 demographic data shows 60% underrepresented minorities and 44% female in SBP. The Currie data are 25% underrepresented minorities and 44% female.

For 2014, the makeup of the SBP offering has been changed to concentrate more fully on mathematics instruction, per the request of the NSF. The current SBP has been decoupled from the College of Engineering’s Summer Program.

**Gateway Program**

The College participated in the Gateway program, which targets underrepresented students that were offered admission but have not yet made a decision to attend Virginia Tech. Of this year’s participants, 38 of the matriculating students listed a major in the College of Science.

**Campus Climate and Intergroup Relationships**

**The KAUST Program**

In collaboration with the Language and Culture Institute, the COS offered a full-year, pre-baccalaureate experience to 17 Saudi Arabian students sponsored by the King Abdullah University of Science and Technology (KAUST). The COS is continuing the KAUST program for the 2014-2015 academic year.

**AdvanceVT**

**Madeline Schreiber (GEOS)** is the college liaison with AdvanceVT. She met with 44 candidates for faculty positions in the college during AY 2013-2014.

**International Outreach**

**Esteban Gazel (GEOS)** applied to the National Science Council, Ministry of Science and Technology of Costa Rica to obtain funding for Hispanic graduate students from Costa Rica to attend Virginia Tech. He was successful for an award of $89,157 for “Superplumes, Large Igneous Provinces and Oceanic Anoxic Events” to support Pilar Madrigal for her Ph.D. project (Award No. MICITT-274-2013).
Education and Scholarship

The ISC Program

The Integrated Science Curriculum enters its fourth year in Fall 2014. To date, 71 students have been involved in the program. In the most recent cohort of students, 26% of the class was made up of students from underrepresented populations. Women comprised 56% of the most recent class.

Funded Proposals

Megan Wawro (MATH) PI on NSF Transforming Undergraduate Education in STEM, MPWR: Mentoring and Partnerships for Women in RUME (DUE-1352990), M. Wawro (PI), Jessica Ellis and Hortensia Soto-Johnson, senior personnel, $44,148, 2013-14. She organized the meeting supported by this grant and held it in February, 2014.

Institutional Infrastructure

As noted in the scorecard, the College has experienced a significant rise in the number of underrepresented students over the past three years. We anticipate this growth will continue with the establishment of the new degree programs (approved and pending). The attractive nature of these STEM-H programs should garner more interest from all students.

The College is working both in the Departments and the Academy to advertise the current departmental programs and the new programs of the College and the Academy. Of keen interest is the recruitment of underrepresented students.

Work on planning, implementing and reporting within the College is occurring. The Associate Dean meets with the Undergraduate Program Directors of each Department. A focal point this year is the strengthening of the current college diversity plan, especially with regard to the implementation and reporting processes.

College of Science Diversity Committee

The Diversity Committee, Chaired by Madeline Schreiber continued to fulfill its charge to work with new diversity initiatives in the college, to provide the COS faculty and other colleges with information on diversity programs, to foster a positive climate of multiculturalism in COS, and to support and reward collaborative initiatives and partnerships that promote and recognize the importance of multiculturalism.
Major activities of the committee were the organization of the first COS Diversity speaker, Milton Slaughter on February 29, 2014 and the continued interaction with the Office of Diversity and Inclusion.

*Future Diversity Goals of the College*

The College of Science is firmly committed to the goals set forth in the University’s Diversity Strategic Plan.

In the area of undergraduate students, the College will continue its efforts with the Summer Bridge program in order to enhance gender and ethnic diversity in the STEM programs.

The Integrated Science Curriculum will interact with the Summer Bridge program to engage new STEM students with the unique pathway of the ISC curriculum.

The KAUST program will continue to engage new international students in STEM education at Virginia Tech.

The College’s efforts through AdvanceVT will remain involved in promoting our work in diversity and inclusion and will continue to be a strong part of our recruiting efforts.

*Diversity awards and honors*

Four faculty members and three students received diversity awards from the Office of Services for Students with Disabilities; two faculty members received College diversity awards; and one faculty member received an award and funding for international graduate students to attend Virginia Tech.

Patricia Amateis (CHEM) received a 2013 Excellence in Access and Inclusion Award, presented by the Office of Services for Students with Disabilities.

Susan Anderson (MATH) won the 2013-2014 College of Science Diversity Award.

Susan White (PSYC) received the Sally Bohland Award for Exceptional Leadership in Providing Access and Inclusion.

Susan White (PSYC) and Angela Scarpa (PSYC) received Excellence in Access and Inclusion Awards from the Services for Students with Disabilities Office and the Office for Diversity and Inclusion.
Geological Sciences graduate students Kathryn Donlon, Merage Ghane-Ezabadi, and Andrea Trubanova received Excellence in Access and Inclusion awards from SSD Office for their work with the Game Group.

The following students received MAOP Scholarships:

Biological Sciences: Meryl Anne Dexter, Yasir Hussein, Juliana Pham

Chemistry: Marsella Hatfield, Ann Gutierrez-Lemus, Brooke Van-Derpeol

Geological Sciences: Kathleen Craft, Kristin Dorfler

Psychology: Ilana Elias, Meili Liu, Shawnna Mencias, Stephanie Vu, A. J. Simmons

VT-IMSD Scholars: Albert Hinman, Ayana Stukes, Camille Harris, Regina Wallace, Bianca Baker, Tristan Hayes, and David Vasquez (BIOS), Shara Grant and Bryce Riley (PSYC).

Faculty Searches and Hires

In this past academic year, the College conducted 13 searches for tenure track faculty. Nine of the searches were departmental with the remaining four being academy searches. One of the academy searches was a senior position.

Advertisements were placed in the relevant scientific magazines, publications and websites. Of the submitted applications, 44 candidates were invited to interview.

AdvanceVT played an important role in the on-campus interview process. Madeline Schreiber (GEOS) is the college liaison with AdvanceVT and met with each of the 44 candidates.

Candidates met with faculty and presented seminars. They met with the search committee and members of the Dean’s office. Care was taken to ensure uniformity in all campus visits.

The search process was successful in achieving five hires. There were also two conversions. One of the five hires was a female and one of the two conversions was a female. Of the five hires, two were from Asia. One of the conversions was from Asia.
Academy of Integrated Science

The Academy of Integrated Science (AIS), launched July 1, 2013, manages multi-departmental and interdisciplinary degree programs, minors, and curricula housed within the College. The Academy’s first year involved a major push to submit four undergraduate degree programs for approval, while also conducting faculty searches in support of AIS initiatives which include the current Integrated Science Curriculum and the Science, Technology, and Law minor. The submitted degree programs are in Computational Modeling and Data Analytics (CMDA), Nanoscience, Neuroscience, and Systems Biology. Synopses for all of these programs, and lists of associated faculty, may be found at www.science.vt.edu/ais.

Current Activity

New degree programs

CMDA. The CMDA degree, approved in Summer 2014, is open for enrollment in Spring, 2015, and the CMDA introductory sequence (CMDA 2005-6) will commence Fall, 2015. Three upper level CMDA courses, enrolling a total of 64 students, were offered for AY 2013-14 as electives for students having sufficient mathematics, statistics, and computer science background. The CMDA colloquium series began this past year. For a listing of CMDA courses, please see Table 1 on Page 43.

An assistant professor search for CMDA, seeking specialization in data analytics, machine learning, stochastic modeling, or related computationally intensive statistical methods, was conducted this past academic year. Four candidates were interviewed during the spring semester, and one offer was made, however, the committee decided to roll the search to the coming year.

Nanoscience. The Nanoscience degree proposal was approved by SCHEV during Summer 2014. The B.S. in Nanoscience degree program will be open for enrollment in Spring, 2015. We are already offering a full slate of courses, with 10 courses enrolling 116 students during AY 2013-14. In addition, the highly successful Nanoscience Winter semester course debuted in January 2014. For a listing of NANO courses, please see Table 1 on Page 43.
An open search for a faculty member in support of the Nanoscience degree was conducted this past academic year. The search sought expertise in areas including (but not limited to) physical characterization of nanoscale order in multi-phase systems, physical and chemical phenomena leading to morphological development and molecular assembly, and structure-morphology-property relationships in nanoscale systems, including nanoparticle, macromolecular, and supramolecular structure. Four candidates were interviewed during the spring semester, and the top choice has been hired. Greg Liu joined the Chemistry Department this fall, coming to us from a Northwestern postdoc following his PhD at Wisconsin-Madison.

**Neuroscience.** The Neuroscience degree proposal passed the Board of Visitors on June 2, 2014. The SCHEV proposal (a greatly expanded version of the internal VT proposal) is now undergoing final revision prior to being forwarded to SCHEV. It is possible the degree could be initiated as soon as Fall, 2015. Six neuroscience courses were offered in AY 2013-14, enrolling 121 students, and 10 are scheduled for the coming year. For a listing of NEUR courses, please see Table 1 on Page 43.

A senior search for a faculty member in support of the Neuroscience degree was conducted this past academic year. The search sought to bring a significant presence in neuroscience to the Blacksburg campus, to spearhead the launch of the Neuroscience degree and to guide building a core neuroscience faculty. Four candidates were interviewed during the spring semester, but the search committee recommended none of them for offer. The search will be rolled to the coming year, prior to which its scope will be re-evaluated.

An instructor search, conducted in May and June of this year has resulted in the hiring of Vicky Tu as Neuroscience Instructor who joined us in August after completing a postdoc with Rachel Diana in the VT Psychology department.

**Systems Biology.** The Systems Biology degree proposal is currently before the Commission on Undergraduate Studies and Policies. Ten courses comprising 36 credits have been approved, with first offerings expected for Fall 2015. For a listing of SYSB courses, please see Table 1 on Page 43.

An assistant professor search in support of the Integrated Science Curriculum, seeking candidates with a research focus in chemical biology, molecular systems biology, or
computational cell biology, was conducted this past academic year. This search interviewed four candidates during the spring semester. Unfortunately, the position could not be filled.

Table 1: Core courses for each new major. Course descriptions may be found in the University Catalog or at [www.science.vt.edu/ais](http://www.science.vt.edu/ais).

<table>
<thead>
<tr>
<th>CMDA</th>
<th>NANO</th>
<th>NEUR</th>
<th>SYSB</th>
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<tbody>
<tr>
<td>Quantitative Science</td>
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<td>(1)</td>
<td>(4,4)</td>
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<td>(6,6)</td>
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<tr>
<td>3605-6: Mathematical</td>
<td>2024: Quantum Physics of Nanostructures (4)</td>
<td>2025-6: Introduction to Neuroscience (3,3)</td>
<td>3035-6: Systems Biology of Genes and Pro</td>
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<td>Modeling: Methods</td>
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<td>teins (4,4)</td>
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<td>and Tools (3,3)</td>
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<td>3634: Computer</td>
<td>2114: Nanoscience Research Seminar (1)</td>
<td>2035-6: Neuroscience Laboratory (1,1)</td>
<td>3115-6: Network Dynamics and Cell</td>
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<td>Science Foundations</td>
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<td>Physiology (4,4)</td>
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<td>for CMDA (3)</td>
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<td>3654: Introductory</td>
<td>2124: Nanoscience Research Rotations (2)</td>
<td>3044: Cell and Molecular Neuroscience</td>
<td>4065-6: Research Experience in Systems</td>
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<td>Data Analytics and</td>
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<td>(3)</td>
<td>Biology (4,4)</td>
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<td>Visualization (3)</td>
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<td>4654: Intermediate</td>
<td>3015-6: Nanoscale Synthesis, Fabrication, and Characterization (4,4)</td>
<td>3084: Cognitive Neuroscience (3)</td>
<td>4135-6: Professional Development in</td>
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<td>Data Analytics and</td>
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<td>Systems Biology (2,2)</td>
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<td>Machine Learning (3)</td>
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<tr>
<td>4864: CMDA Capstone</td>
<td>3114: Professional Dissemination of Nanoscience Research (1)</td>
<td>4034: Clinical Neuroscience (3)</td>
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<td>Project (3)</td>
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<td>3124: Nanoscience</td>
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<td>and the Environment</td>
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<td>(3)</td>
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<tr>
<td>4124: Advanced</td>
<td>4044: Senior Neuroscience Seminar (3)</td>
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<td>Nanomaterials and</td>
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<td>Devices (3)</td>
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<td>4314: Nanomedicine</td>
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| 30 credits total      | 32 credits total          | 24 credits total          | 36 credits total          |

30 credits total | 32 credits total | 24 credits total | 36 credits total
Integrated Science Curriculum

The Integrated Science Curriculum (ISC) is an intensive, two-year, 32-credit program for entering freshmen presenting freshman and sophomore-level biology, chemistry, mathematics, physics, and statistics in a comprehensive learning environment. Launched in 2011, we have 31 students (11 from the 2011 cohort, 20 from 2012) who have completed the program and moved on to their chosen majors. Of these, 15 are pursuing their degrees in Biological Sciences, six in Biochemistry, four in Mathematics, four in Physics, one in Psychology, and one in Sociology. The 2013 cohort has 24 students ready to move into their second year of ISC, and 35 have joined the program as freshmen in Fall 2014.

Science, Technology, and Law

Science, Technology, and Law (STL) is a university minor focusing on the myriad issues surrounding intellectual property law as it pertains to scientific research and product development. The minor was approved Spring 2012 with first enrollees in Fall 2012. In its first two years of availability, 37 students have enrolled in, and 14 students have graduated with, the minor. In October, 2013 the inaugural STL Symposium featured Dr. Christoph Ann, a renowned European intellectual property lawyer and Professor at Technische Universitat in Munich, Germany, as its keynote speaker. The STL Symposium will be held annually as a platform for faculty, students, alums and friends of the STL program to network and to discuss current intellectual property topics.

Moving forward

Research opportunities that span traditional disciplinary boundaries continue to grow, and with these the need to provide appropriate educational avenues for aspiring scientists seeking to pursue evolving, interdisciplinary areas. The coming academic year will see the Academy working to cement the foundation for the new degree programs in preparation for their first entering classes in AY 2015-16. Unfilled searches from AY 2013-14 will be rolled and opened again. It is not yet known if any new positions will be available. College-wide informational meetings will be held to keep faculty abreast of developments and to welcome all who wish to participate in any capacity. Executive committees for each degree program are now being assembled, with members appointed by departments involved in delivering the degrees.
The most important ingredient for success of these programs is harmonious interactions of the faculty, the departments, and the institutes whose interests overlap, and who wish to see students educated in these areas and in novel ways. AIS staff will be working to promote these interactions in ways that are beneficial for all. The Academy is an evolving enterprise that needs and welcomes input from the entirety of the Virginia Tech community.
Progress Against the Metrics in the University Scorecard

The College recognizes the importance of the scorecard in gauging the growth of the College in accordance with the University’s Strategic Plan. Of the 17 graded metrics, the College has growth in nine of the areas. Three of the areas show no change. Five of the areas indicate a decline in the metrics.

The Office of the Dean has carefully considered these areas. The following reflections are offered to help frame the assigned score in light of current physical/fiscal conditions. The reflections are grouped according to the resulting score.

3-year trend shows growth

FYE experiences

The College has been active in promoting the FYE experiences. As of this AY, each department in the college has or will have an FYE experience. Four of the courses have been entered into the course catalogue. The remaining four courses have currently funded FYE proposals and will be submitting course proposals to governance. The college will achieve a near 100% enrollment measure in the forthcoming AY.

Underrepresented students in the first year class

Growth in this area is an important role in establishing a vibrant community of 21st century science scholars. The 30% increase over 2012 is largely due to university programs and individual efforts of departments.

Degrees awarded to underrepresented students

As with our efforts in the first year class, the College’s commitment toward achieving a diverse student body has seen a 40% rise in Bachelor’s degrees for this year, as compared to 2012. Graduate degrees are approximately level for this period.

Student credit hours

The College continues to teach a large percentage of university students. Of note is the Winter offering of 199 Student Credit Hours.
Percentage of graduating students who participated in virtual and/or technology assisted courses

The College continues to have a strong presence in providing courses in these areas, as shown by the measurement of 80% or greater on the scorecard. With the addition of the newly approved degrees in the Academy of Integrated Science, it is expected this percentage will rise in the years to come.

Total expenditures in grants and contracts

As reported to the NSF our total College expenditures are $37.0 M for the year. In this time of fiscal uncertainty of funding sources, the College continues to maintain a strong funding record.

Faculty awards, fellowships and memberships

As noted by the National Science Foundation, the Faculty of the College of Science continue to be recognized in for their contributions in their fields.

Industry-funded research expenditures

As reported to the National Science Foundation, industry-funded research expenditures have doubled since 2012.

Study Abroad and Foreign Language

With the addition of new departmental programs, the percentage of students participating in study abroad programs will rise. With our eye on the international collaboration of our faculty, it is hoped that more of our COS students will become involved in foreign language courses.

3-year trend level or mixed

Graduate enrollment profile

Per the university proposal to increase the number of graduate students, the College wishes to increase its enrollment by an additional 350 students over the next decade. This addition, however, will necessitate the increase of 100 additional faculty to our ranks.

Sponsored Awards

The College continues to be competitive in research funding with the number and average amount of the awards having minimal fluctuations. The College anticipates the research
activity, from the new programs in the Academy of Integrated Science (AIS), to allow the faculty to be competitive in grant submissions to federal agencies with larger funding streams. This integrated approach (team building) with the AIS, the College, and Faculty from other Colleges and Institutes, is the first step in these efforts. Extramural participation in research teams is envisioned and will be promoted by the College.

Diversity of the faculty

There is no significant change in the diversity of our faculty over the past three years. We will continue our work with AdvanceVT in working with faculty candidates on issues of diversity.

3-year trend shows decline

Number of students involved in research experiences

The College takes exception to the evaluation of this metric. As noted earlier, the College has eight 4994 undergraduate research courses and another 15 courses that involve undergraduate research. We believe our listing of courses identified with this research attribute is not complete.

A list of our courses was provided to the Office of the University Registrar in Spring 2014. We believe the courses meet the scorecard metrics as defined by the Office of the University Registrar.

We believe the reported number of 56.3% is low and not reflective of the College’s effort in this area.

Total Degrees Awarded by Level

We note the decline, but feel that it is within variance. We will be monitoring this metric closely.

STEM-H degrees awarded

The use of the CIP codes in this metric does not include Psychology (clinical). Psychology has a strong clinical component, and we feel their numbers should be included.

Undergraduate participation in service learning and experiential programs

The College currently has five service learning courses and 16 courses in experiential learning. A list of our courses was provided to the Office of the University Registrar in Spring 2014. We
believe the courses meet the scorecard metrics as defined by the Office of the University Registrar.

*Number of Postdocs*

We note the decline, but feel that it is within variance. We will be monitoring this metric closely.
Administrative Quality and Improvement (AdQI)

2013-2014 Assessment Practices

In 2013-2014, the College hosted an external review of the Chemistry Department and college reviews of the Biological Sciences, Chemistry, and Psychology chairs. The College also held a review of the Arlington Innovation Center. The assessment practices of the departmental and chairs reviews were consistent with university practice. Associate Dean J.P. Morgan oversaw the reviews.

The findings of the Chemistry review noted the substantive role the department plays in the undergraduate education and the quality of the graduate research program. Concerns raised were over research space, the future of the polymer program, graduate support, and interdisciplinary programs.

The three chair reviews indicated a high level of support of each chair. A common finding of the assessments was the need of improved communication with the administration of the College.

Changes Implemented over the past three years

Through the information provided in assessments of departments and chairs, changes have been instituted in the College. These changes include the areas of communication, research space, graduate support and interdisciplinary programs.

In order to foster increased communication between the college and the departments, the Chairs and the Deans meet together on a monthly basis. Individual meetings between the Dean and the individual Chairs occurs on a monthly basis. Bi-monthly “small group” meetings of four chairs and the Dean are scheduled.

Research space is a challenging issue. As noted in the Chemistry review, there is a perceived lack of research space. While the newly renovated wing of Davidson Hall opened this summer, no new research space was gained, as many researchers had been placed in temporary lab spaces at the CRC. For the department to grow in research stature and graduate population, additional space is needed.
Likewise, graduate support is a growing issue for all departments. External support is often tied to research awards, which in turn is linked to lab space. The College recognizes this critical issue. As additional support from the Commonwealth will not be realized in the next two years, the College believes the pursuit of multidisciplinary research proposals may provide an extra level of support to all departments.

Over the last three years, Interdisciplinary programs and faculty hires is an avenue that is not fully appreciated by all faculty. There is a general misunderstanding of interdisciplinary programs among faculty. The College administration has met with the faculty of each department to explain the vision of interdisciplinary programs and the positive impact the program can have on both external funding (by allowing a team of researchers to be more competitive in responding to RFPs from agencies that have larger funding streams than the NSF) and the impact a broader knowledge base will have on their graduate students. As the AIS graduate programs will soon be developed, the positive results of such multi-PI proposals may help change faculty attitudes.

A final change that occurred is the clarification of review practices and procedures for department and chairs. Associate Dean J.P. Morgan works with the departments and external review committees on these matters.

**Action plans for 2014-2015**

In the forthcoming academic year, an external review of the physics department will occur. Associate Dean J.P. Morgan will coordinate the external review and ensure that it is consistent with the external review policy.

Communication with department chairs and heads will continue and be modeled on the changes adopted from the assessment practices.
Contact Information

Lay Nam Chang
Dean

JP Morgan
Associate Dean

Gary Long
Associate Dean

College of Science
North End Center (0405), Ste 4300
300 Turner St., NW
Blacksburg, VA 24061
Tel 540-231-5422
Fax 540-231-3380
www.science.vt.edu