STEM / BMAH
Magnet Pathway Information

AACPS STEM/BMAH programs strive to inspire the next generation of STEM-proficient citizens and leaders by igniting and sustaining their passion for lifelong STEM learning in an experiential educational environment that empowers, excites, engages, and establishes connections with a changing global culture. The STEM/BMAH programs focus on teaching the overall STEM ideals through different lenses, such as biomedical and allied health.

Pathways are concentrations within the STEM/BMAH magnet programs. Students will choose a pathway at the end of their 9th grade year and then begin to take specialized courses, within those pathways, that allows them to focus in on an area of study that will give them a more concentrated focus.

The current STEM pathways are:

Computer Science and Applied Mathematics, Earth and Space Systems, Engineering, Green Technologies, and Nanotechnologies and Materials Science.

The current BMAH pathways are:

BioEngineering, BioScience, Health Information Technologies, Public and International Health, and Aging and Wellness

For more information please use this QR code or you can go to

http://www.aacpsadvancedstudies.org/aacps/Magnet/STEM

Computer Science and Applied Mathematics

Computer science is a study of the theory, experimentation, and engineering that form the basis for the design and use of computers. It is the systematic study of the feasibility, structure, expression, and mechanization of the procedures for the acquisition, representation, processing, storage, communication of, and access to information. A computer scientist would work in the theory of computation and the design of computational systems. There are two areas of the computer science field, theoretical and applied. Theoretical computer science is more abstract and looks to provide more efficient methodologies and would examine the theory of computation, coding, data structures, and programming. Applied computer science seeks to solve real world problems and involves artificial intelligence, graphics, security, networks and databases, and software.

Applied Mathematics is an interactive environment is provided for the study real world of problems through the use of applied mathematical and scientific modeling. A model is a simple construct which unveils or describes important properties of a more complex system that a learner may want to understand more fully. Students will learn about the nature and structure of scientific models, limitations of models, where mathematical formulas can be used to solve problems, and how math exists in the everyday worlds. Numerous technological modeling tools will be used to explore and study complex problems and challenges within an inquiry-based classroom setting.

Pathway Courses (3 credit total)

10th grade - AP Computer Science (1 credit)

11th grade - Math and Science Modeling (0.5 credit) **and** Parallel Computing (0.5 credit)

12th grade - STEM Research and Data Analysis (1 credit) ***or*** Gaming Design* (1 credit)

*Gaming design is only available at North County High School

Associated Local Companies, Higher Education, and Government Programs:

University of Maryland, College Park • University of Maryland Baltimore County • National Security Administration • Defense Information System Agency • PayPal •

Program Careers:

Information Technologies • Statistics • Actuary • Cryptography • Biomathematics • Software Engineer • Software Designer • Systems Analyst • Database Administration • Cyber Security • National Security • Computer Programmer • Web Developer • Accounting

Fun Facts:

Only 8% of the world's currency is physical money, the rest only exists on computers.

http://money.howstuffworks.com/currency.htm

$$111{,}111{,}111 \times 111{,}111{,}111 = 12{,}345{,}678{,}987{,}654{,}321.$$

https://www.quora.com

Resources:

Code.org

Society for Industrial and Applied Mathematics

IEEE Computer Society

STEM
science • technology • engineering • mathematics

Earth and Space Systems

For years we have focused in on the study of Space or the study of the Earth as separate entities. This pathway's goal is to bridge the study of the two sciences because there is no way to understand on without the other. For a better understanding, modules have been developed to narrow focus and help understand the connection between the two realms. Earth mission modules include a focus on earthquakes, volcanoes, plate tectonics, weather, climate, and climate predictions. Space mission modules include topics such as rocky planets, gas giants, extra-solar planetary systems, the Milky Way, galaxies in the universe, and the Big Bang theory. Students will attend weekly mission briefings, work online alongside scientists, and collect and analyze recent NASA data from the stream of current explorations. NASA technology support tools allow students to collect and analyze data, and present their findings using authentic methods of practicing scientists.

Pathway Courses (3 credit total)

10th grade - AP Environmental Science **or** STEM Aeronautics* (1 credit)

11th grade - STEM Earth and Space Missions (1 credit)

12th grade - STEM Research and Data Analysis (1 credit)

*STEM Aeronautics only available at South River

Associated Local Companies, Higher Education, and Government Programs:

University of Maryland, College Park • University of Maryland Baltimore County • Rockwell Collins • Northrop Grumman • NASA Goddard

Program Careers:

Aerospace Engineer • Astronaut • Airline Pilot • Climatologist • Meteorologist • Mineralogy • Spacecraft Engineers • Robotics Engineer • Astrophysicist • Telecommunications • Astronomer • Paleontology • Seismology • Geology • Geothermal Engineer • Oceanographer • Geophysics

Fun Facts:

Earth is the only planet not names after a god. The other seven plants in our solar system are all names after Roman gods or goddesses. Although only Mercury, Venus, Mars, Jupiter, and Saturn were named during ancient times, because they were visible to the naked eye.

http://space-facts.com/earth/

Since the moon doesn't have an atmosphere, there's no wind or water to erode or wash away the Apollo astronauts' mark on the moon. That means their footprints, roverprints, spaceship prints, and discarded materials will stay preserved on the moon for a very long time. They won't stay on there forever, though.

www.space.com

Resources:

NASA

Space.com

United States Geological Survey

Engineering (North County)

Engineering requires the use of mathematical and scientific principles to develop effective solutions to real-world, technical problems. Engineers help to design, develop and build machinery as well as complex systems used in the production of a large variety of goods. Engineers are also vital in the development of buildings, highways, and transportation systems. They may develop alternative power sources for mankind or find new ways to take advantage of and apply the latest technological advancements. Engineers are responsible for improving the quality of healthcare, ensuring the availability and safety of the food we eat and the integrity of critical operational, financial and computer systems that support society. Apart from just designing and developing, engineering professionals are also engaged in testing, producing and maintaining activities. In essence, engineers are at the heart of everything important to the quality of human life.

Pathway Courses (4 credit total)

10th grade - AP Computer Science (1 credit)

11th grade - CAT-N Engineering Explorations [CAD, Elec, PrsMachine, NRM](1 credit)

or CAD Academy Course (0.5 credit)

12th grade - CAT-N Level II [CAD, Elec, PreMachine] (2 credits)

or STEM Research and Data Analysis (1 credit)

[CAD - Computer Aided Design, Elec - Electricity, PrsMachine - Precision Machining, NRM - Natural Resource Management]

Associated Local Companies, Higher Education, and Government Programs:

University of Maryland, College Park • University of Maryland Baltimore County • Johns Hopkins • USNA • Anne Arundel Community College • Northrop Grumman • Rockwell Collins • Carderock Division of the Naval Surface Warfare Center • Defense Information Systems Agency • Rochester Institute of Technology •Baltimore Museum of Industry

Program Careers:

Aerospace Engineer • Chemical Engineer • Civil Engineer • Computer Engineer • Electrical Engineer • Mechanical Engineer • Nuclear Engineer • Software Engineer • Technical Writer • Industrial Designer • Architect • Cartographer • Robotics • Solar Energy

Fun Facts:

The first Ferris Wheel was created by Pittsburgh, Pennsylvania engineer, George W. Ferris, in 1893. The wheel is supported by two 140-foot steel towers and connected by a 45-foot axle -- the largest single piece of forged steel ever made at that time.

https://www.nspe.org

A women named Emily Roebling supervises construction of the Brooklyn Bridge. When her husband became ill in 1872, Emily tool over the day-to-day supervision of bridge construction. Emily had studied many engineering topics related to bridge construction. Her name is included on the plaque dedicating the bridge.

http://www.engineergirl.org/144.aspx

Resources:

Engineering, Go For It!

Engineering.com

Careers in Engineering

Project Lead the Way Engineering (South River)

From launching space explorations to delivering safe, clean water to communities, engineers find solutions to pressing problems and turn their ideas into reality. PLTW Engineering empowers students to step into the role of an engineer, adopt a problem-solving mindset, and make the leap from dreamers to doers. The program's courses engage students in compelling, real-world challenges that help them become better collaborators and thinkers. Students take from the courses in-demand knowledge and skills they will use in high school and for the rest of their lives, on any career path they take.

www.pltw.org

Pathway Courses (4 credit total)

10th grade - STEM Introduction to Engineering (1 credit)

11th grade - STEM Digital Electronics (1 credit) ***and***

STEM Aerospace Engineering (1 credit)

or STEM Civil Engineering and Architecture (1 credit)

12th grade - STEM Research and Data Analysis (1 credit)

Associated Local Companies, Higher Education, and Government Programs:

University of Maryland, College Park • University of Maryland Baltimore County • Johns Hopkins • USNA • Anne Arundel Community College • Northrop Grumman • Rockwell Collins • Carderock Division of the Naval Surface Warfare Center • Defense Information Systems Agency • Rochester Institute of Technology • Baltimore Museum of Industry

Program Careers:

Aerospace Engineer • Chemical Engineer • Civil Engineer • Computer Engineer • Electrical Engineer • Mechanical Engineer • Nuclear Engineer • Software Engineer • Technical Writer • Industrial Designer • Architect • Cartographer • Robotics • Solar Energy

Fun Facts:

The snowboard was invented by an engineer. Serman Poppen invented a toy for his daughter by tying two skiis together and attaching a rope to one end. This invention called the "snurfer" eventually evolved into the snowboard. With some twists and turns along the way, the snowboard has become a marvel of geometry, chemistry, and biometrics.

www.electronicproducts.com

Ever ridden a roller coaster? All roller coasters are designed by engineers! The world's largest steel roller coaster – The Millennium Force – reaches a height of 310 feet, which is longer than a football field! The coaster is also the world's fastest at 92 miles per hour – faster than a cheetah! Takes a lot of ingenuity and skill to create something that big, fast and safe!

www.northropgrumman.com

Resources:

Project Lead the Way Engineering

Engineering.com

Careers in Engineering

science • technology • engineering • mathematics
STEM

Green Technologies

Green Technologies is designed to engage the student in the complex relationships between human society and the natural environment. It provides an interdisciplinary introduction to the environmental challenges we face in our contemporary world through foundational theoretical ideas illustrated with concrete, familiar real-world examples. The goals of a green technology program would be to meet the needs of society in ways that can continue indefinitely into the future without damaging or depleting natural resources, creating products that can be fully reclaimed or re-used and reducing waste and pollution by changing patterns of production and consumption. Students will use technologies to gather and analyze environmental (macro and micro), political, and economic data from large social science and scientific data sets as well as data gathered in the field.

Pathway Courses (3 credit total)

10th grade - AP Environmental Science (1 credit)

11th grade - STEM Environment and Society (1 credit)

12th grade - STEM Research and Data Analysis (1 credit) **or**

STEM Modern Biotechnologies (1 credit)* **or**

Environmental Media (1 credit)^^

* South River only   ^^ North County only

Associated Local Companies, Higher Education, and Government Programs:

Program Careers:

Environmental Economists • Epidemiologist • Industrial Ecologists • Park Naturalists •
Water Resource Specialist • Carpenters and Electricians • Environmental Engineers • Geoscientist
Industrial Engineers • Aquatic Biologist • Petroleum Engineer • Energy Manager

Fun Facts:

If taken advantage of to its fullest extent, sunlight that beams on the earth for <u>one hour</u> could meet world energy demands for an entire year.
https://www.ovoenergy.com

Paper can be recycled only six times. After that, the fibers are too weak to hold together.
www.huffingtonpost.com

Resources:

SustainaFest

Environmental Protection Agency

Chesapeake Bay Foundation

STEM

Nanotechnologies and Materials Science

Nanoscience and nanotechnology are the study and application of extremely small things and has many applications across STEM disciplines. Researchers seeking to understand the fundamentals of properties at the nanoscale call their work nanoscience; those focused on effective use of the properties call their work *nanoengineering*. Encompassing nanoscale science, engineering, and technology, nanotechnology involves imaging, measuring, modeling, and manipulating matter at the nanoscale.

Materials Science is *the study of stuff*! Just about everything you use every day—it's all made of different kinds of stuff. Understanding how that stuff is put together, how it can be used, how it can be changed and made better to do more amazing things - even creating completely *new* kinds of stuff: that's what materials science is all about.. Sometimes materials scientists are called ceramic or polymer engineers or metallurgists, and as diverse as they are, materials scientists look at materials from a unified point of view: they look for connections between the underlying **structure** of a material, its **properties**, how **processing** changes it, and what the material can do – its **performance**.
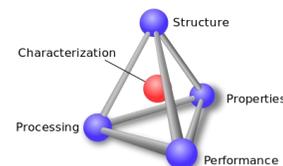
Pathway Courses (3 credit total)

10th grade - AP Computer Science (1 credit)

11th grade - Materials Science (0.5 credit) **and** Nanotechnologies Exploration (0.5 credit)

12th grade - STEM Research and Data Analysis (1 credit)

Associated Local Companies, Higher Education, and Government Programs:

Johns Hopkins University • University of Maryland College Park • Institute of Nanoscience, Naval Research Laboratory • Center for Nanoscale Science & Technology • Dupont • Materials Science Corp • Blue Wave Semiconductors • Pixelligent • Nanotec-USA • 3M Company • Bayer Corporation • Hewlett Packard • Proctor & Gamble • Sherwin Williams • Johnson Controls, Inc. • Vorbeck Materials • National Science Foundation • Under Armour

Program Careers:

Electronics/ Semiconductor fields • Auto and Aerospace fields • Sporting goods • Biotechnology industry • Environmental fields • Forensics • Military and National Security • Materials Engineer • Metallurgist • Patent examiner • Pharmaceuticals • Medical Scientists • Polymers

Fun Facts:

Nano particles are also found in nature. Milk is in fact an example of a nanotechnology in which incredibly small particles of protein are suspended in water.

Nano and Me,Natural Nano,viewed 30 April

Gore-Tex is a composite which is used to make clothing. It contains layers of different materials which work together to create a fabric which is waterproof and breathable.

scitechconnect.elsevier.com

Resources:

American Chemical Society

American Society of Mechanical Engineers

National Nanotechnology Initiative

STEM

Project Lead the Way BioEngineering

Bioengineering, or Biomedical Engineering, is a discipline that advances knowledge in engineering, biology, and medicine and improves human health through cross-disciplinary activities that integrate the engineering sciences with the biomedical sciences and clinical practice. Bioengineering combines engineering expertise with medical needs for the enhancement of health care. It is a branch of engineering in which knowledge and skills are developed and applied to define and solve problems in biology and medicine. Bioengineers work with doctors, therapists and researchers to develop systems, equipment and devices in order to solve clinical problems. Areas of study could include biomechanics, cardiovascular engineering, genetic engineering, agricultural biotechnology, tissue engineering, biomedical devices, human interface, bioprocesses, forensics, and bio-ethics.

Pathway Courses (4 credit total)

10th grade - Introduction to Engineering Design (1 credit)

11th grade - Digital Electronics (1 credit) **and** Environmental Sustainability (1 credit)

12th grade - Engineering Design and Development (1 credit)

Associated Local Companies, Higher Education, and Government Programs:

Program Careers:

Bioinstrumentation · Biomaterials · Biomechanics · Clinical Engineering · Medical Doctor · Rehabilitation Engineering · Systems Physiology · Prosthetics · Chemical Engineer · Medical Imaging · Genetic Engineer · Medical Equipment Manufacturing and Sales · Bioprocess Engineering · Agricultural and Environmental Engineering · Biomolecular Genetics

Fun Facts: Believe it or not, there are currently over 250 people cryopreserved (frozen) in the hopes that one day technology will be invented to revive them and extend their lives.

www.techblog.com

In 1993, five biomedical engineers in Edinburgh, Scotland created the first functional bionic arm. Known as the Edinburgh Modular Arm System, the arm contained miniature motors, gears, pulleys, microchips and position-control circuits. The arm also had artificial fingers for gripping objects, a twistable wrist, a bendable elbow and a rotating shoulder.

http://work.chron.com/interesting-biomedical-engineering-26734.html

Resources: PLTW.org

American Institute for Medical and Biological Engineering

Society for Biological Engineering

Biomedical and Allied Health
BM/AH

Project Lead the Way BioScience

By immersing students in activities like practicing suturing and constructing body structures from clay, PLTW Biomedical Science empowers students to build knowledge and skills in biomedical science, as well as in-demand, transportable skills like problem solving, critical and creative thinking, communication, and collaboration. Students explore concepts of biology and medicine to determine factors that may lead to the death; examine the interactions of human body systems and apply what they know to solve real-world medical cases; students delve into activities like designing a prosthetic arm as they follow the life of a fictitious family and investigate how to prevent, diagnose, and treat disease; and build on the knowledge and skills gained from previous courses to design their own innovative solutions for the most pressing health challenges of the 21st century.

www.pltw.org

Pathway Courses (4 credit total)

10th grade - BMAH Human Body Science (1 credit)

11th grade - BMAH Principles of Biomedical Science (1 credit) **and**

BMAH Medical Interventions (1 credit)

12th grade - BMAH Biomedical Innovation (1 credit)

Associated Local Companies, Higher Education, and Government Programs:

Program Careers:

Animal Behaviorist · Entomologist · Genetic Counselor · Immunologist · Marine Biologist · Microbiologist · Process Engineer · Validation Engineer · Validation Specialist · Veterinarian · Zoologist · Pharmacist · Pharmaceutical Technician · Pharmaceutical Representative

Fun Facts: If you rub an onion on your foot – within 30 – 60 minutes you will be able to taste it – this is because it travels through the blood stream

http://listverse.com/

The oldest known prosthetic was found in Cairo, Egypt in 2000. It was estimated that the wood and leather prosthetic toe was nearly 3,000 years old.

http://www.bakersfield.com/news/health/2015/03/13/15

Resources:

Project Lead the Way—BioScience

Careers in BioScience

Bioscience.org

Biomedical and Allied Health
BMAH

Health Information Technologies

Health information technologies involves both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for the communication and decision making processes among health professionals. This program would use technology to store information for easy access and create a network of solutions that can be used across the health care industry and by the professionals in that industry. Informatics, another branch of health information technologies, deals with information processing and the engineering of those systems. Health informatics relies on the combination of information science, computer science, and health care and how those systems can be used to create resources and devices for the obtaining, storage, retrieval, and use of health information. The development and use of these resources and devices could be used by doctors, nurses, pharmacists, researchers, and other industry professionals to help revolutionize the health care industry.

Pathway Courses (4 credit total)

10th grade - Computer Essentials (1 credit)

11th grade - AP Computer Science Principles (1 credit) **and**

Cyber Security (1 credit)

12th grade - AP Computer Science (1 credit) **and**

Health Information Technology 1 and 2 (Anne Arundel Community College Credit)

Associated Local Companies, Higher Education, and Government Programs:

Program Careers:

Medical Records Technician • Medical Billing • Coding Specialist • Health Information Technician • Healthcare Information Managers • Medical Secretary • Health IT Computer Programmers • Compliance and Risk Management • Health Informatics • Database Management • Software Tech

Fun Facts:

One of the countries to really push the development of medical informatics early on was Brazil in 1968. Brazil was using computers for medicine and health care. The country was also among the first to begin installing computer mainframes in hospitals at university hospitals.
https://mastersinhealthinformatics.com

Another interesting wearable technology device is the **LifeShirt**. This device is essentially a garment that contains sensors which monitor the vital signs and 30 other important biometric readings of chronically ill, elderly, cardiac and other patients who are suffering from life-threatening illnesses.
http://usabilitygeek.com/

Resources:

Health Resources and Services Administration

Health IT

Healthcare Information and Management Systems Society

Public and International Health

Public and International health is the science of protecting and improving the health of families and communities through promotion of healthy lifestyles, research for disease and injury prevention and detection and control of infectious diseases. The number one goal of public health is concerned with protecting the health of entire populations. These populations can be as small as a local neighborhood, or as big as an entire country or region of the world. Public health professionals try to prevent problems before they happen or if they have happened – prevent them from recurring through education of the community, recommendations to current policies, administering services and conducting research. This is different than clinical professionals, like doctors and nurses, who focus primarily on treating individuals after they become sick or injured (reactionary). Public health also works to limit health disparities by promoting healthcare equity, quality and accessibility. Public health is community health.

Pathway Courses (3 credit total)

10th grade - AP Psychology (1 credit) **or** AP Human Geography (1 credit)

11th grade - BMAH Public and International Health 1 (Nutrition and Social Behavior) (0.5 credit) **and** BMAH Public and International Health II (Global Epidemics and Health Systems) (0.5 credit)

12th grade - BMAH Capstone (1 credit) **or**

BMAH Capstone (0.5 credit) **and** BMAH Public and International Health III (0.5 credit)

Associated Local Companies, Higher Education, and Government Programs:

Center for Disease Control • Department of Health and Human Services • World Health Organization •

Program Careers:

Biostatistics and Informatics • Epidemiology • Community Health • Environmental Health • Health Policy and Management • Maternal and Child Health • Minority Health • Social and Behavioral Health • Communicable Diseases • Research • Disaster Preparedness • Pharmaceuticals

Fun Facts:

People who laugh a lot are much healthier than those who don't. Dr. Lee Berk at the Loma Linda School of Public Health in California found that laughing lowers levels of stress hormones, and strengthens the immune system. Six-year-olds have it best - they laugh an average of 300 times a day. Adults only laugh 15 to 100 times a day.

http://health.abc4.com/

In an average lifetime does a person have more breaths or heartbeats? _Heartbeats_ – on average a person has 3 billion heartbeats compared to 600 million breaths.

www.ispahealth.com

Resources:

American Public Health Association

US Surgeon General

World Health Organization

Biomedical and Allied Health
BMAH

Aging and Wellness

Aging is a fact of life. This pathway aims to analyze literature and conduct research on the genetic, biological, clinical, behavioral, social, psychological, and economic aspects of aging. The goal is to study aging populations' health issues can be affected by race, ethnicity, gender, socioeconomic status, age, education, occupation, and other, as yet unknown, lifetime and lifestyle differences. Students will use research insights and advances to influence policy on the health, wellness, economic status, and quality of life of all aging adults. Through an immersion in problem-based learning and critical thinking, students will develop and apply knowledge from multiple disciplines to explore the event of aging, common illnesses, physiological problems, and the mental and social aspects involved in aging. All of this will assist in the exploration of how the health system engages with aging populations.

Pathway Courses (3 credit total)

10th grade - AP Psychology (1 credit) **or** AP Human Geography (1 credit)

11th grade - BMAH Public and International Health 1 (Nutrition and Social Behavior) (0.5 credit
   and BMAH Aging and Wellness I (0.5 credit)

12th grade - BMAH Capstone (1 credit) **or**

   BMAH Capstone (0.5 credit) **and** BMAH Aging and Wellness II (0.5 credit)

Associated Local Companies, Higher Education, and Government Programs:

Program Careers:

Gerontologist · Physical Therapist · Occupational Therapist · Behavioral Therapist · Nurse · Doctor · Geriatric Care Manager · Dietician · Nutritionist · Long Term Care Administrator · Grief Counselor · Retirement Planners · Social Workers · Wellness Managers · Activity Directors

Fun Facts:

We shed on average 600,000 particles of skin every hour. As we age, that accumulates to approximately 1.5 pounds each year. The average person will therefore have lost around 105 pounds of skin by 70 years of age.

http://www.health24.com/

Human brains do not fully develop until age 25? And it's also why the last seven years of your primary childhood, ages 18-25, are as important to your development as your first seven years. Stick close to your parents and grandparents during those years for advice and wisdom.

scitechconnect.elsevier.com

Resources:

US Dept of Health and Human Services

National Institute on Aging

Nutrition.gov

Biomedical and Allied Health
BMAH