HCC and STEM

Knowledge for a Global Economy

SCIENCE • TECHNOLOGY • ENGINEERING • MATH

HAGERSTOWN COMMUNITY COLLEGE

A message from HCC's president

So often these days we hear from both government and business leaders at all levels that nothing is more critical to our country's future economic success than the reemergence of the United States as the world leader in STEM (science, technology, engineering, mathematics) education. Today, more than two dozen nations are arguably doing a better job than the United States in educating their citizens for math and science careers vital to a country's success in the global economy. It is important that the workforce in the Washington County region increase the number of people who are well educated in STEM-related skills and knowledge, if we are to compete well in bringing new-century, high-skill, high-wage jobs to local communities.

This report is intended to provide assurance that HCC is not resting on the success of its current programs, but that as the community's open-access higher education gateway, we are doing a variety of valuable things to make innovative STEM opportunities available to local citizens. Whether it be health sciences, biotechnology, information technology and cybersecurity, engineering, alternative energy, or applied mathematics, HCC is doing all it can, along with its local educational partners, to provide the community with STEM education-based opportunities that will heavily influence the success of the local economy. For example, an extraordinary partnership between HCC and Washington County Public Schools has begun through the creation of a STEMM (science, technology, engineering, mathematics, medicine) Technical Middle College on the HCC campus. This skill-based educational program allows high school students to earn a high school diploma and at least 30 college credits simultaneously. Many will complete college certificates and degrees by the time they graduate from high school.

As HCC further develops its STEM programs, rest assured that an emphasis on educational programs in the humanities, social sciences, and business will continue, as they are also important components of student and community success.

I'm proud to say that HCC is committed to educating the adults in the service region at all stages in their lives, and that we are equally committed to contributing as much as we can to the economic and cultural development of our region. I hope you will find this STEM report to be further evidence of the varied opportunities HCC provides to stay close and go far.
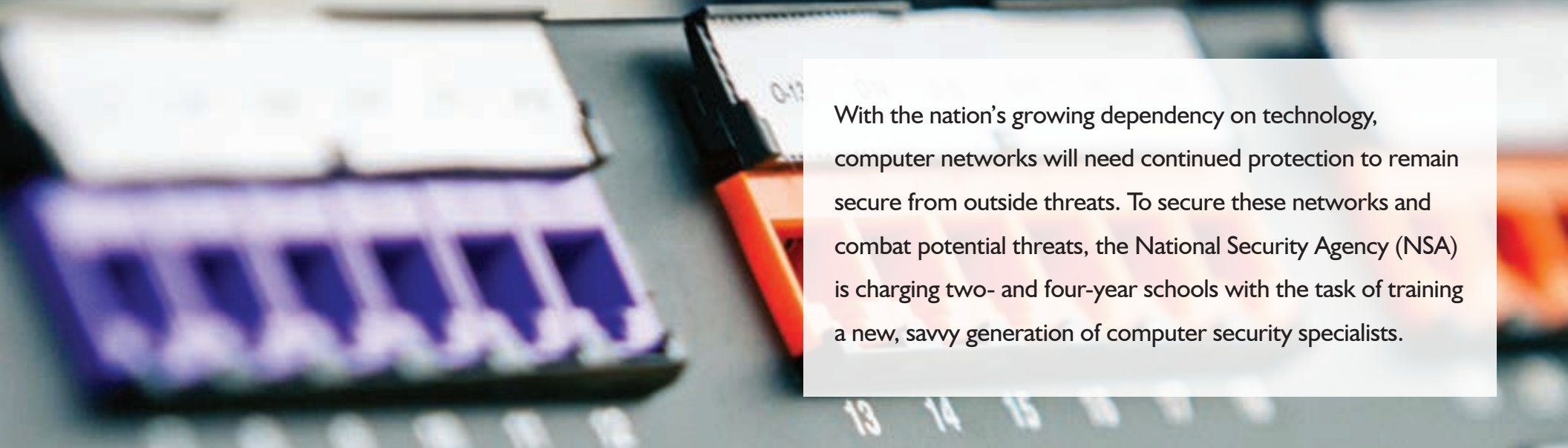
Guy Altieri, Ed.D.
President

What is
STEM education?

The term STEM is used to represent the areas of science, technology, engineering, and mathematics. There is a growing movement in educational settings, both at the secondary and collegiate levels, to enhance STEM offerings to better prepare students and communities to be competitive in a growing global environment. In recent years, many educational institutions have begun adding an additional 'M' to the acronym, making it STEMM, specifically to include the field of medicine. Students studying in these fields typically have strengths as innovators, inventors, logical thinkers, problem solvers, and collaborators.

Why is STEM education important?

Experts warn that the U.S. is not adequately preparing its students, teachers, and employees in the areas of STEM. The U.S. is beginning to fall behind nations from Europe and Eastern Asia in regards to its scientific excellence and technological innovation. The job market is changing and future jobs will require greater levels of skill in these areas. The U.S. Department of Labor projects that, through 2016, 15 of the 20 fastest growing occupations will require significant science or mathematics training. While these jobs are growing, students are increasingly choosing not to major in these areas. If this trend continues, the U.S. will find it more difficult to compete in the global economy. By enhancing STEM offerings, schools and colleges can help encourage greater understanding of the need for these programs, solicit support from key partners, and foster an interest in the pursuit of these fields as important and rewarding career paths.

With the nation's growing dependency on technology, computer networks will need continued protection to remain secure from outside threats. To secure these networks and combat potential threats, the National Security Agency (NSA) is charging two- and four-year schools with the task of training a new, savvy generation of computer security specialists.

Cybersecurity @ HCC

Advanced training for students

HCC offers two associate degrees in cybersecurity, as well as a number of certificates. The A.A.S. degree option trains students to go directly into the workforce, providing a solid foundation in technologies currently being used in the field. The A.S. degree option prepares students for university transfer by placing special emphasis on programming, cybersecurity and computer forensics classes, and general education.

HCC's three, short-term certificate programs—Network Security, Advanced Network Security, and Cisco CCNA Prep—are stackable certificates that allow students to build their skills quickly and efficiently as they prepare for workforce entry.

Training for all cybersecurity programs is conducted in HCC's new, technologically advanced STEM Building, which houses a dual-purpose penetration testing lab. The penetration lab allows students to train in the art of "ethical hacking" so that they learn to not only combat potential threats, but also how to "hack" existing systems to determine weaknesses and correct those flaws before a system is attacked.

Cybersecurity training is further enhanced through HCC's cyber defense team: the Cyber Hawks. Any student enrolled in the Cybersecurity Program can join the team, which competes against student teams from other two- and four-year schools, allowing students to hone their ethical hacking skills at both the regional and national levels.

Nationally recognized program

In 2010, HCC became one of the first community colleges in the nation to be named a Center for Academic Excellence for Two-Year Education in Information Assurance (CAE2Y). The CAE2Y designation allows students to transfer seamlessly from HCC to four-year colleges to complete their degrees.

HCC is also a proud member of Cyberwatch, a consortium of more than 150 higher education institutions, businesses, and government agencies. HCC's affiliation with Cyberwatch allows the college to share best practices, methodologies, curricula, and course modules and materials, as well as receive training and support for its students and faculty.

A year after earning the CAE2Y designation, HCC received a $650,000 grant from the National Science Foundation to enhance its cybersecurity offerings for students. That same year, HCC also received a $50,000 grant from Cyberwatch to strengthen community awareness about cyber threats and to provide short-term training for industry certification through the development of a Cybersecurity Institute offered through HCC's Continuing Education and Business Services Division.

Program initiatives

HCC is currently in the process of acquiring and implementing NETLAB+. This virtual lab solution will provide HCC the ability to offer advanced scenario-based, technical training online. HCC students will have access to a lab environment in the comfort of their own homes and will be able to gain the sophisticated technology skill sets required to successfully enter the IT field.

In addition to college students and community members, HCC also offers training for high school students through a special program called the Cybersecurity Summer Institute. Offered annually, the Cybersecurity Summer Institute allows currently enrolled high school students to earn three college credits at a greatly reduced cost. Students can later apply those credits towards an A.S. degree in cybersecurity.

www.hagerstowncc.edu/cyber

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"The job outlook is extremely good, especially in our region. More than 50 cybersecurity companies recently relocated to Maryland, which will bring thousands of new jobs to the state. And Maryland is ranked second in the nation for the highest annual wages for computer security specialists."

—Anthony Hanners

Cybersecurity Recruiter
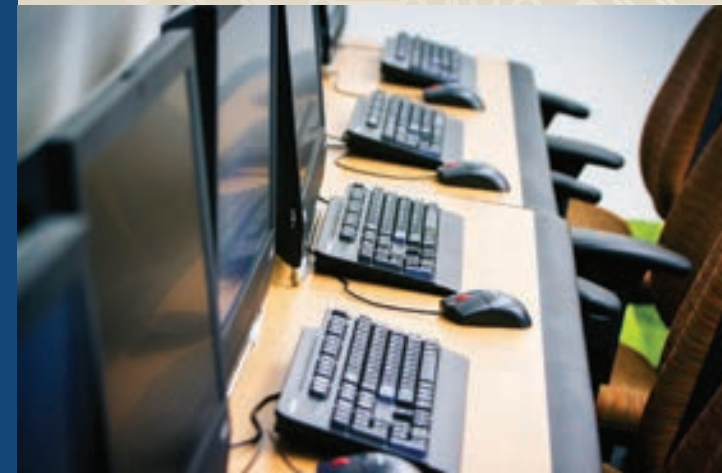
Growing demand for energy jobs attracts HCC students

The Alternative Energy Technology (AET) Program is designed to prepare students to enter the industrial, commercial, or residential setting in the growing areas of solar, wind, and geothermal technology, while also providing students with technical and thinking skills desired by many other industries.

In the program, students can earn progressive levels of certificates that can be applied toward employment or advanced degrees. HCC offers the only intensive alternative energy degree program in the tri-state region.

The AET Program teaches basic skills such as organization, communication, customer service, and problem solving, as well as energy efficiency, electrical theory and applications, solar photovoltaics, solar thermal heating, geothermal technologies, and wind energy. Students learn foundation skills such as safety, electrical circuits, HVAC theory, and plumbing. A special emphasis is placed on servicing alternative energy components and equipment to meet the growing demand in those fields. Area energy employers as well as other industries are currently benefitting by having access to well-trained personnel to grow their businesses as industry demand increases.

In addition, HCC's Digital Instrumentation and Process Control Program further helps students expand their technology skills for computer-automated commercial, industrial, and residential jobs such as those in the alternative energy, biotechnology, medical, manufacturing, and industrial technology fields. Students can earn an A.A.S. degree in the program, which can then be applied toward employment or an advanced degree.

AET student projects

HCC students gain practical experience by working on the 28KW solar array, located next to the ARCC. This system, along with the pole-mounted solar array on the STEM Building and the wind turbine adjacent to the Behavioral Sciences and Humanities Building, provides hands-on learning opportunities and reduces HCC's energy costs.

HCC's energy training house adds a residential learning component for students in credit and continuing education programs. The house provides a unique learning lab in which students can explore highly efficient energy systems, as well as inefficient systems that may be found in current residences. It also provides training space for foundation skills that support STEM technologies.

GreenEnergy GreenJobs

Energy industry connections

Students benefit from the many industry connections maintained by HCC. Here are some of the places where students have served as interns and been hired:

- Nexus Energy Homes, Frederick, Md.
- Green Brilliance, Sterling, Va.
- Millennium 3 Energy, Hagerstown, Md.
- Mountain View Solar, Berkeley Springs, W.Va.
- Cinetic Landis, Waynesboro, Pa.

HCC has developed a unique relationship with Maryland Solar/First Solar and its 20-megawatt solar facility near the prison complex in Washington County. The arrangement provides HCC and its students with solar farm site visits, guest lectures, internships for HCC students, and a digital "dashboard" at HCC's STEM Building so students can monitor non-confidential operational data direct from the solar farm.

www.hagerstowncc.edu/energy

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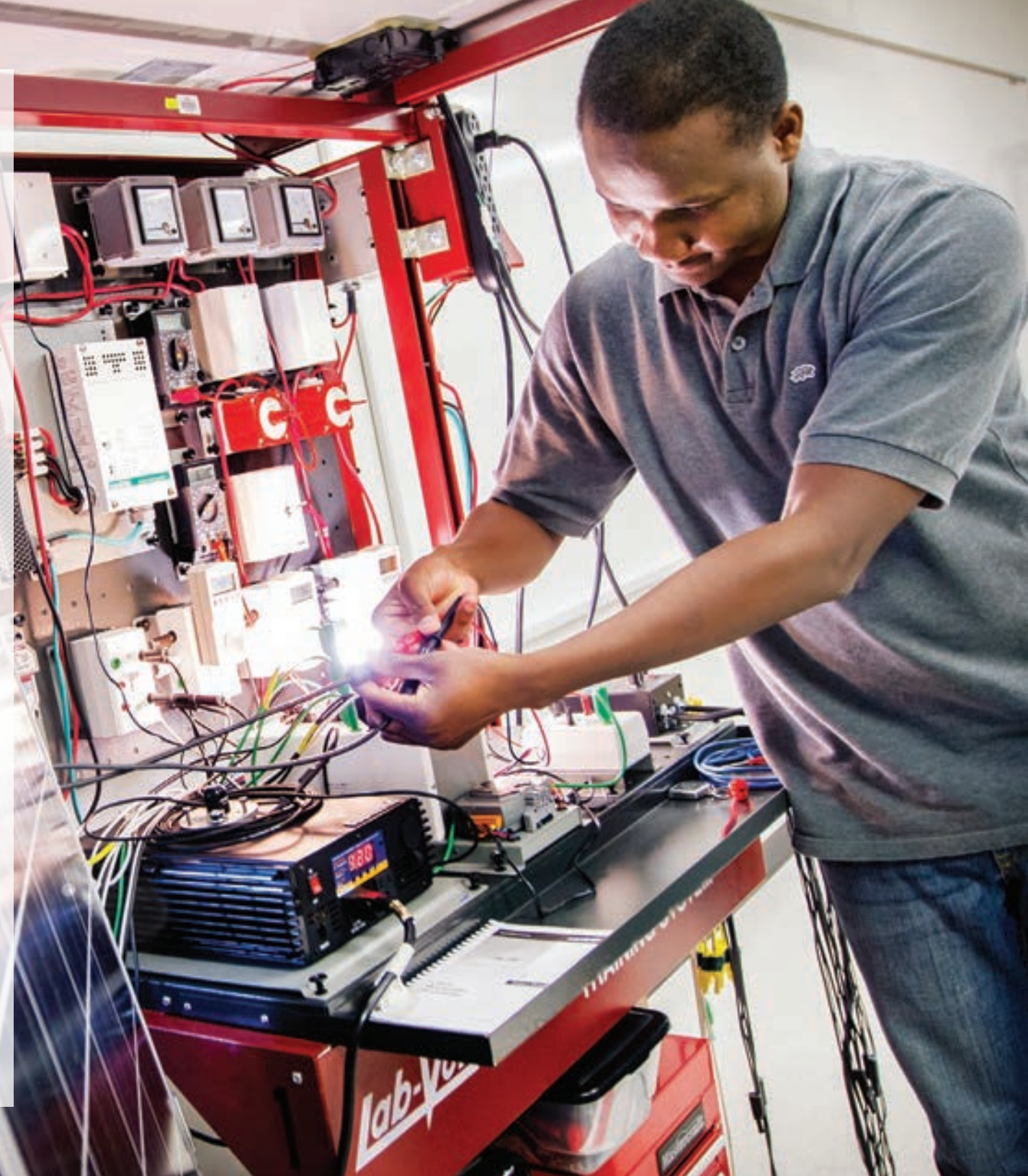Master Electrician
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Biotechnology program recognized nationally

HCC is home to a steadily growing Biotechnology Program which began in 2007 in response to the increased demand for biotech workers within commuting distance of Washington County. The A.A.S. degree program (60 credits) is designed to prepare students to enter the workforce directly as technicians or to transfer to upper division programs leading to career pathways requiring bachelor's, master's, and doctoral-level education. The certificate program (22 credits) is designed for students with previous academic and work experience to complete the biotechnology specialty courses in one-year and enter the workforce immediately.

Since the beginning of the program, HCC graduates have been working as technicians at Medimmune, Cumberland Valley Analytical, Life Technologies, Lonza, the USDA, and Fort Detrick laboratories. Other students have transferred directly into bioengineering, biochemistry, and related programs at the University of Maryland College Park, Frostburg University, West Virginia University, and others. One of the first graduates of the HCC program was accepted into a Ph.D. program at the University of Texas.

The HCC Biotechnology Program has been nationally recognized with the award of six highly competitive grants totaling over $1.5 million. These funds have helped to support the development of new courses, purchase 21st century equipment and support educational outreach in the community. Students have on-site, hands-on experience with standard research-quality equipment and specialty equipment. Laboratory courses and internships allow students to practice DNA, RNA, and protein extractions; standard and reverse transcriptase PCR; southern, northern blots, and immunoblotting; high pressure liquid chromatography; DNA subcloning; and production/purification of recombinant proteins.

The most recent HCC grant-supported project is a National Science Foundation Advanced Technology Education project to support the development of the HCC Microscopy Training Hub (MTH). The $651,249 award was used to purchase dissecting microscopes, light/phase-contrast microscopes, light/phase-contrast/fluorescence microscopes, and digital imaging systems for use in biology and biotechnology courses. Also included in this project is the mobile MTH, a set of 15 compound light microscopes with digital imaging, and a microscopy outreach coordinator who brings microscopy to K-12 classrooms to help teachers introduce their students to biotechnology through hands-on microscopy experiments.

Unique internships prepare biotech students

An internship in research or industry is a degree requirement for the A.A.S. degree and prepares students for immediate hands-on work in critical, high-impact laboratories the way no other training program can do. At HCC, students have a choice of completing this required internship at many external sites such as Fort Detrick or at a unique on-campus internship facility like InnovaBio-MD (IBMD).

IBMD contracts projects from regional biotechnology agencies and biotechnology interns conduct the work. The projects are supervised by the IBMD laboratory technician and a Ph.D.-level scientist. The challenging research completed by the interns creates a skilled talent pool of potential hires for Maryland biotechnology companies.

IBMD was modeled after the Salt Lake Community College InnovaBio program. Interns receive credible research experience and internship credit with a focus on a marketable set of skills required for the workplace, effective communication, and problem solving. Some students complete an internship first with IBMD and then complete another internship with an external site such as the National Institutes of Health.

www.hagerstowncc.edu/biotech

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Health sciences and nursing programs continue to expand

HCC is home to more than 12 health sciences programs including nursing, radiography, dental, and emergency medical services. Grant monies and charitable contributions from local and community entities have made it possible for students in these programs to receive quality instruction and advanced training on equipment that is comparable to that of hospitals, medical centers, and four-year institutions.

Exciting new programs coming soon

- **Dental Hygiene – A.A.S. degree**
  Learn how to provide preventative dental care by training in HCC's new, on-site dental clinic.

  www.hagerstowncc.edu/dental

- **Health Information Management – A.A.S. degree**
  Learn how to combine clinical knowledge, information technology, and leadership into a successful career. Employment opportunities include medical records and risk management, medical coding, tumor registry, and data analysis in numerous health organizations.

  www.hagerstowncc.edu/him

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Learning through medical image archiving

Due to a generous donation by Fuji Film, HCC now features the latest digital technology in medical imaging, which is capable of processing radiographic images in seconds. The donation from Fuji allowed HCC to build a full-scale radiographic room that mirrors the imaging departments found in acute care facilities.

In 2010, HCC also installed the PACS (Picture Archiving and Communication System) network, which allows images to be stored and shared for use by multiple classes and instructors.

"PACS is an amazing teaching tool," said Angela Stoops, director, health sciences. "Being able to send images electronically allows us to integrate images of diseases and other illnesses into the curriculum for several different programs. Now nursing, medical assisting, and paramedic students can all benefit from these images along with our radiography students."

Learning through simulation

HCC has become a regional leader in simulation training for nursing and other health sciences programs. To prepare students for real-life scenarios they will encounter on the job, students train on one of 18 VitalSim manikins before moving to work with "SimMan," an interactive simulation manikin with realistic anatomy and clinical functionality.

SimMan can be used to simulate a variety of medical situations such as respiratory distress, diabetic coma, shock, or heart attack. Using a microphone, health sciences faculty can make SimMan talk to students, which allows them to practice interacting with a live patient.

"This educational approach is vital," said Karen Hammond, director, nursing. "It allows our students the opportunity to practice advanced emergency training scenarios in a safe environment."

Students also utilize a birthing manikin and a human baby simulator. The birthing manikin can be programmed to simulate various stages of pregnancy, as well as birth and breech scenarios that students would likely encounter during an obstetrics rotation.

Preparing for university transfer

Across the nation, a growing number of hospitals are now requiring registered nurses to have a bachelor's degree. HCC offers numerous RN to BSN pathways that allow nursing students to get their first two years of training at HCC before transferring to a four-year school to complete their bachelor's degree. Maryland options include: Towson University (Hagerstown campus); University of Maryland (Baltimore, Shady Grove, or online); and Frostburg University (online).

In addition, HCC recently signed an agreement with Drexel University Online that allows students who have completed the registered nursing (RN) program at HCC to complete their RN-BSN or RN-MSN degrees online through Drexel. To eliminate the need for travel, students can complete their on-site, pre-requisite requirements at HCC and take the remaining course content online. Students who enroll in the RN to BSN online program through Drexel will have their application fee waived and will receive a 40 percent reduction in tuition costs.

HCC also offers an LPN-RN ladder program that allows licensed practical nurses (LPNs) to transition to registered nurses (RNs).

Pharmacy prep program gives students a strong start

HCC's Pre-Pharmacy and Pharmacy Technician Programs prepare students for successful entry into the field. As one of only two public institutions in Maryland to be accredited by the American Society for Health Systems Pharmacists (ASHP), HCC's program is well respected throughout the tri-state area. Students frequently intern at Meritus Medical Center and a number of local pharmacies.

Students in the Pharmacy Technician Program can choose from one of two options: a 28-credit certificate or an eight-credit letter of recognition. The letter of recognition option allows students to easily transition from HCC to the workforce after a single semester.

"Pharmacy technicians often have very little in the way of formal training," said Elaine Ashby, professor and coordinator of HCC's pharmacy programs. "Our program is intended to help students get the professional training they need. It's a great option if you want to get started working right away or want a decent job while you're still in college."

Students who desire to go beyond the technician level to become pharmacists can begin their training at HCC by enrolling in the college's 60-credit pre-pharmacy program. Several students, including the head of pharmaceutical computing at the University of Maryland, have transferred directly to pharmacy school after completing their pre-pharmacy training at HCC.

"Pharmacists need to obtain their doctorate in order to work," said Ashby. "What's great is that you can do your first two years at HCC and then go directly to pharmacy school. For a high school graduate, it would literally be six years until they had their doctoral degree."

www.hagerstowncc.edu/pharmacy

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HCC's STEM Programs

LETTERS, CERTIFICATES, AND DEGREES OFFER PROGRESSIVE OPTIONS

Health Sciences	L	C	D
Computed Tomography Imaging		•	
Dental Assisting		•	
Dental Hygiene *			•
EMS: Paramedic Emergency Services		•	•
EMS: Paramedic Emergency Services: EMT-I to EMT-P Bridge		•	
EMS: Prehospital Basic Life Support	•		
Health Information Management **			•
Magnetic Resonance Imaging		•	
Mammography	•		
Medical Assistant		•	•
Medical Coding and Reimbursement Specialist		•	
Phlebotomy		•	
Radiography			•

Mathematics and Science	L	C	D
Biology			•
Biotechnology		•	•
Chemistry			•
Engineering			•
Mathematics			•
Pharmacy Technician	•	•	
Pre-Pharmacy			•
Physics			•

Nursing	L	C	D
Certified Medicine Aide	•		
Certified Nursing Assistant/Geriatric Assistant	•		
Nursing			•
Nursing: LPN to RN Transition			•
Nursing: Practical Nursing		•	

Technology and Computer Studies	L	C	D
Alternative Energy Technology (AET)			•
AET: Geothermal Energy Installation and Service		•	
AET: Solar/Wind Energy Installation and Service		•	
Commercial Transportation Administration			•
Commercial Transportation Management		•	
Commercial Vehicle Transportation Specialist		•	
Computer Science			•
Cybersecurity (CYB)			•
CYB: Advanced Network Security		•	
CYB: Cisco CCNA Prep		•	
CYB: Network Security		•	
Digital Instrumentation and Process Control (ICP)			•
ICP: Automation Technology *		•	
Graphic Design Technology (GDT)		•	•
GDT: Computer Graphic Artist	•		
GDT: Graphic Production Specialist	•		
Industrial Technology (INT)		•	•
INT: Facilities Maintenance Technology		•	
INT: HVAC and Plumbing	•		
INT: Welding and Fabrication		•	
Information Systems Technology (IST): Computer Forensics			•
IST: Computer Science			•
IST: Computer Support Specialist			•
IST: Desktop User Specialist		•	
IST: Network Administration		•	•
IST: Simulation and Digital Entertainment			•
IST: Small Business Technology		•	
MET: Mechanical Engineering Technology			•
MET: Computer-Aided Design	•	•	•
Web and Multimedia Technology (WEB)			•
WEB: Web/Multimedia Development		•	
WEB: Web Site Development	•		

L = Letter of Recognition
C = Certificate
D = Degree or Option

* Pending CODA approval
** Pending MHEC approval

Partnerships help students succeed

Hagerstown Community College has long been recognized as a leader in providing arts and sciences transfer programs. In recent years, however, the college has significantly increased its offerings in career programs, especially those related to STEM. Through strong connections with area employers, HCC maintains numerous Program Advisory Committees, whose members offer insight and expertise to help develop career program curricula that are relevant for today's workplace and focused on the future of each industry. Here are just a few of HCC's key partners in the STEM programs:

- Defense Information Systems Agency
- Energy Systems
- First Data
- Fort Detrick agencies
- JLG Industries
- Life Technologies
- Maryland Solar/First Solar
- Maryland Space Grant Consortium

- MedImmune
- Meritus Medical Center
- National Cancer Institute
- Total Comfort Inc.
- USDA-ARS Appalachian Fruit Research Station
- Volvo Powertrain North America
- Washington County Economic-Development Commission
- Washington County Public Schools

Grant funding

HCC has been actively seeking and successfully securing many state and federal grants to assist with the costs associated with STEM programs. Here are some of the STEM-related grants recently secured by HCC:

- U.S. Department of Labor – $1.8 million to support the Alternative Energy Technology Program
- National Science Foundation – $650,000 to support the Cybersecurity Program
- National Science Foundation – $651,249 to support the Biotechnology Program
- National Science Foundation – $629,192 to provide student scholarships for multiple STEM programs
- Maryland Higher Education Commission – $2.54 million to support the Nursing Program (5 grants)
- Appalachian Regional Commission – $172,000 to support the Alternative Energy Technology Program (2 grants)
- Appalachian Regional Commission – $73,000 to support the Digital Instrumentation and Process Control Program
- Maryland Space Grant Consortium – $2,444 to support Girls in Engineering College for Kids course
- JLG – $3,540 to support Girls in Engineering College for Kids course
- Maryland Higher Education Commission/ Complete College America – $30,000 to support developmental math redesign
- Maryland State Department of Education – $387,258 to support the STEMM Technical Middle College

HCC and WCPS offer STEMM Technical Middle College

HCC and Washington County Public Schools (WCPS) have established a new STEMM (Science, Technology, Engineering, Math, and Medical) Technical Middle College (STMC) to bring high school students more opportunities to earn postsecondary credits and credentials. Since 2003, HCC has encouraged college-ready high school students to take classes at HCC. HCC and WCPS have worked together to offer HCC classes at the local high schools. This new program allows county high school students to finish their last two years of high school on the HCC campus.

Through STMC, each student will be given an opportunity to earn at least 30 college credits and many will be able to complete requirements for certificates and associate's degrees by the time they graduate from high school. In addition, ninth and tenth grade students will be enrolled in STMC and take significant math and science coursework at their "home" high schools to prepare them for their junior and senior years in the middle college.

www.hagerstowncc.edu/middlecollege

STEM Building enhances learning

HCC's five-story STEM Building opened in 2012 and offers 65,000 sq. ft. of classrooms, laboratories, and faculty offices to support STEM programs.

The building's design has incorporated many sustainable and green technologies for energy efficiency and instructional purposes.

- A rainwater harvesting system collects rain from standard roof drains, which is then collected in two giant cisterns on the third floor. Water collected in the cisterns is used to flush toilets on the third, fourth, and fifth floors of the building.

- Green roof features are located on the third and fifth floor of the STEM Building. The green roof plants absorb water like a sponge, reducing rainwater runoff from the roof, which helps reduce energy costs.

- Four adjustable-angle solar arrays on the roof are tied to the electrical grid that provides power for the STEM Building. These solar arrays produce approximately six kilowatts of power, which contributes to the overall power for the building.

- Exterior solar shades help to combat heat and reduce energy costs in the building.

- The ceiling above the exterior staircase features the constellations Cancer and Aquarius. Those constellations were chosen because they represent the beginning and end of construction on the building.

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