

STEM

M A G A Z I N E

To The Moon & Mars

Dr. Michaelyn Thomas

Adolescent Brain Risks

Dr. Judy Willis

Women In STEM
Success Stories

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October 2023

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Contributing Editor
STEM Funders Network
Errika Moore

Wayne Carley
Publisher
Wayne@stemmagazine.com
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STEM Magazine is a monthly non-profit education publication for educators, students, their parents and industry professionals.

Read monthly in 74 countries and 47 U.S. states, STEM Magazine strives to encourage the educator to better understand the importance of STEM skills, their use in every school subject, the need and ease of integration into curriculum and the urgency for students to embrace STEM through a more complete understanding of it.

Human Spaceflight To Mars

DR. MICHAELYN THOMAS / SPACE SYSTEMS

System Upgrade

DWANA FRANKLIN-DAVIS
CEO, REBOOT REPRESENTATION



Women In STEM

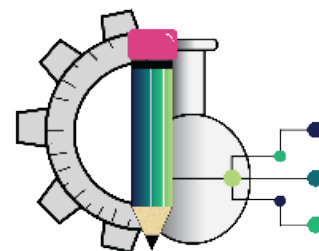
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Adolescent Brain Risks

DR. JUDY WILLIS

Long COVID

BY JANNATUL FERDOUS
BS, PHARMD CANDIDATE 2024



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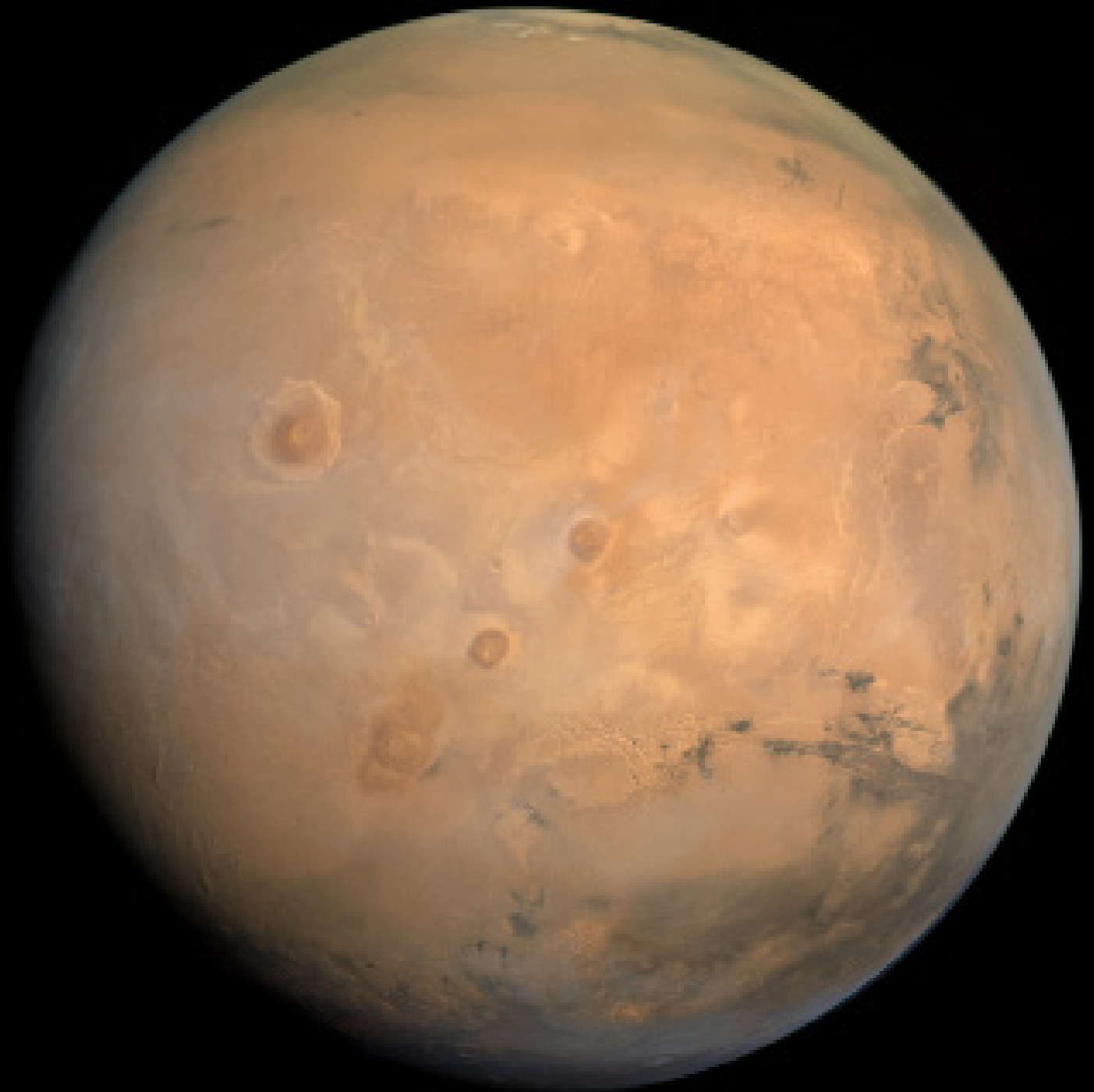
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Nov. 12, 2023

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Human Spaceflight to

Mars

By Dr. Michaelyn Thomas / Space systems engineer



Mars is a rocky, terrestrial planet approximately 225 million kilometers from Earth. It is a very attractive destination for humanity's first interplanetary human spaceflight mission because of its proximity to the Sun and conditions on its surface. The first human spaceflight mission could be as early as 2024, according to the private commercial space sector, but others are targeting the 2030s.

Mars is ripe for exploration as humanity continues to push the bounds of scientific discovery. The goal of landing humans on the surface of Mars has been on the horizons for many Nations and private companies for decades, and it is requiring many space exploration advances to get humans there.

To date, humans have successfully landed six rovers, and two remain active — Curiosity and Perseverance. This robot technology helps engineers and scientists learn as much as possible about Mars, and this is a very critical step prior to landing humans on the surface of Mars. It is imperative to understand what it takes to survive on Mars for sustained periods of time, and rovers and other spacecraft orbiting Mars collect samples and scan the atmosphere to inform researchers for human habitability.



Other spaceflight activities include the commercialization of space—private investors making space accessible to private citizens and private companies; continuous human spaceflight missions to Low Earth Orbit (LEO); and returning humans to the surface of Earth's Moon are all helping to advance humankind to Mars. Private investors have used their own funds to develop spacecraft capable of sending humans to the edge of space.

Many private citizens have conducted mini experiments while visiting space, as well as exploring Earth beyond its surface. Human spaceflight missions to

LEO include missions to the International Space Station (ISS) which has an approximate altitude of 420 kilometers above Earth and orbits Earth at 28,164 kilometers per hour.

Missions such as these help researchers know more about living and working in space environments for long periods of time. Another pathway to Mars is humankind's return to the Moon in 2025. This is a critical stepping stone in getting humans on Mars, and redeveloping the appropriate technologies that provide safe human spaceflight to Earth's Moon and an indirect ascension

to Mars through innovation, multi-national collaboration, and leveraging diverse talents for maximum scientific discovery. During the Apollo Era of 1961 to 1972, the Moon is the furthest humans have traveled in space, with an average distance of 384 thousand kilometers from Earth.

All About Mars

Mars is the fourth rock from the Sun, and its average distance from Earth is 225 million kilometers. When the Solar System took shape about 4.5 billion years ago, Mars formed when gravity pulled in swirling gas and dust, and similar to Earth, Mars has a central core, a rocky mantle, and a stable crust. Mars is one of Earth's neighbors, and the planet is the furthest terrestrial planet from the Sun, taking 687 days to orbit the Sun as opposed to Earth's 365 days.

The typical Martian day is slightly longer than Earth's day, at 24 hours and 39 minutes as opposed to Earth's 24 hour day. Mars is nicknamed The Red Planet because of its finely grained ferric oxide dust, making it reddish in color due to its rocky planet soil. Mars is just about half of the diameter of Earth at 6,779 kilometers, and is less dense than Earth having approximately 15 percent of Earth's volume and 11 percent of Earth's mass.



This means that the gravity on Mars is approximately 3.7 meters per second squared, which is 38 percent of Earth's gravity. If you weighed 100 pounds on Earth, you would only weigh 38 pounds on Mars because the surface gravity on Mars is 62 percent less than the surface gravity on Earth.

Mars has a relatively thin atmosphere, and it is primarily made up of carbon dioxide with traces of nitrogen, argon, oxygen, methane, and other gases, which means that a spacesuit is definitely required! Because the atmosphere is so thin, heat and light from the Sun can easily escape the planet.

The temperature on Mars can be as high as 21 degrees Celsius and as low as negative 128 degrees Celsius. It could feel as nice as Spring weather, or more chilling than Antarctica. Mars can sometimes have very strong winds causing massive dust storms that cover the entire planet. The severity of such storms could take several months for all the dust to finally settle. Mars also has two small, potato-shaped Moons, or natural satellites, named Phobos and Deimos.

Why should humans travel to Mars?

Engineers and scientists are working tirelessly around the globe to research



and develop technological advances that space explorers will use to live and to work on Mars, while returning safely to Earth. Robotic space rovers are path-finding the way to get humans to the rocky red planet. There are many scientific and strategic reasons including:

- 1) Mars is currently the most accessible planet to reach in the Solar System
- 2) Reaching Mars could unlock the origins of life as we know it



3) Mars could be a future destination to relocate humankind for evolutionary survival

Space exploration improves life on Earth through scientific discovery. Conducting research and experiments in different environments, especially in space, helps scientists understand how certain experiments would react on Earth. These experiments range from improving telecommunications, to how medical doctors treat disease, to understanding and preventing climate change. Mars has many similarities to Earth—from its complex climate, geology, and evolutionary change—Mars exploration will continue to give humanity the blueprint to how our Solar system was formed.

While scientists do not necessarily expect to find life or intelligent beings thriving on Mars, they are expecting to discover signs of life that may have existed when Mars was warmer with many bodies of water. Many scientific questions are at the brink of being answered as humans safely get to the surface of Mars. In the very distant future, it could be incredibly important for humanity to become a multi-planetary species.

According to many scientists, the Earth will perish in approximately five billion years due to the increasing temperature of the Sun, causing a runaway

greenhouse effect. This means that the Earth's oceans will boil, and the surface temperature will be so high that Earth will become a lifeless rock incapable of sustaining human-beings. Even before Earth's end, there are many factors that would make Mars or other outer planets a desirable location.

Learning how to live and survive beyond Earth could be the key to human existence. Most importantly, space exploration is the key to maximizing human intelligence as it pertains to improving life on Earth, learning more about the scientific origins of the universe, as well as inspiring the next generation of space explorers.

What does human space-flight to Earth's Moon have to do with landing humans on Mars?

Humankind's return to the Moon will establish a framework for international space cooperation, peace, and civil space exploration to the Moon, comets, asteroids, and Mars. The Moon is the only place where humans have set foot beyond Earth.

The Apollo program was a human spaceflight program led by the National Aeronautics and Space Administration (NASA) from 1961 through 1972 with 17 Apollo missions.

President John F. Kennedy addressed Congress on May 25, 1961 sharing his vision of landing humans on the moon and returning them safely to Earth before 1970.

Despite human tragedy and failed lunar missions, on October 11, 1968, Apollo 7 was the first human space-flight mission that successfully demonstrated engineering capability and command and service module performance. On July 20, 1969, President Kennedy's vision became a reality when the Apollo 11 mission landed NASA astronauts, Neil Armstrong and Buzz Aldrin, on the surface of the Moon—this was the first time humans ever walked the lunar surface.

After Apollo 11, five of six successful landings were carried out, resulting in 12 additional astronauts walking on the Moon. The Apollo program set a strong foundation for human space-flight, and it chartered the course for human space exploration today. Due to budgetary constraints, the Apollo program was canceled in 1972, terminating three planned lunar missions. While the lunar surface has remained human-less for several decades since the Apollo era, today, there is a fervent initiative to get humans back to the moon and beyond, and that is the Artemis Program, Apollo's twin sister.

The Artemis Program is a human spaceflight, American-led program to return humans to the Moon by 2025 which would serve as a catalyst to sending humans for the first time to Mars. It was started in 2017 to revive the human presence on the Moon, and NASA shared their vision of landing the first woman and person of color on the Moon.

The objectives of the Artemis Program include establishing an international human spaceflight team; creating a sustainable human presence on the Moon; and making human spaceflight missions to Mars an executable reality. This initiative is a multi-National collaboration between governmental space agencies and commercial space-flight companies. Many Nations have been invited to join the program by signing the Artemis Accords, and as of today, 29 countries and territories have joined.

The Artemis Accords were drafted by NASA and the United States Department of State, and it is an international agreement between governments participating in the Artemis Program. This agreement outlines a set of principles, guidelines, and innovative space exploration best practices that are applicable to not only reaching the Moon, but to get humans safely to Mars and beyond.

Human liftoff to Mars

Human spaceflight missions to Mars will be meticulously timed for rocket launches from Earth's ground when Earth and Mars are aligned in a good position to each other. The space journey to Mars will take about nine months, and a round trip journey will take approximately 21 months—Mars space explorers will need to wait on Mars for about three months, ensuring that Earth and Mars are aligned appropriately.

The alignment of Earth and Mars is very important because it will reduce the amount of time it would take to travel to and from Mars. Earth and Mars orbit the Sun at different speeds and distances, and once every 26 months, Earth and Mars are aligned in the best position which would allow less spacecraft power, maximizing the most energy efficient and affordable way of getting to and from Mars.

There are several technologies that NASA and other commercial space companies are working on to successfully launch humans safely to Mars. These include massive spaceships that can comfortably transport humans and cargo to Mars; propulsion systems capable of flying humans to deep space; inflatable technology large enough for humans and cargo to land safely on



Mars; spacesuits that perform in the harshest of outer-planetary environments; pressurized habitats for working and living on Mars; continuous and sustainable power needed to charge devices; and laser communications for reduced latency in the transmittal of information.

Researchers have already learned a great deal about the spaceflight journey to Mars, the environments of Mars, and what it takes to land humans on Mars through launching and monitoring the many uncrewed missions including robotic rovers and spacecrafts orbiting Mars. These advancements have directly contributed to the scientific knowledge needed to safely land and to sustain human life on Mars.

Mars human spaceflight exploration objectives recognize the need to work multi-Nationally to advance humans to the surface of Mars, while making humans a multi-planetary species. This will take the continuance of scientific discovery, space exploration throughout the cosmos through uncrewed spacecrafts, and building upon the legacy of the Apollo era through the Artemis program. Technological innovation starts with merging diverse human talents across space exploration, and diverse persons, perspectives, and skill-sets are needed to create and deliver out-of-this-world technology.

Humanity's unique experiences, backgrounds, and talents create an environment ripe for global unity which can and should be leveraged for space systems innovation to Mars and beyond.

About the author:

Dr. Michaelyn Thomas is a senior executive leader with nearly two decades of start-up and traditional space industry experience in the private and public aerospace sectors. She has an extensive success record in technical program management, business operational strategy, and model-based systems engineering of complex space systems.

Scholastically, Dr. Thomas belongs to Tau Beta Pi, the engineering honor society. She holds a doctorate degree in organizational leadership from University of La Verne; a master of science degree in space systems engineering from The Johns Hopkins University; a master of business administration (MBA) degree from University of Redlands; and a bachelor of arts degree in political science, public law with a minor degree in Russian language from California State University, Long Beach.

Dr. Thomas is the founder of <https://spacedoutdoc.com/>, and there she shares thoughts, experiences, and research through storytelling in efforts

to build community with a shared vision of women empowerment in the aerospace industry. She is also very passionate about community service, and she dedicates her spare time to inspire as many underrepresented groups to pursue STEM education and STEM careers.

She accomplishes this through community STEM activities, sponsorship, and serving as an executive mentor for the Patti Grace Smith Fellowship program which provides Black college students with paid internships in the aerospace industry as well as leading as a board member for the Society for the Advancement of Material and Process Engineering (SAMPE) foundation which aims to expand and enhance K-12 STEM education and knowledge of advanced materials and process engineering by bringing this curriculum to classrooms around the Nation.

Further, Dr. Thomas serves as an advisory board member for Tau Beta Pi to ensure the enhancement of engineering resources are shared and are consistent across all collegiate chapters around the globe.



Dr. Michaelyn Thomas

To understand STEM...

...you must DEFINE STEM, but you cannot define an acronym using the words it stands for; you must define the words the acronym represents.

Universities and organizations around the world continue to debate what a STEM career is. There is no doubt that “every career” uses STEM skills and this observation remains the focus of STEM Magazine.

Science: “The systematic accumulation of knowledge” (all subjects and careers fields)

Technology: “The practical application of science” (all subjects and careers)

Engineering: “The engineering method: a step by step process of solving problems and making decisions” (every subject and career)

Math: “The science of numbers and their operations, interrelations, combinations, generalizations, and abstractions” (every career will use some form[s])

For a moment, set aside any preconceived notions of what you think a STEM career is and use the above dictionary definitions to determine the skills used in any career field you choose.

These definitions are the “real” meaning of STEM and STEM careers.

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SYSTEM UPGRADE: REBOOTING CORPORATE POLICIES FOR IMPACT

By Dwana Franklin-Davis / CEO, Reboot Representation



System Upgrade is a practical and data-driven set of nine policies and practices that will help untapped talent enter, thrive, and stay in the workforce. Tech employers: have you ever wondered if your corporate policies and practices are the ones your employees really need? Are these the policies that help your employees not only join your company, but stay there, and excel? A new report asks 1 question: what if companies worked smarter, not harder to keep their talent?

This new report features groundbreaking research from Reboot Representation, conducted by McKinsey & Company, and in partnership with Pivotal Ventures.

Executive Summary:

All great leaders want and need their people to thrive at work. Companies that consistently invest in their core talent tend to outperform their competitors and are more likely to thrive long term.

For years, companies have invested significant time and resources in improv-

ing representation and inclusion in the workplace. Yet there is still little concrete and lasting progress, particularly when it comes to the inclusion of Black, Latina, and Native American (BLNA) women in the technical workforce. This report is an effort to understand why, as well as what works to change that reality.

When we published the first Rebooting Representation report in 2018, the number of BLNA women receiving computing degrees wasn't just low—it was declining. The collective power of the Reboot Representation Tech Coalition partners and countless others across the ecosystem helped turn those numbers around. The number of computing degrees awarded to BLNA women nearly doubled between 2016 and 2021. That's worth celebrating.

We've come a long way, and we know where to double down next: retention in the workplace. In the same moment that we see an increase in degree conferrals, BLNA women's representation in the technical workforce is shrinking—dropping by more than 10 percent in the past four years (from 4.6 percent in 2018 to 4.1 percent in 2022)⁵—compared with 16.5 percent in the working age population as a whole.⁶ To consolidate educational gains and build a workforce of thriving technologists, companies need to act.

Companies must be more intentional about ensuring that their talent strategies explicitly address employee needs at the intersection of gender and race or ethnicity. This is a smart way to prioritize talent efforts and get the most out of the investments companies are already making in their talent, especially at a time in which companies are being asked to stretch resources. When done right, this effort could lay the foundation for a more supportive workplace for additional groups that face steep barriers in the technical workforce and, ultimately, help all employees thrive.

Companies have a clear and tangible opportunity to reverse the decline in BLNA women's representation in the technical workforce. We surveyed more than 2,000 BLNA women in technical roles and their peers from other demographic groups about 38 specific policies and practices at their organizations. In addition to our survey, this report builds on existing research, much of which focuses on the experiences of BLNA women (such as their sense of belonging at work).

We found that, while current policies and practices aren't quite hitting the mark for BLNA women in technology, there are concrete actions employers can take that would positively affect the workplace experience for BLNA women

and all employees—in technical roles. Our research shows the following:

- Companies are offering policies and practices that aren't being used. Only 32 percent of BLNA women said they used more than half of the policies and practices referenced in the survey, compared with 43 percent of all other demographic groups. That means the investments companies are making in offering these policies and practices are not yet achieving their full potential for impact.
- An investment in these cornerstone policies is an investment in employee retention. BLNA women whose organizations offer all nine cornerstone policies and practices reported being more than 75 percent more likely to stay at their companies than BLNA women at companies that do not offer all nine.
- These policies benefit the entire workforce. Employees from all other demographic groups reported being nearly 80 percent more likely to be satisfied with their work experience at organizations that offered all nine cornerstone policies and practices.

Just 36 percent of all respondents reported that their company currently offered all nine cornerstone policies and practices.⁸ Offering the full package is

a crucial start for leaders who want to move the needle for BLNA women in the technical workforce.

Companies that do offer the cornerstone policies have an opportunity to take advantage of data disaggregated simultaneously by race or ethnicity and gender. Disaggregated data enables companies to increase the return on their investment in policies and practices by uncovering hidden barriers to impact. Only 46 percent of BLNA women reported that their employer's average existing cornerstone policies were designed to be accessible and effective for them, 16 percentage points lower than what their peers reported.

That might not be surprising: the significant majority of companies surveyed and interviewed for this research had not yet set goals, measured progress, or tracked outcomes at the intersection of race and gender.

By exploring existing policies and practices from both corporate and technologist perspectives, this report provides a road map to help companies prioritize the tactics that will make the most of limited time and resources. It includes key opportunities for action along with tools and resources to support companies in creating environments in which all employees feel supported and contribute fully.



To create lasting progress, business leaders must tap into three familiar (but critical) factors for success: collecting and disaggregating data at the intersection of race or ethnicity and gender to sharpen decision making; delivering results and fulfilling the promises that have been made to employees by focusing on the highest-impact practices; and iterating and improving continuously by centering the needs of BLNA women technologists to create a workplace in which all employees can truly thrive.

[Review full report here](#)

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WOMEN IN STEM

By The Chartered Institute of Patent Attorneys

Women in IP have been working to highlight the benefits of gender inclusion within the profession and work towards greater equality.

Internet Protocol (IP)

The Internet Protocol is the network layer communications protocol in the Internet protocol suite for relaying datagrams across network boundaries. Its routing function enables internet-working, and essentially establishes the Internet.

About [Dr. A.K. Ola Hekselman](#)

Dr. A.K. Ola Hekselman is a distinguished scientist, entrepreneur, and visionary in the field of battery science. With a profound commitment to environmental sustainability, her work has redefined the possibilities within battery technology. Dr. Hekselman's academic journey includes a PhD from the University of St Andrews, research fellowships at the University of Oxford, and postdoctoral research at Imperial College London. Her contributions extend beyond academia, as she continues to drive innovation at the intersection of science and business.

Ola was keen to provide a sustainable and efficient alternative, so she worked with Dr Payne on developing an improved, solvent-based method of recycling lead-acid batteries. This prompted the filing of a UK patent application to protect their invention, which has since been used to seek patent protection in multiple countries.

Ola's vision goes beyond innovation; it's about real-world impact. She envisions scaling Solveteq's technology globally, revolutionizing battery recycling while diminishing environmental footprints.



This commitment to progress was recognized with the Innovate UK 'Women in Innovation' award in March 2023.

About **Dr. Fanya Ismail** – CEO, Director and Co-founder of SGMA

Dr Fanya Ismail, Chief Executive Officer, Director, and Co-founder of Sol Gel Materials and Applications (SGMA) Limited, has led an interesting and impactful life.



Fanya founded SGMA in 2017 with the aim of creating sustainable and plastic-free paper packaging using sol-gel technology. Her work was recognised with an Innovate UK 'Women in Innovation' award in 2019.

SGMA has grown rapidly and moved from the small industrial unit in Gillingham which first housed its labora-

tory and office, to a site in Kent Science Park in Sittingbourne. Its initial focus was on providing a waterproof barrier to replace the plastic liner in single-use disposable coffee cups to make them fully recyclable, compostable and biodegradable. Never short of ideas, SGMA's goal is to apply its technology to a wide range of areas including food and drink, textiles and construction.

As the business has grown, SGMA has filed an increasing number of patent applications, all which list Fanya as an inventor. Securing patent protection for her inventions gives SGMA's investors' confidence that the business is protected as it expands, which was key in attracting investment in its early stages. The company's diverse portfolio of patent applications now includes four international patent families.

Here's what their patent attorney Dr. Marianne Privett had to say about her clients;

"Dr Fanya Ismail and Dr. A.K. Ola Hekselman are truly inspirational scientists and entrepreneurs who are helping pave the way for women in science and technology. It has been a privilege to join Fanya and Ola on their journeys in developing innovative and sustainable products and services to combat key environmental issues and assist them in using intellectual property to support their businesses as they grow."

About [Siana Zhekova](#) – Computer Science Finalist at The University of Cambridge

Building bridges: Siana Zhekova, and her “necklace” bridge



Student inventor, Siana Zhekova, is the inventor of a temporary “necklace” bridge designed for rapid deployment following a natural disaster. Siana, a visionary student and aspiring engineer, has engineered a ground-breaking solution that stands poised to revolutionize disaster relief efforts.

Her ingenious bridge design, coupled with a user-friendly winch mechanism, could significantly expedite recovery in disaster-stricken areas.

The bridge concept, meticulously crafted by Siana, serves as a lifeline during catastrophe-induced devastation, such as floods or earthquakes, where existing bridges have succumbed. Leveraging cutting-edge technology, the bridge is deployed by launching support cables across riverbanks, anchoring them securely. Subsequent attachment of platform sections onto the cables creates the foundation, followed by the tensioning of cables via a novel winch mechanism.

Collaborating with Beck Greener – a supporter of women in STEM, Siana’s work embodies their shared mission, Beck Greener’s STEM Branching Out Initiative, aimed at introducing STEM careers to students, providing crucial guidance to Siana throughout her intellectual property journey.

Here’s what her patent attorney had to say about her journey:

“I am always surprised when young people tell me that they are not an inventor, or that patents are not for them.

At Beck Greener, we want to show that being an inventor simply means having a good idea to solve a problem. Siana’s bridge is a perfect example. As part of a school project, she came up with an elegant solution to the problem of reaching people in an emergency.

The innovative bridge design she devised may be deployed quickly and easily by the emergency services at instances where time is critical. A real lifesaver. We are delighted that we were able to secure a patent for her invention as part of our STEM: Branching Out project."

Erin Reid – Founder of LU Innovations

Erin Reid (26) is the founder of LU Innovations Ltd, a menstrual health company for adventurers. Erin, a self-proclaimed adventurer, felt uncomfortable and a lack of ease in the products and resources available to her when she participated in outdoor activities on her period. In her final year studying product design, she started researching and designing period kits to truly work in remote environments, without the need for toilets, handwashing facilities or bins, taking pride in thinking about the whole user journey.



With no previous business experience or knowledge in taking a product to market, she has described entering the period care market as fascinating. She said “Being a female inventor with a female orientated product range can be difficult.

As menstrual health isn’t talked about enough and seen as secretive and taboo subject, conveying the pain points and health risks LU solves to those that do not menstruate is time consuming. But it’s really cool getting to call yourself an inventor and CEO of a company that people connect with, even though the foggiest of the menstrual taboo. I take great pride in being able to design products that really make a difference, both socially and environmentally, and being able to play a part in inspiring girls and women to achieve all their goals any time of the month”.

With a huge drive and focus on Fem-Health and female focused innovations recently the importance of having a diverse team in all fields of innovation and patenting is even more significant. Having women represented helps to smooth the journey of bringing a product to market. Erin described:

Quote from patent attorney, *“It has been a wonderful experience working with Erin and LU Innovations, helping to develop and strengthen their IP*

portfolio. Erin has an infectious passion for her work and is a true advocate for menstrual health and hygiene and technologies for improving them.

We are really excited to continue supporting LU innovations as they grow and flourish. While it is fantastic to shine a light on the amazing work ongoing by Erin and LU innovations, it would be remiss not to mention that female inventors like Erin are still in the minority, with only around 13% of EP patent applications having a female inventor.

At HLK, we are committed to helping improve diversity and inclusivity in STEM and the IP sector. One way in which we try to help is by having a dedicated interdisciplinary FemTech team committed to working with female inventors, particularly those whose inventions serve the health and wellbeing of women.”

Erin O'Connor, HLK

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The High **Risks** of an Adolescent Brain

By Judy Willis, MD, M.Ed



The Adolescent Growth Spurt in their Bodies Before Their Brains

During adolescence, your child's body matures and she becomes more self-sufficient and independent. These years also bring dramatic hormonal fluctuations, greater peer pressure, increased access to drugs, alcohol, sex, and potentially unsafe driving practices. The problem is that the part of the brain that will in later years guide her logical thinking, judgment, prioritizing, and risk-assessment have yet to literally "get it together". This is a setup for disaster.

The brain goes a first maturation phase in the months before and after birth and second throughout childhood and adolescence. The second involves reorganizations that stabilize the efficient communication among neurons that increases control over physical coordination, effective communication, emotional regulation, and ultimately of cognitive dominance over immediate gratification.

The neural networks that ultimately guide the volitional and goal-directed

dominance over immediate gratification are called executive functions. These circuits are located in the prefrontal cortex, which is the last part of the brain to undergo the maturation that make neuron- to-neuron communication efficient.

The executive functions are the brain circuits that direct the complex mental processes you see emerge as your children grow. These are the brain's hubs of emotional stability, value and moral judgment, reasoning, planning, prioritizing, impulse control, and analysis of risk. The problem is that while your teen's body is reaching peak efficiency, these networks of the highest thinking, reasoning, and emotional control are still getting organized. It is not until the twenties that these circuits that will serve as the brain's chief executive officers (CEOs) develop the efficient neuron-to-neuron connections needed to successfully control reasonable decision-making and logical choices.

Delayed Teen Brain Maturation and Risk

Until these networks of logical thinking, judgment, and prioritizing mature into their efficient communication state, adolescents' impulses can have more power over their choices and actions than does logic. Decisions you consider obvious and behaviors you



know are dangerous may not be interpreted that way by the still incomplete circuits in the prefrontal cortexes of your teenage child.

Without the efficient wiring of the still maturing executive function networks to guide judgment, the instinctual, more primitive desire for immediate gratification promotes impulsive decisions and inadequate risk-assessment. Without the guidance of judgment, your teen's behaviors can reflect his overconfidence in his abilities and inability to consider the consequences of his actions. This body over brain influence puts him at risk for engaging in perilous behaviors that exceed human brain capabilities, such as driving while talking on his cell phone, texting, or when under the influence of drugs or alcohol.

Executive Function Development You Can Promote

Adolescence is a critical time for you to help your teen build the self-awareness to resist immediate gratification and high-risk behavior. Lapses in judgment and illogical decision contribute to the fact that teenagers are three to four times more likely to die from risk-taking and accidents than at any other non-elderly age after infancy.

It has been said that if children expect to be told what to do at each moment, they will not learn how to handle moments when they don't know exactly what to do. Parent-child connectedness and trust are protective influences that reduce high-risk behaviors. Show your trust in your child's developing capacity for building good judgment while his executive function networks are under construction by giving him increasing responsibilities with accountability. Give him opportunities to make choices, explore options, and learn from both the successes and authentic consequences of his choices.

Your adolescent also needs guidance to become aware of the potential consequences of her actions, to resist first impulses, and to avoid making decisions based only on peer influence. You can help her build these skill sets by providing opportunities for her to

set and plan how to achieve personal goals, distinguish fact from opinion, and judge credibility of information from various sources. When you provide experiences for your child to anticipate the outcomes of her actions and consequences of her decisions you will be influencing the decisions she will make from that point forward.

Involve your children in decision-making about family vacations, evaluating propositions you'll vote on in upcoming elections, big purchases such as the new family car, or the community service project in which you'll participate together.

To motivate their interest, it should be a decision in which you are open to multiple options so he experiences the satisfaction of constructing a vacation plan within the designated budget that includes a day at the waterpark on route to your destination. If you are open to listening to your teen's defense of the financial benefits of buying the family car she wants, she'll build her critical analysis of validity. Her initial support of her car choice may be the e advertising slogan promising "best mileage", but to comply with your request for factual support.

As you guide her to more reliable consumer resources she'll have the "ah-ha" experience that will help her analyze

validity of subsequent internet sources and build the judgment to reflect before reflexively following her friend's declaration that just one beer will never impair her driving or show up on a blood alcohol test.



An opportunity to do this can occur when she develops an excessive passion for a diversion, video game, or social media connections that becomes an obsessive, reducing her interest in academics, family time, healthy eating, and exercise. That is an opportunity to build their insight and judgment as you guide in developing a plan to cut back instead of just prohibiting any time spent at the pursuit. Help them find strategies to delay the immediate gratification and prioritize obligations in a

reasonable balance.

The goal of your interventions then becomes more than having her spend less time on Facebook. You are building her skills of analyzing and recognizing the triggers or “risk factors” that limit her ability to resist the temptation of immediate gratification. She will be building potential life saving skillsets of risk assessment, considering consequences before acting, and impulse control that will empower her future judgment –

and have the self-control to resist texting when driving.

Teachable moments are opportunities for building your child's awareness of consequences. These are probably already present in abundance if you are the parent of a teen. The underdeveloped executive function networks needed to guide adolescents in prioritizing and planning ahead often result in rescues by parents.

These are the times your child doesn't ask you to get the poster board he needs for his project display until 10pm the night before.

A teachable moment is lost if he experiences with no authentic consequences for his failure to plan and prioritize.

His actions become a teachable moment if you resist your desire to rescue him from a low grade and have him experience the consequences of his action (or inaction). You'll be helping him build the planning, prioritizing, and goal-directed executive functions that will be critical for his future success in school, work, and relationships.

You'll probably increase the likelihood they he will have a spare tire when he gets a late night flat on a rural road. Just remind yourself that points off a grade now will impact the judgment and risk assessment needed for his safe passage through the teen years.



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Long COVID for the Long Haul

By Jannatul Ferdous, BS, PharmD Candidate 2024

In light of the Centers for Disease Control and Prevention (CDC) recommendations for vaccination published September 15, 2023¹, and the most recent resurgence of COVID-19, let's discuss a lesser-known complication of COVID: Long COVID.

The term “Long COVID” originated from long haul patients who suffered from lingering COVID symptoms and did not achieve full recovery for three or more months after an acute infection caused by the SARS-CoV-2 virus.² Long COVID is known by many names such as Post-COVID Conditions (PCC), Post-Acute Sequelae of SARS-CoV-2 infection (PASC), and Chronic COVID, among others.² Even after 3 years, Long COVID remains a mystery that is continuously being studied by scientists.

Long COVID: statistics

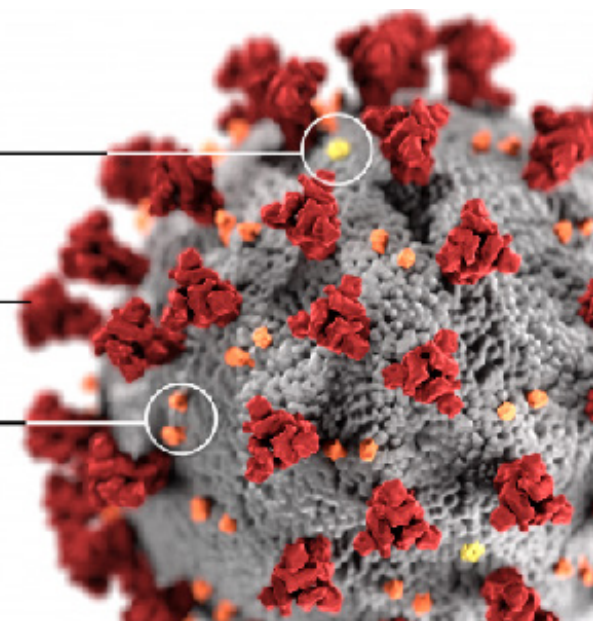
The prevalence of Long COVID was assessed through the Household Pulse Survey, a 20 minute online survey conducted by the National Center for

Health Statistics (NCHS), U.S. Census Bureau, and other federal organizations.³ The survey data, collected from June 1-June 13, 2023 found that approximately 1 in 13 American adults diagnosed with COVID-19 have Long COVID symptoms.⁴ Long COVID is predominant among younger adults and women.⁴ Of the survey participants, 9% of the Hispanic population suffers from Long COVID compared to 6.8% of the black and 7.5% of the white population.⁴ The incidence of Long COVID also differs between states; Kentucky, Alabama, Tennessee, and South Dakota have higher rates of Long COVID compared to Hawaii, Maryland, and Virginia.⁴

E protein

S protein

M protein



Organs

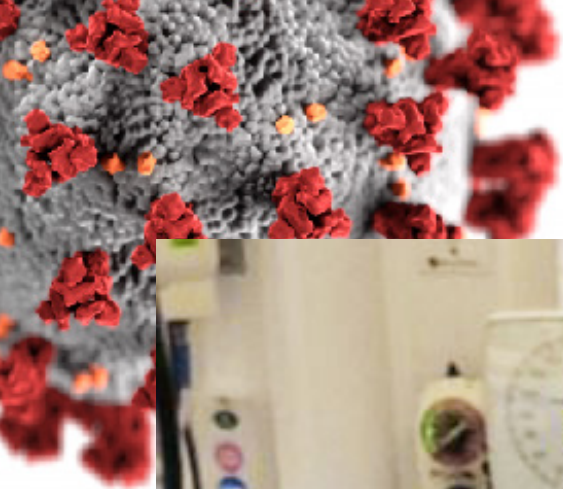
Complications

Lungs	Shortness of breath, cough
Heart	Chest pain, irregular heartbeat, feeling faint
Kidneys	Change in urination, pain on the side
Brain and nerves	Brain fog, headache, dizziness, mood symptoms, nerve damage, seizures, dementia, anxiety, depression
Eyes	Change in vision, yellowish eyes
Ears	Hearing loss, tinnitus
Nose	Loss of smell
Female / male sex organs	Erectile dysfunction, menstrual cycle changes, reduction in male fertility, worsened premenstrual symptoms
Stomach and intestines	Diarrhea, stomach pain
Muscles and bones	Muscle and joint pains, reduced mobility
Others	Fatigue, post-exertional malaise, abnormal movement, fever, chills, weakness, sleep disturbance

Disease burden

Long COVID can affect multiple organs at once and create various complications throughout the body (see Table above for the list of complications seen in Long COVID). The symptoms may present as relapsing and remitting patterns during which the symptoms worsen (relapse), go away completely (remission), and then return.⁶ The symptoms can also progress over time, causing life-threatening conditions even years after the infection passed.⁶

According to the Kaiser Family Foundation (KFF), Long COVID can cause significant limitations to a person's day-to-day activities.⁷ In the Household Pulse Survey mentioned above, 79% of patients who experienced Long COVID reported having restrictions to their daily activities and 27% of these limitations were rated as significant.⁷ These limitations contributed to loss of income estimated between \$500,000 - \$4 million.⁷ Long COVID is now considered a disability under the American Disabilities Act (ADA) Section 504 and



Section 1557 due to its ability to cause physical and mental impairments, thus limiting life activities.⁸ Under the law, patients diagnosed with Long COVID are entitled to receive accommodation for their illness.

Diagnosis and Treatment

Although the exact reason for Long COVID is unknown, it is suspected that the virus's protein and genetic materials linger in the blood and the tissues after the acute phase of the infection.⁵ The leftover virus material triggers the immune system and activates numerous inflammatory cascades causing injuries to various parts of the body.⁵

Due to its multi-organ involvement, it is difficult to diagnose and treat Long COVID. Usually, it is a diagnosis of exclusion, meaning that all other underlying illnesses should be ruled out before Long COVID is confirmed.⁹ The treatment options include symptomatic, supportive, and rehabilitative treatment which may vary among patients.⁹ Symptomatic treatment involves addressing the clinical presentations such as fever, cough, diarrhea, etc. Supportive care addresses neurological and psychological conditions such as pain, fatigue, brain fog, anxiety, depression, and insomnia.

Cognitive-behavioral therapy and counseling can be utilized to treat neurological and psychiatric symptoms and rehabilitative techniques such as deep breathing techniques can be utilized to treat breathlessness and chronic cough.⁹

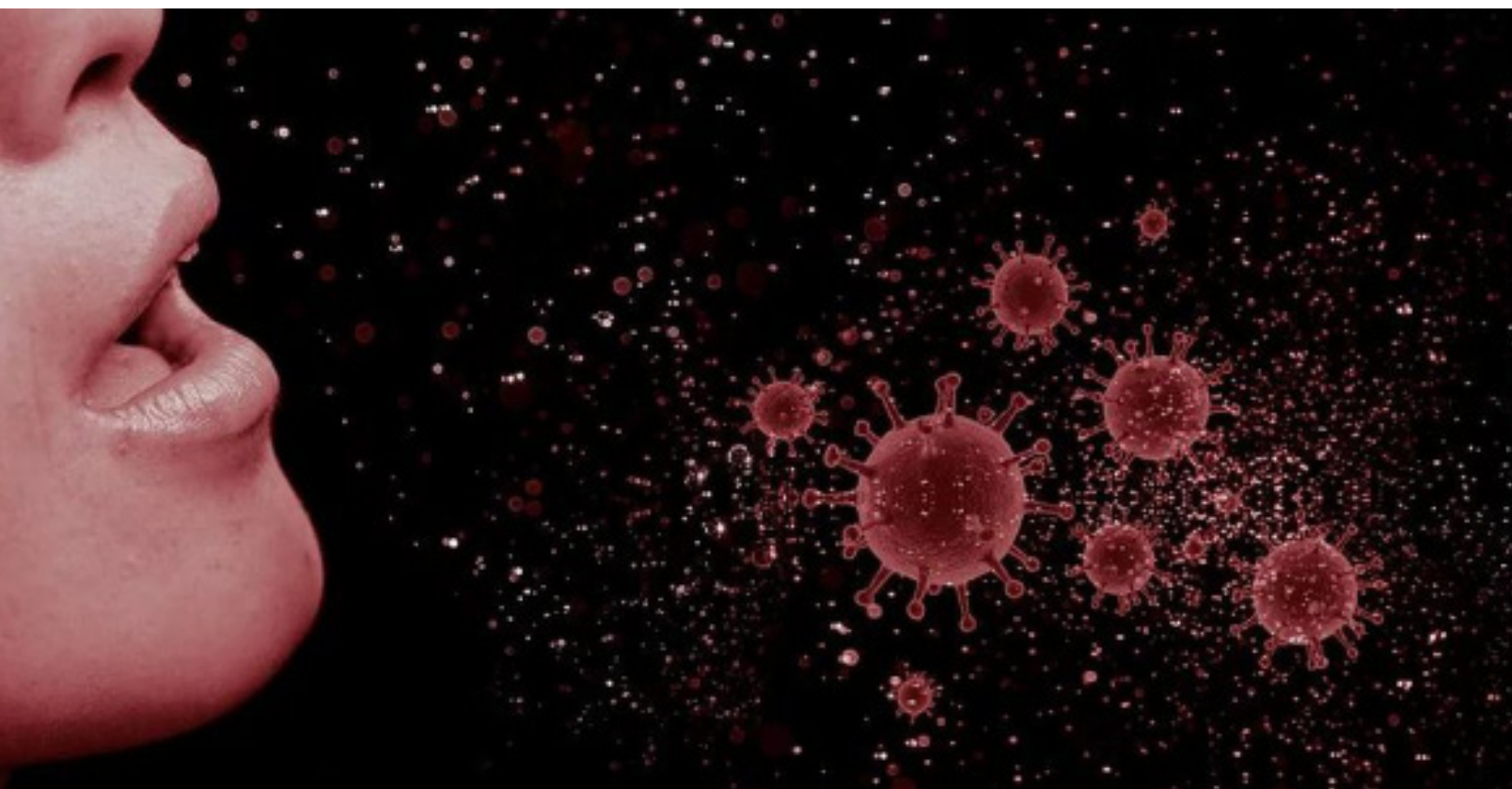
Protection through vaccination

Every year after the pandemic, we are haunted by the COVID-19 virus as it mutates into new strains. This year, a new Omicron strain called EG.5, "Eris," is dominating the United States and is suspected to be very contagious, although it is not as lethal than the previous strain.¹⁰ The CDC recommends that everyone 6 months and older receive an updated COVID-19 vaccine.¹

While the vaccine doesn't prevent the infection, it reduces the severity of symptoms, length of illness, and risk of COVID-19-related hospitalization and death.¹¹ The updated COVID-19 vaccines from Pfizer-BioNTech and Moderna will soon be available at the local pharmacies. Although most insurance plans will cover the COVID-19 vaccine at no additional cost, local health centers, state health department, or some participating pharmacies may provide the vaccine free of charge thanks to the CDC's Bridge Access Program.¹¹ Officially launched in April 2023 by Health and Human Services (HHS), the CDC's



Bridge Access Program is estimated to provide free vaccination to 25-30 million American adults.¹² CDC has made an agreement with more than 20,000 retail pharmacies nationwide to provide such broad access to COVID-19 vaccination. The program, however, is temporary and scheduled to end in December 2023.¹²



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