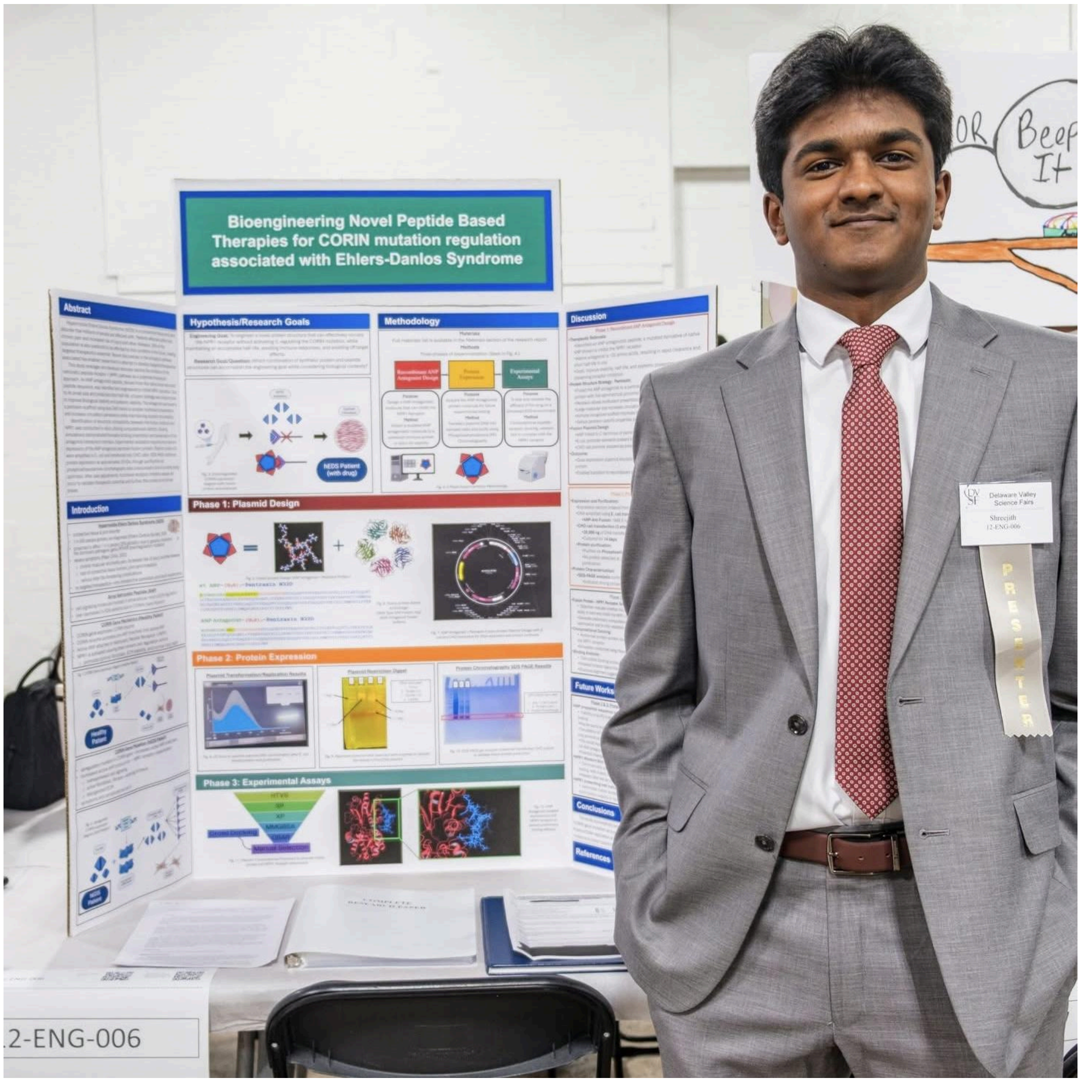
Delaware Valley Science Fairs
2026 Meet the Medalists

Compiled by Isabelle Romine

MEET 2026 DVSF GRADE 12 GOLD MEDALIST
Shreejith Krishnamoorthy, Central Bucks South High School (Bucks County)



Project: "PentraCOR: Bioengineering a Novel Synthetic Fusion Protein Therapeutic for Targeted Regulation of CORIN Gene Signaling in Hypermobile Ehlers-Danlos Syndrome"

Shreejith shares how is research was inspired by meeting someone:

"Like most others, I had never heard of hypermobile Ehlers-Danlos Syndrome ever before in my life. That is until I met someone who would change my view of medicine and its applications forever. I personally met an individual who suffers from Ehlers-Danlos Syndrome and when I heard the profound impact that it had on her life I was frightened. She was diagnosed with hEDS at around 14 years old and her life would not be the same ever again. She now needs to

consider every single aspect of her life to anticipate her pain tolerance. Despite her struggles, she is still an extremely intelligent person who I look up to greatly. Now she goes around local areas to share her story and raise awareness for hEDS. On a similar visit to a local seminar, I got to engage with her and discuss the lack of research being done on this growing topic of discussion. Seeing how this disease had altered her life, I was inspired to develop my own therapy to ensure that no one else faces the same disappointment and pain that she had. I would also like to thank Mark Hayden, my adult supervisor and chemistry teacher. He supported my journey in connecting and guiding me through my research internship. His contributions to my research practices and presentational skills are insurmountable. "

Abstract:

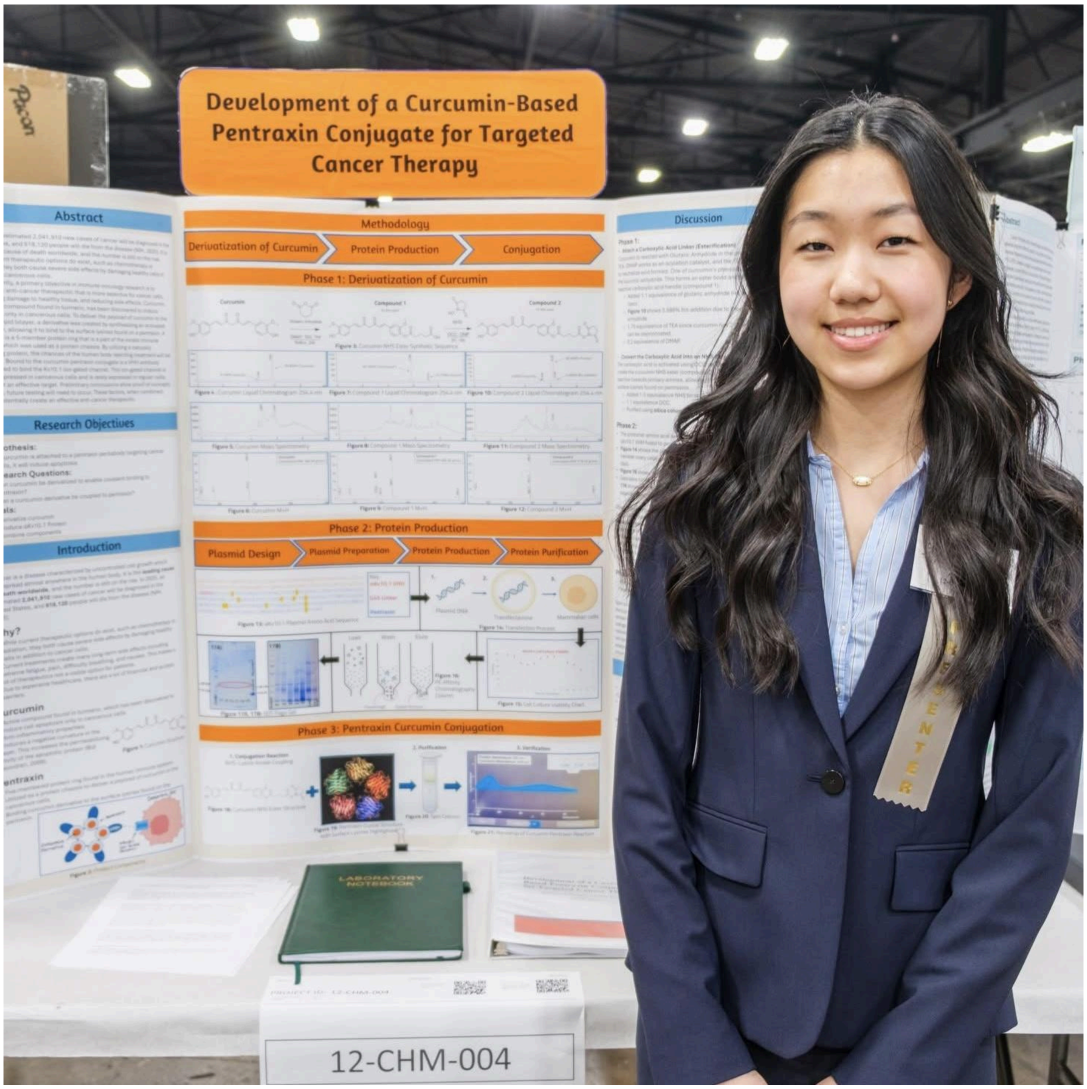
Hypermobile Ehlers Danlos Syndrome (hEDS) is a connective tissue and joint disorder that millions of people are affected with. Patients affected suffer from chronic pain and increased risk of injury and other diseases. 20% of the population is also predicted to be affected by this condition in the future, making targeted therapeutics essential. Recent discoveries in the biological pathway associated has enabled researchers to attempt to develop targeted therapeutics.

This study leverages and develops rationale behind the inhibition of the natriuretic peptide receptor 1 (NPR1) pathway as a potential therapeutic approach. An ANP antagonistic peptide, derived from the native atrial natriuretic peptide sequence, was identified and engineered to inhibit NPR1 activation. Due to its small size and predicted short half-life, a fusion strategy was implemented to improve biological stability and systemic viability. The antagonist was fused to a pentraxin scaffold using dual G4S linkers to enable multivalent presentation and increase circulatory bioavailability while maintaining potency.

Identification of structural compatibility between the fusion construct and NPR1 was conducted in-silico utilizing computational metrics. Docking simulations demonstrated favorable binding orientation of the antagonist interaction interface. Experimental validation required recombinant expression of the ANP antagonist–pentraxin fusion protein. Plasmid constructs were amplified in E. coli and transfected into CHO cells. SDS-PAGE confirmed protein expression at approximately 25 kDa, though purification via phosphoethanolamine chromatography is currently being optimized. After said adjustments, functional receptor inhibition assays will occur to validate therapeutic potential.

MEET 2026 DVSF GRADE 12 SILVER MEDALIST
Athena Man, Central Bucks High School East (Bucks County)

Received an ISEF Special Award



Project: “Development of a Curcumin-Based Pentraxin Conjugate for Targeted Cancer Therapy”

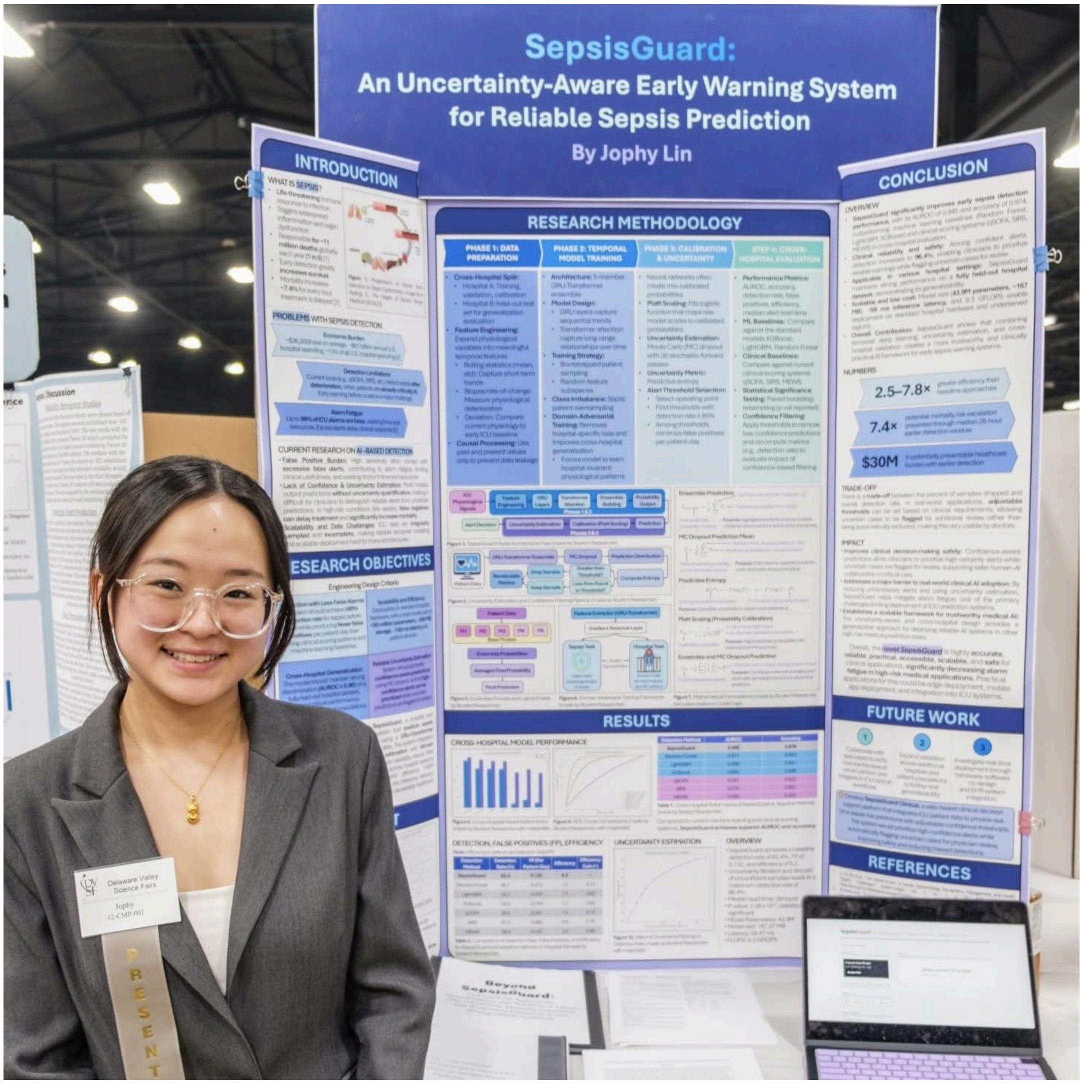
Athena encourages science fair students to challenge what they think they know:

“I wanna turn the whole thing upside down” is a line from my favorite song "Upside Down" by Jack Johnson, and it stayed with me throughout my research experience. To me, it captures what curiosity in science really feels like—challenging what you think you know and being open to shifting your perspective.

Mark Hayden, Dr. Willett, and Dan Nguyen were central to that journey. They pushed me beyond what I initially thought was possible, and I'm deeply grateful for their mentorship. More than anything, they made sure I enjoyed the process as much as the outcome. On the side, we also grew a turmeric plant! A small but memorable part of my experience that kept things grounded.
Sometimes curiosity really does turn everything upside down, and in my experience, that's where the fun begins!"

Abstract:
In 2025, an estimated 2,041,910 new cases of cancer will be diagnosed in the United States, and 618,120 people will die from the disease (NIH, 2025). It is a leading cause of death worldwide, and the number is still on the rise. While current therapeutic options do exist, such as chemotherapy or radiation, they both cause severe side effects by damaging healthy cells in addition to cancerous cells.
Consequently, a primary objective in immune-oncology research is to develop an anti-cancer therapeutic that is more selective for cancer cells, minimizing damage to healthy tissue, and reducing side effects. Curcumin, the active compound found in turmeric, has been discovered to induce apoptosis only in cancerous cells. To deliver the payload of curcumin to the phospholipid bilayer, a derivative was created by synthesizing an activated NHS ester, allowing it to bind to the surface lysines found on a pentraxin. A pentraxin is a 5-member protein ring that is part of the innate immune system, serving as a protein chassis. By utilizing a naturally occurring protein, the chances of the human body rejecting treatment will be reduced. Bound to the curcumin pentraxin conjugate is a VHH antibody engineered to bind the Kv10.1 ion-gated channel. This ion-gated channel is highly expressed in cancerous cells and is rarely expressed in regular cells, making it an effective target. The curcumin derivative was synthesized with a 27.6% yield, confirmed using analytical methods. Protein expression in mammalian cells was achieved but yielded low amounts, indicating a need for optimization. Preliminary conclusions support the proof of concept; however, further testing will be necessary. These factors, when combined, could potentially create an effective anti-cancer therapeutic.

MEET 2026 DVSF GRADE 12 BRONZE MEDALIST
Jophy Lin, Manalapan HS (Jersey Shore).



Project: SepsisGuard: An Uncertainty-Aware Ensemble Early Warning System for Safe, Reliable, and Scalable Prediction of Sepsis and Acute Clinical Deterioration

Jophy reminds science fair students that it’s about the journey:

“When I look back on this journey, the results almost feel secondary to everything that happened along the way. Research is hard. There will be weeks where nothing works, where your model and prototype underperform, where you question whether the whole thing was a mistake. My advice is to sit with that discomfort. Those are the moments that actually shape you as a scientist, not the wins. Persistence isn't about never doubting yourself. Rather, it's about showing up the next day anyway.

One thing I wish someone had told me earlier: science fair isn't a competition against others - it's a chance to grow. It's so easy to look around the room and compare yourself to the person next to you, but your only true competition is yourself. Are you pushing your ideas further than you did last year? Are you asking harder questions? That's the only thing that matters. This will be my third consecutive year competing at ISEF, and honestly, what I feel most is gratitude - not just for the opportunity, but for how much I've grown between each trip. Each year I've come back a different scientist, and that continuity has meant more to me than any individual result.

Science fair is also one of the few places where you get to stand in front of strangers and share something you genuinely care about, and have them care back. Some of the most valuable moments I had weren't during judging, but in the in-between conversations with other students, learning about their projects, realizing how much brilliant work is happening in rooms just like this one. Go into it curious, not competitive. And if you're just starting out, pick a problem that actually bothers you. Not one that sounds impressive, not one you think judges will like. One that keeps you up at night. That genuine obsession is what carries you through the hard parts, because there will be hard parts.

The most rewarding moment of this whole experience wasn't seeing my results, but getting to *present* them. Seeing your work come to life in front of an audience, watching someone's eyes light up when they understand what you built and why it matters is the feeling no trophy can replicate. I'm very grateful to my teachers, friends, family, and peers who supported me every step of the way. Research can feel isolating, but I was never truly alone, and this project is as much theirs as it is mine. To anyone just starting their science fair journey: trust the process, embrace the mess, and remember that the point was never the medal. It was always the work."

Abstract:

Sepsis, responsible for 11,000,000+ deaths globally and 270,000+ annually in the U.S., is very time-sensitive. Mortality increases by 7.6% per hour of delayed antibiotic treatment. Bedside tools (qSOFA, SIRS, MEWS) often miss cases, generate many false alarms, or fail to detect sepsis before deterioration, which causes alarm fatigue and delayed intervention. Existing AI systems are trained to provide "best-guesses" without a measure of confidence, making them unsafe for deployment in ICUs. This study introduces SepsisGuard, a scalable GRU–Transformer ensemble (43.9M parameters, 59.5 ms latency, 9.3 GFLOPS) trained on 20,000+ ICU patients (PhysioNet 2019) using domain-adversarial learning for cross-hospital generalization and Monte Carlo dropout for uncertainty estimation. Trained on Hospital A and evaluated on a fully held-out Hospital B cohort, SepsisGuard achieves 82.4% early detection at 0.132 false positives per patient-day (efficiency 6.2), outperforming XGBoost, LightGBM, Random Forest, and bedside tools (AUROC 0.9447, $p < 0.05$) with 2.5–7.8× greater efficiency. It also detects sepsis on median about 28 hours before clinical recognition (7.4× mortality escalation if untreated). With it costing ~$36.5k per case in the U.S., the detection rate corresponds to 824 cases per 1,000 (~$30.1M in associated expenditure). With uncertainty filtering, detection increases to 96.4% among high-confidence predictions, which enables prioritized alerts while routing uncertain cases to clinicians for further review. With its combination of cross-hospital validation, uncertainty estimation, and early detection, SepsisGuard creates a scalable, physician-centered framework for safer AI deployment in critical conditions, with the framework applicable to broader healthcare settings

MEET 2026 DVSF GRADE 11 GOLD MEDALIST
Zining Fan, Emmaus High School (Lehigh Valley)

Received 2nd Place in Mathematics at ISEF

Project: Detecting causality in globally hyperbolic spacetimes using Conjugation Quandles

Zining shares how research that bridges your interests can make doing research truly enjoyable:

"My project is at an intersection between theoretical mathematics and physics. Since I have always loved both of these subjects, it was perfect for me. I enjoyed doing the research, asking the questions, and hypothesizing the why. This project was supported by my Professor, Dr. Chernov, who helped me along the way and gave me the support I needed to preprint this research.

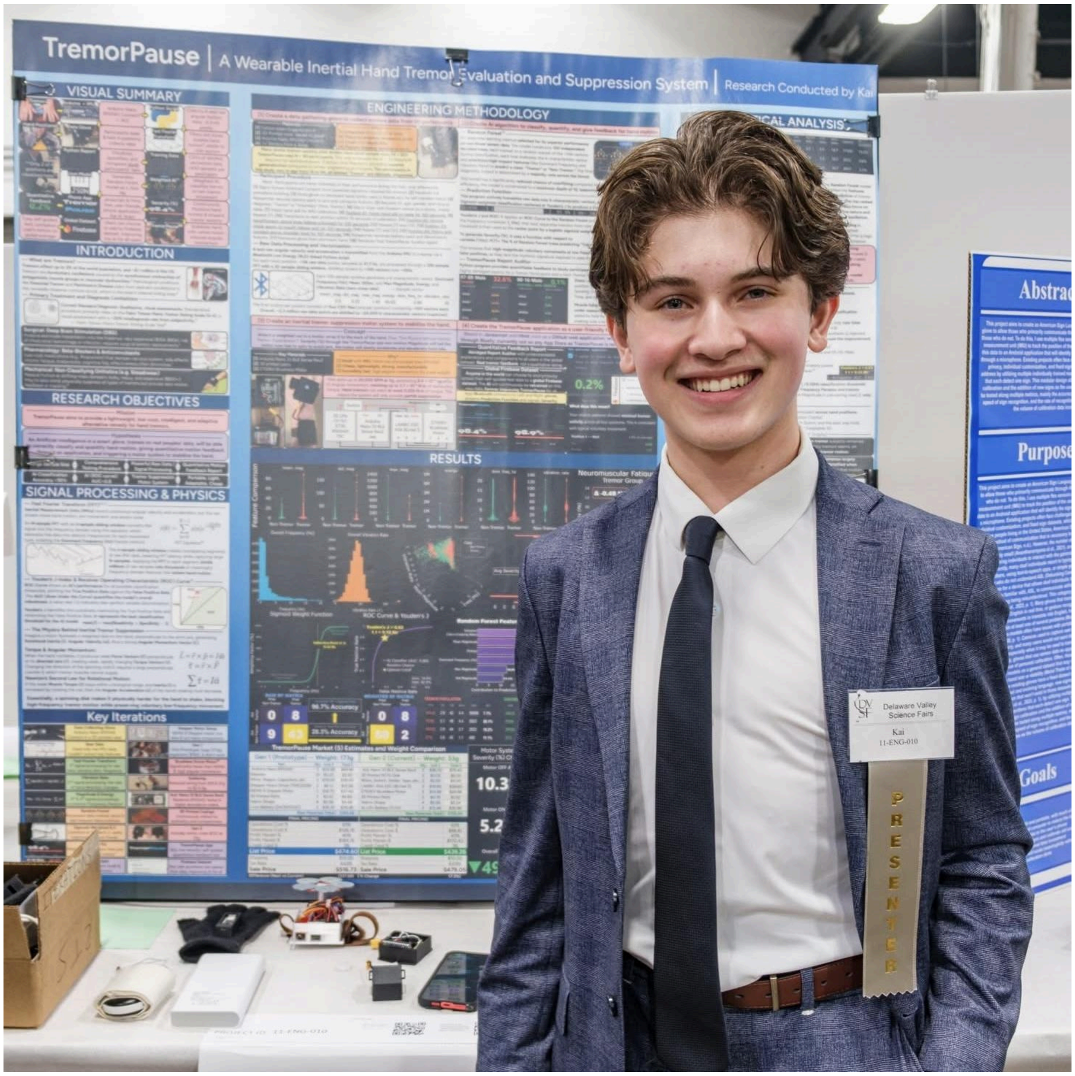
On another note, I also loved the experience at DVSF. Everyone was super friendly, deeply intellectually curious, and great people to get to know and talk to. I would share my research, and they would share theirs, being very supportive along the way. I had a great experience there and would recommend anyone to participate."

Abstract:

I investigated whether quandle colorings (homomorphisms) can detect causality for links realized as skies in a (2+1)-dimensional globally hyperbolic spacetime X. I built on the Allen–Swenberg example, where certain 2-sky links were conjectured to be causally related. Allen and Swenberg showed that the Alexander–Conway polynomial does not distinguish these links from the connected sum of two Hopf links H#H, which represents two causally unrelated events. I asked whether quandle invariants can detect the distinction missed by the Alexander–Conway polynomial. I proved that the conjugation quandle of the dihedral group D5 distinguishes the two links: although they share the same Alexander–Conway polynomial, they have different D5 quandle counting invariants. For D5 , the counting invariant alone separates the pair, while for other small dihedral groups such as D3, D4, D6, and D7 , even the enhanced counting polynomial fails to do so. I further proved that the conjugation quandle over D5 distinguishes the full infinite Allen–Swenberg family from H#H. To explain this, I analyzed reflection and rotation signatures and associated to each coloring an integer matrix determined by the local crossing types. Smith normal form revealed an additional invariant factor pattern for the Allen–Swenberg links, producing a gcd(10,n) term absent for H#H. I showed that the number of quandle homomorphisms satisfies $\mathrm{Hom}(Q, L) = \Sigma\, a \cdot n^{m-r} \cdot \prod \gcd(d_i, n)$, which gives a general formula for the number of homomorphisms for all Dn and explains why causality is detected precisely for dihedral groups of the form D5n.

MEET 2026 DVSF GRADE 11 SILVER MEDALIST
Kai Alexander Vajapey, Moorestown High School (Jersey Shore)

Received 3rd Place in Biomedical Engineering & Received an ISEF Special Award



Project: TremorPause: A Wearable Inertial Tremor Evaluation and Suppression System

Kai encourages science fair students to find their “reason”:

“Roughly 5% of the world population experiences pathological hand tremors, yet diagnosis still relies largely on subjective visual scoring, and treatments are often invasive, expensive, or accompanied by severe side effects.

My project, TremorPause, is a wearable system designed to both objectively evaluate and inertially suppress pathological hand tremors. The device uses AI to generate Tremor Severity, a continuous 0-100% tremor score, achieving 96.7% classification accuracy. Through the TremorPause mobile app, users can complete a tremor assessment in under three minutes and anonymously contribute data to a global dataset that continuously improves the AI model. The wearable itself physically resists hand shaking using angular momentum and reduced tremors by 49.8%, closely matching theoretical physics predictions of 56.6%.

My favorite part of this project was the people. To gather data, I individually contacted 60 participants, people diagnosed with tremors and without. One participant, a 69-year-old man, was shaking so much he struggled to even put the glove on himself. Meeting people actually struggling with the disease became my motivation and my drive. I want to help these people.

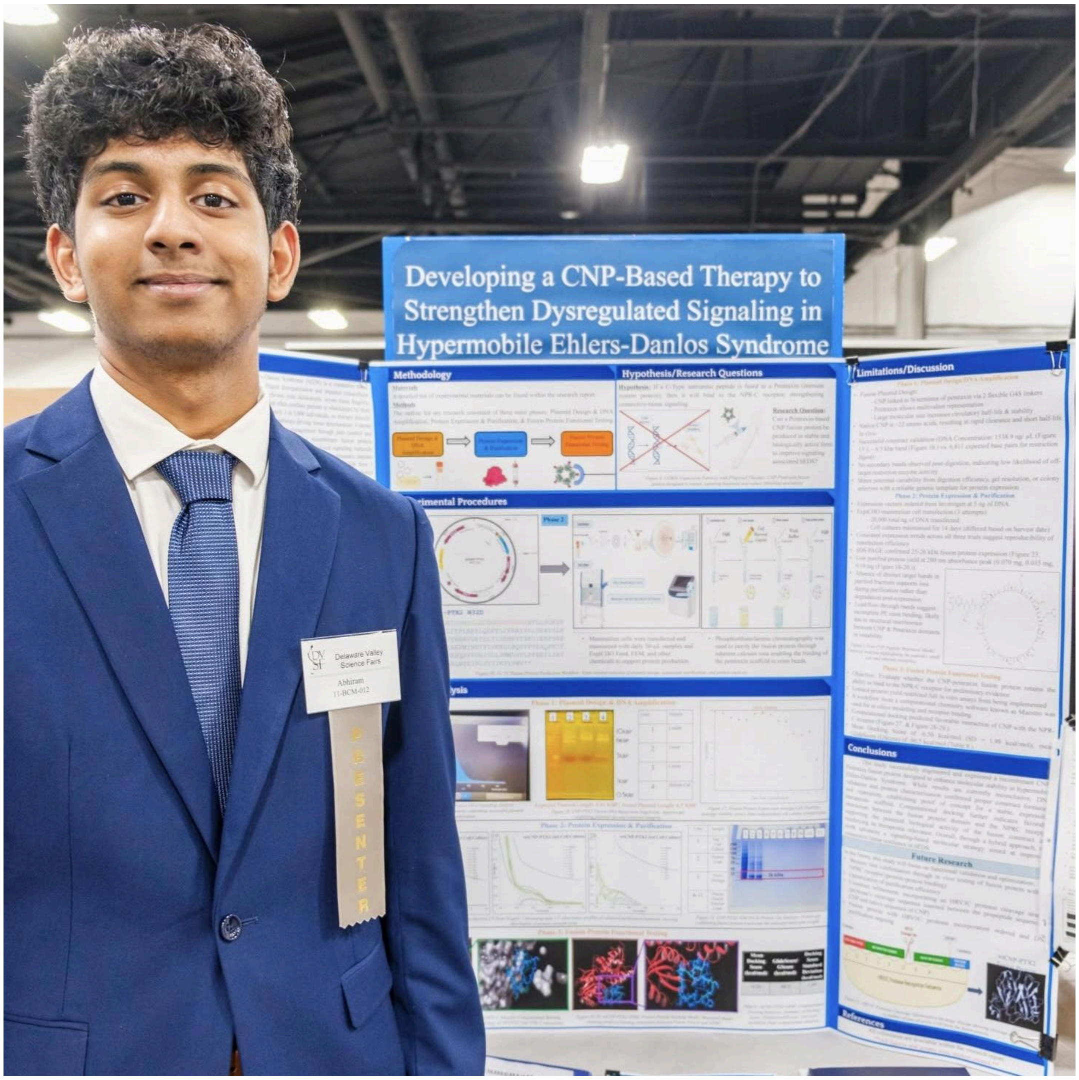
As I reflect upon my journey, I want to extend my thanks to my family, friends, teachers, and the many participants who dedicated their time to this project. As I continue to ISEF, I will continue to drive. This project is the first step of a staircase to my dream. I will continue this research, and intend to improve TremorPause; in the future, it could become the life changing remedy to help tens of millions understand and regain their hands. To these people, I will not let you down.

My advice to other STEM researchers is to find a reason. If you want to truly make a change with science, you must have a reason behind it. Research takes time and a serious dedication to the craft; without a genuine reason to research, it’s impossible to create something revolutionary. Science is built upon the dedication of bright innovators; without a reason for that dedication, humanity would not be where it is today.”

Abstract:

Pathological hand tremors affect 5% of the world population, yet diagnosis remains a subjective 0-4 visual score, and treatments are dangerous (Beta-Blockers), ineffective (orthotics), or expensive (Deep Brain Stimulation, \$30k-\$80k). TremorPause is a low-cost (~\$440), low-volume (61.3dB), and long-lasting (~2 hr.) wearable that quantifiably evaluates and suppresses hand tremors. To evaluate motion, an Arduino-BLE glove collected IMU data from 60 participants. A Fast Fourier Transform pipeline distilled 2.3 million raw angular velocity data points into 24,000 feature vectors. To isolate tremors from voluntary motion, a Random Forest AI was augmented with a Sigmoid-weighting function, centered at Youden's J-Index, improving classification accuracy from 28.3% to 96.7% ($p<0.001$, AUC=0.89). This produces Severity, a novel, objective 0-100% quantitative metric. Statistical analysis revealed the effects of motion consciousness: when participants focused, tremors worsened; when they didn't, shaking decreased ($p<0.001$). For suppression, a brushless motor inertially generates velocity-dependent counter-torques opposing hand oscillations, stabilizing the hand. Preliminary 2-participant testing demonstrated a 49.8% tremor reduction ($p<0.001$), consistent with the theoretical physics prediction of 56.6%. The TremorPause mobile app provides a clinician-free 0-100% severity score, the world's first quantitative tremor assessment anyone can self-administer anywhere. Users can upload anonymous results to a global Firebase dataset on which the AI continuously trains. Where current studies average ~43 participants, TremorPause is positioned to become the largest in the field, and the only system that gets measurably smarter every time someone uses it, at zero additional cost.

MEET 2026 DVSF GRADE 11 BRONZE MEDALIST
Abhiram Kaakarla, Central Bucks High School South (Bucks County)



Project: Developing a CNP-Based Therapy to Strengthen Dysregulated Connective Tissue Signaling in Hypermobile Ehlers-Danlos Syndrome

Abhiram urges young scientists to chase understanding over perfection:

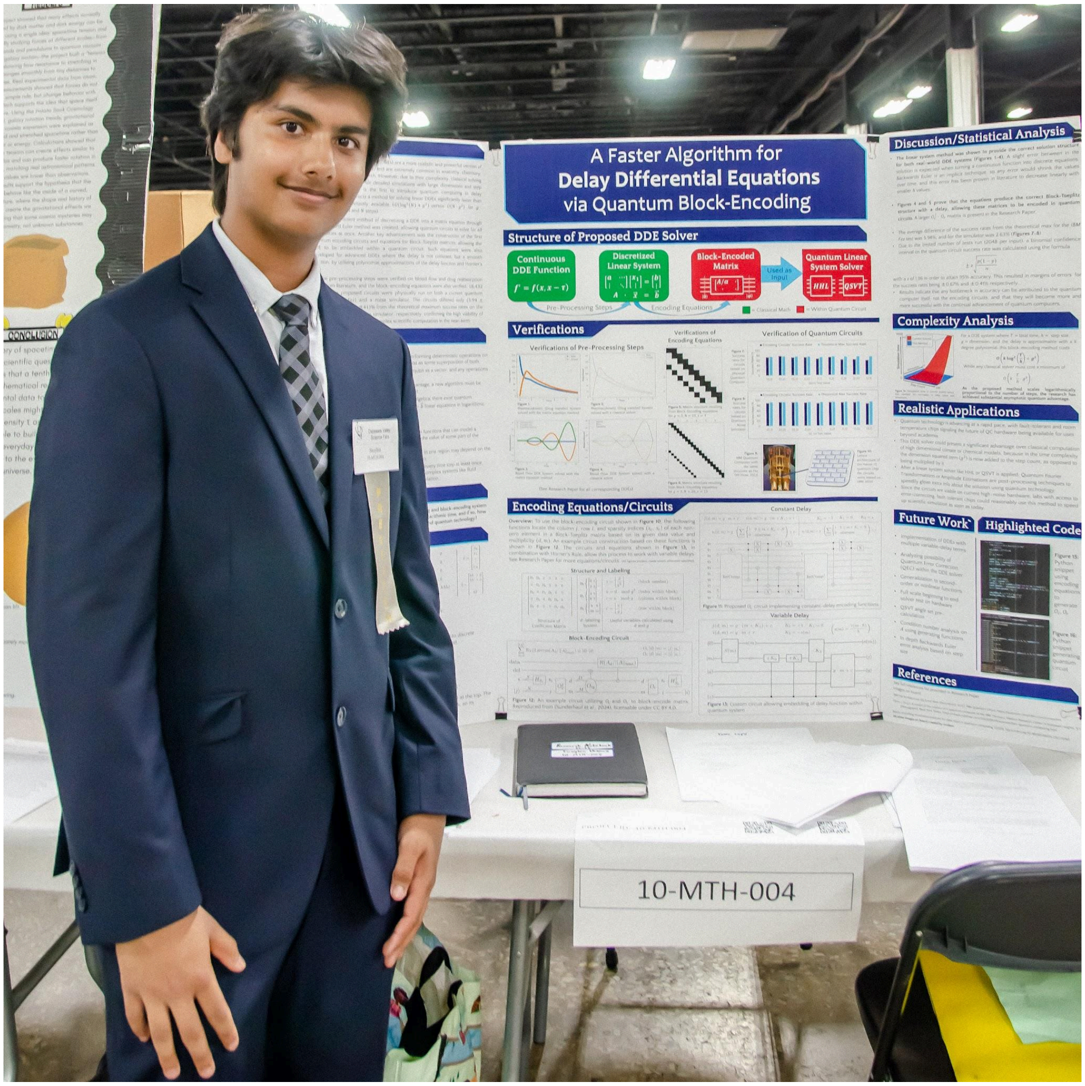
“It’s easy to think science is all breakthroughs, but honestly, most of my project was the opposite. Three separate times, my protein didn’t work the way I expected. Low yields, failed purification - the kind of results that make you question everything. At first, that was frustrating. But over time, I realized those ‘failures’ were actually pointing me in the right direction. They led me to redesign my protein and explore computational modeling, which became one of the most exciting parts of my project.

This work was inspired by my grandfather, whose joint issues first led me to learn and engage with this condition, and made me want to find a deeper solution. I'm also incredibly grateful to my lab mentor, whose guidance helped me push through challenges and keep improving my work. If I had one piece of advice, it would be this: don't chase perfect results, but chase understanding. The moments where things don't work are usually where you learn the most. That's where your project actually becomes yours."

Abstract:
Hypermobile Ehlers-Danlos Syndrome (hEDS) is a connective tissue disorder characterized by collagen disorganization and impaired extracellular matrix signaling (ECM), resulting in chronic joint dislocations, severe tissue fragility, and progressive mobility loss that can confine patients to wheelchairs by their 40s. Affecting ~1 in 5,000 individuals, no therapy directly addresses the disrupted signaling pathways; treatment is limited to symptom management via pain control or physical therapy. This research engineered a recombinant fusion protein combining C-type natriuretic peptide (CNP), a short-lived signaling molecule essential for connective tissue regulation, with a Pentraxin scaffold (through a G4S linker) to extend circulatory half-life from 3 minutes to 30 hours – a ~600-fold improvement. The design enables sustained NPR-C receptor activation, restoring ECM signaling, supporting cellular communication, and promoting tissue stability. The CNP-Pentraxin construct was expressed in ExpiCHO cells, maintaining 93% viability across three transfections. Calcium-dependent PE affinity purification yielded 0.035-0.100 mg purified protein, and SDS-PAGE analysis confirmed a 26.07 kDa (CNP-PTX-2 molecular weight) band. Substantial protein remained in load and flow-through fractions, hinting at interference between the CNP domain and Pentraxin binding regions. Redesign with an HRV3C protease cleavage site between the fusion protein and CNP propeptide region is being incorporated to improve expression efficiency. Preliminary computational docking analysis showed favorable CNP-Pentraxin-NPR-C receptor engagement. Functional validation remains ongoing, but findings demonstrate molecular feasibility and support continued optimization toward a signaling-based therapeutic for hEDS.

MEET 2026 DVSF GRADE 10 GOLD MEDALIST
Snayhin Sharma, Central Bucks High School East (Bucks County)

Received 3rd Place in Software Design & Received an ISEF Special Award



Project: A Faster Algorithm for Solving Constant and Variable Delay Differential Equations via Quantum Block-Encoding

Snayhin shares how having flexibility going into research is a benefit:

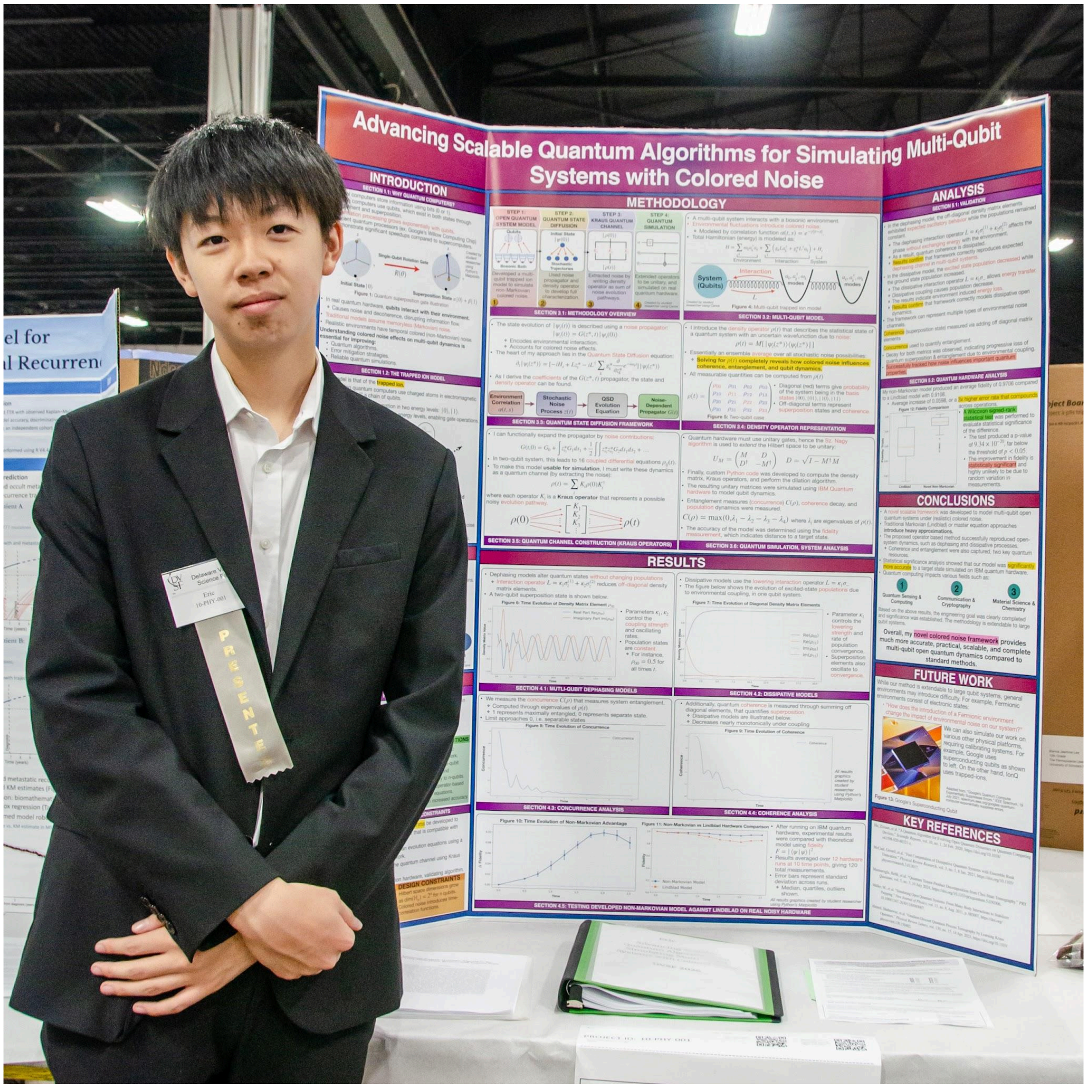
“In my opinion, one of the most fun things about doing research yourself is that you don’t know where it might take you. You may begin with a hypothesis, but as you keep on experimenting and researching, you could end up with something totally different than what you initially expected! That’s why my biggest piece of advice to students starting science fair is to make a plan for how to conduct your work, but to not be afraid to go off and follow different tangents that naturally arise. (This is mostly for math and engineering, you probably should stick to your procedure if you're in a lab so that you don't accidentally make a super-virus or something).

A lot of people are pretty determined as to what their results will be even before they start, but you should always leave a little breathing room for interesting rabbit holes that would be worthwhile going down. Personally, many of the key innovations in my project, like the Block-Toeplitz coefficient matrix or the extension to variable delays, came to me unexpectedly, when toying around with the math late at night. In fact, one of the biggest aspects of my research would have never happened if I didn't have some flexibility. The night after my regional fair, I had an idea- what if I could test my circuits on a real quantum computer? I stayed up all night researching how I could do this, and it ended up being successful! Because we are pushing the frontiers of science, there's always going to be unexpected results or ideas, and I believe that is what makes a great scientist—being able to adapt to them."

Abstract:
Delay Differential Equations (DDEs) are a more realistic and powerful version of regular Differential Equations, and are extremely common in anatomy, chemistry, ecology, and climate research. However, due to their complexity, classical solving algorithms slow heavily for detailed simulations with large dimensions and step counts. This research is the first to introduce quantum computing to delay equations, and constructs a method for solving linear DDEs significantly faster than any technique previously available. O(log^2(N)+ g^2) versus O(N*g^2) for g-dimensional DDEs and N steps) First, an efficient method of discretizing a DDE into a matrix equation through the Backward Euler method was created, allowing quantum circuits to solve for all time values at once. Another key advancement was the construction of the first quantum encoding circuits and equations for Block-Toeplitz matrices, allowing the DDE to be embedded within a quantum circuit. Such equations were also developed for advanced DDEs where the delay is not constant, but a smooth function, by utilizing polynomial approximations of the delay function and Horner's Rule. The pre-processing steps were verified on blood flow and drug reabsorption DDEs from literature, and the block-encoding equations were also verified. 18,432 shots of the proposed circuits were physically run on both a current quantum computer (IBM Fez) and a noise simulator. The circuits differed only (5.94±0.67)% and (2.63±0.41)% from the theoretical maximum success rates on the quantum computer and the simulator, respectively, confirming the high viability of this method for accelerating complex scientific computation in the near-term.

MEET 2026 DVSF GRADE 10 SILVER MEDALIST

Eric Guo, High Technology High School (Jersey Shore)



Project: Advancing Scalable Quantum Algorithms for Simulating Multi-Qubit Systems with Colored Noise

Eric shares how science fair shouldn't be all about winning:

"I've always been obsessed with theoretical topics for as long as I can remember, from abstract mathematics to, more recently, quantum computing. My project idea this year actually comes from a question that a science fair judge asked me at ISEF last year. During an intense (both exhilarating and very scary) 15-minute back-and-forth, the judge pressed me on the type of noise I had used in my system. To be honest, I hadn't given it much thought during my experimentation and was a bit taken aback. I ended up not doing too well, but that experience pushed me to rethink my approach entirely. This year, I completely changed my focus and pivoted towards the modeling of complex noise functions in quantum computing systems, which is a direction that once again aligns closely with the theoretical details that I love.

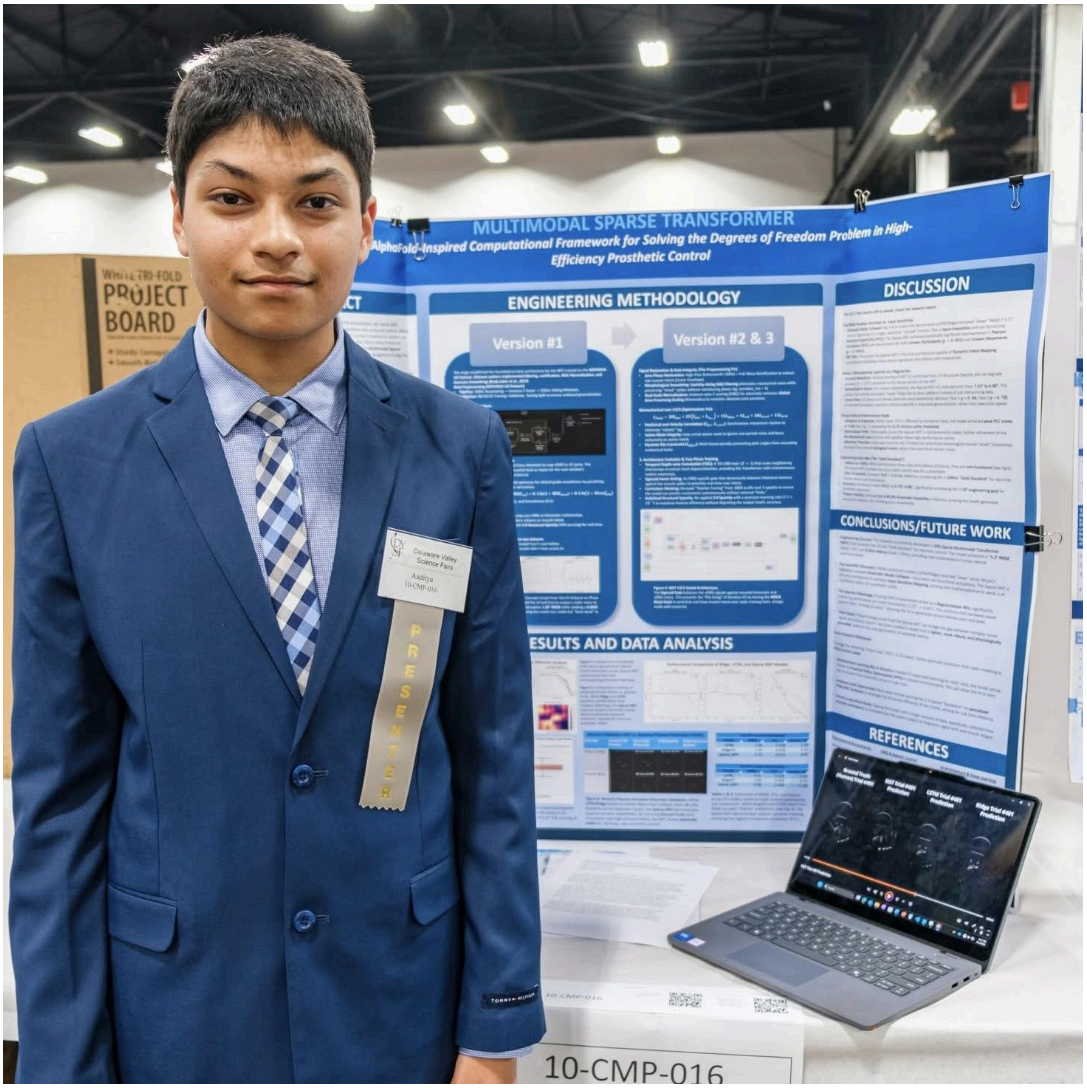
I'm honored to once again represent High Technology High School at the International Science and Engineering Fair. I would like to thank my high school's supportive and collaborative research community, alongside its incredible mentors, Mr. Queenan and Dr. Ellsworth, who provided invaluable feedback throughout my entire process. I am beyond grateful to be learning in a school STEM environment that cultivates true passion for research, as I have seen in my peers. Without my teachers and so many others at high schools around the world, the research community that I have found so vital in my academic journey would not exist.

As for advice, I'd offer something that may seem somewhat counterintuitive: the best research rarely comes from treating science fairs as the primary goal. Although winning is nice, not receiving an award in no way reflects the quality or potential of your research. To any aspiring researchers, focus on what excites you and push it as far as you can. Don't stress about the competitions, and try the most out of this experience itself, especially in this crucial time before you move on to higher education or academia."

Abstract:

Ultra-sensitive, scalable quantum computing relies on the precise control of open quantum systems, where environmental memory effects lead to non-Markovian noise. As quantum systems continue to develop, inaccuracies from memoryless approximations heavily limit hardware reliability and lead to measurement error. Non-Markovian dynamics arise in realistic environments and pose a challenge for accurately modeling qubit evolution, including decoherence and disentanglement. This research develops a novel, complete operator-based framework for simulating non-Markovian dynamics in multi-qubit systems, enabling clear analysis beyond specific noise models. The environment interactions were modeled using the stochastic Quantum State Diffusion approach, allowing for memory effects to be incorporated through propagator functions. To separate the noise, the dynamics were expressed as separate quantum channels in Kraus operator form, allowing for the construction of the density matrix and analysis of population, coherence, and entanglement. Python was used to simulate dissipative and dephasing channels, demonstrating expected physical behavior. Furthermore, the model was shown to accurately compute key physical properties such as entanglement and superposition. Algorithms were implemented across multiple circuits on IBM quantum processors to compare model predictions with experimental results. It was shown that the novel non-Markovian model achieved a 3x smaller fidelity error rate compared to the standard Lindblad model. These results demonstrate that our algorithmic modeling provides more accurate descriptions of open quantum systems, alongside a scalable framework for analyzing larger noisy systems.

MEET 2026 DVSF GRADE 10 BRONZE MEDALIST
Aaditya Chandan Kambli, Central Bucks High School South (Bucks County)



Project: RMST: Continuous Myoelectric-to-Kinematic Decoding via Recursive Multimodal Cross-Attention and 2:4 Structured Sparsity for Bionic Prosthetic Control

Aaditya shares how leaning into hard problems with creativity helped him succeed:

“When I first started my independent research, I thought I was building a better prosthetic controller. But the deeper I went, the more I realized the real problem wasn’t the technology, it was how we were thinking about it.

The human hand has over 20 degrees of freedom/joints, meaning there are infinitely many ways to perform even the simplest movements. Most upper limb prosthetic systems avoid this complexity by simplifying control into a few predefined grasps. It works, but it never feels natural, resulting in a 44% abandonment rate among upper limb amputees.

At some point, I came across how AlphaFold approached protein folding, one of the hardest problems in biology, not by brute force, but by learning the hidden structure underneath it. That completely changed how I thought about this motor control problem I was trying to solve.

Instead of simplifying movement, I tried to embrace its complexity.

After months of failed models, debugging, and rethinking everything from scratch, I developed a system that directly maps muscle signals to continuous, high-dimensional motion, closer to how the human body actually works. One of the most surprising moments was realizing that some models with the "best" mathematical accuracy were actually failing completely in simulation, producing static outputs. A failure mode I later defined as *kinematic mode collapse*.

This project has been a constant reminder that progress doesn't come from avoiding hard problems, but from learning how to face them differently.

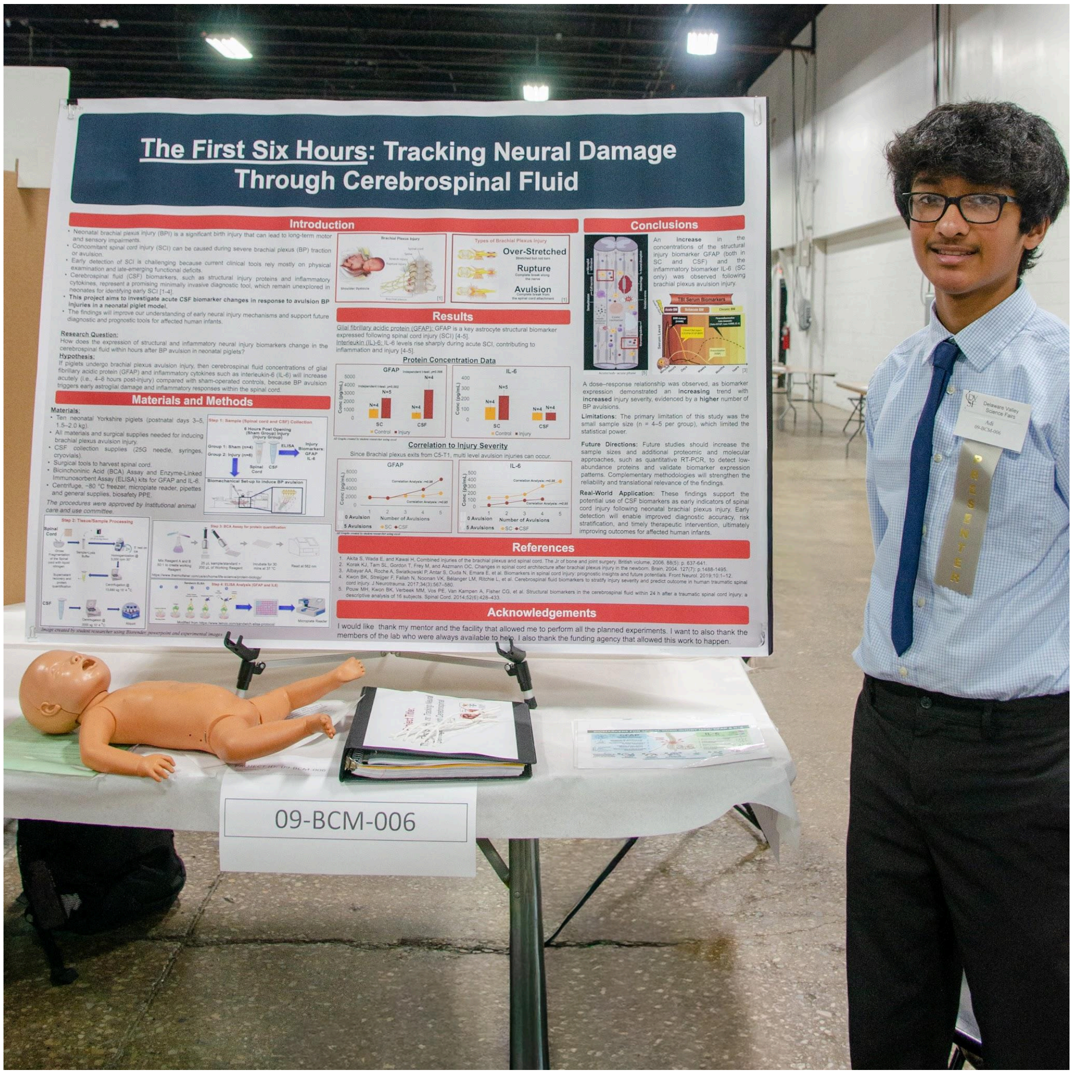
I'm incredibly grateful to my teachers and the science fair community for making this journey possible, and excited to keep pushing this work forward at ISEF"

Abstract:

Upper-limb prosthetic abandonment remains at 44%, a clinical failure rooted in the intractable complexity of human motor control: the approximately 20 degrees-of-freedom (DoF) of the hand creates an infinite kinematic solution space (Bernstein's Paradox). Current myoelectric systems bypass this redundancy by reducing control to the classification of 6–8 static grasps—a computational shortcut that addresses the symptom, not the cause, resulting in staccato, non-intuitive movement. Inspired by AlphaFold's transformative solution to protein folding—not by brute-forcing physics, but by learning deep structural synergies—I hypothesized that a similar AI-driven approach could resolve the DoF problem in prosthetic control. Hence, my RMST architecture leverages recursive, transformer-based hierarchical modeling to map surface EMG directly to continuous, high-dimensional joint trajectories, learning motor synergies that mirror biological coordination. 2:4 structured sparsity reduced model footprint by 19.35% while preserving real-time inference of 8.97 ms (~91% below the 100 ms clinical threshold). Curriculum learning overcame temporal collapse,

stabilizing convergence and resolving gradient vanishing. While regression baselines appeared competitive due to non-functional mode collapse, the RMST robustly decoded dynamic intent, yielding significant correlation gains for unseen subjects (p=0.002) and novel movements (p=0.0065). Validation in the MuJoCo engine confirmed 79.4% kinematic feasibility, linking theoretical advances to real-world movement. By directly confronting Bernstein's redundancy, this research delivers a paradigm-shifting approach: reclaiming continuous, adaptive agency for bionic users, and charting a path toward prosthetic systems as natural and intuitive as the human hand.

MEET 2026 DVSF GRADE 9 GOLD MEDALIST
Adi Iyer, Strath Haven High School (Delaware County)



Project: "The First Six Hours: Tracking Neural Damage Through Cerebrospinal Fluid"

Adi shares how his DVSF Experience pushed his perspectives:

"Walking into the Delaware Valley Science Fair felt like stepping into a room buzzing with energy—posters everywhere, people making last-minute adjustments, and that mix of excitement and "okay, this is really happening."

One of the best moments was meeting other students who were just as passionate (and just as stressed). We swapped stories, laughed about things going wrong at the worst times, and hyped each other up before judging. It made the whole experience feel less intimidating and a lot more fun.

Judging had its intense moments, but it was also surprisingly inspiring. The questions pushed me to think deeper, explain better, and see things from a new perspective.

If you're heading to Delaware Valley: take a breath, trust yourself, and don't forget to enjoy it. It goes by faster than you think, but the experience sticks with you."

Abstract:

Neonatal brachial plexus injury (BPI) can cause lifelong motor and sensory deficits, but early detection of central nervous system (CNS) involvement remains limited. Delayed detection often leads to delayed intervention in newborns. Cerebrospinal fluid (CSF) biomarkers may enable early identification of spinal cord injury following BPI, offering an opportunity to improve outcomes. This study investigated whether CSF biomarkers indicate spinal cord injury after brachial plexus avulsion using a neonatal piglet model that closely resembles human newborn physiology.

Piglets were divided into sham control and injury groups. In the injury group, controlled traction was applied to the brachial plexus to simulate birth-related avulsion injury. CSF samples were collected at baseline and 6 hours post-procedure, and spinal cord tissue was harvested at 6 hours. Levels of glial fibrillary acidic protein (GFAP), a marker of neural structural damage, and interleukin-6 (IL-6), an inflammatory cytokine, were measured using enzyme-linked immunosorbent assay (ELISA). It was hypothesized that injured piglets would show increased levels of both biomarkers compared to sham controls.

Results showed that GFAP and IL-6 concentrations were elevated in injured piglets relative to controls. Biomarker levels also increased with injury severity, defined by the number of avulsed nerve roots. These findings indicate rapid structural damage and inflammation within the spinal cord following injury.

This study supports the potential use of CSF biomarkers as early indicators of CNS involvement after neonatal BPI, enabling earlier diagnosis and improved therapeutic intervention.

MEET 2026 DVSF GRADE 9 SILVER MEDALIST
Sarah Vaida, Cherry Hill East High School (Coriell Science Fair).

Project: Accent or Impediment: Using Machine Learning to Prevent Speech Misdiagnosis in Children

Sarah shares how choosing a topic that matters can change your relationship with “science”:

“For most of my life I was never all that interested in science. The way it was taught in school made it feel like a subject that never really clicked with me, and over the years, I started to dislike it. Participating in the science fair helped to change this notion for me. It helped me discover a passion I honestly did not know I had.

My biggest advice for future science fair students is to choose a project that genuinely matters to you. I think pursuing something I truly cared about is what made me so invested in the process. For my project, I used machine learning to help distinguish speech sound disorders from typical and bilingual-accented speech. Because my own speech difficulties were once mistaken for a bilingual accent, the project felt personal from the beginning. That connection made the difficult parts a lot easier to push through. So, to anyone interested in participating in the science fair, do not be afraid to make your project personal. Science can be an emotional journey just as much as it can be a statistical one."

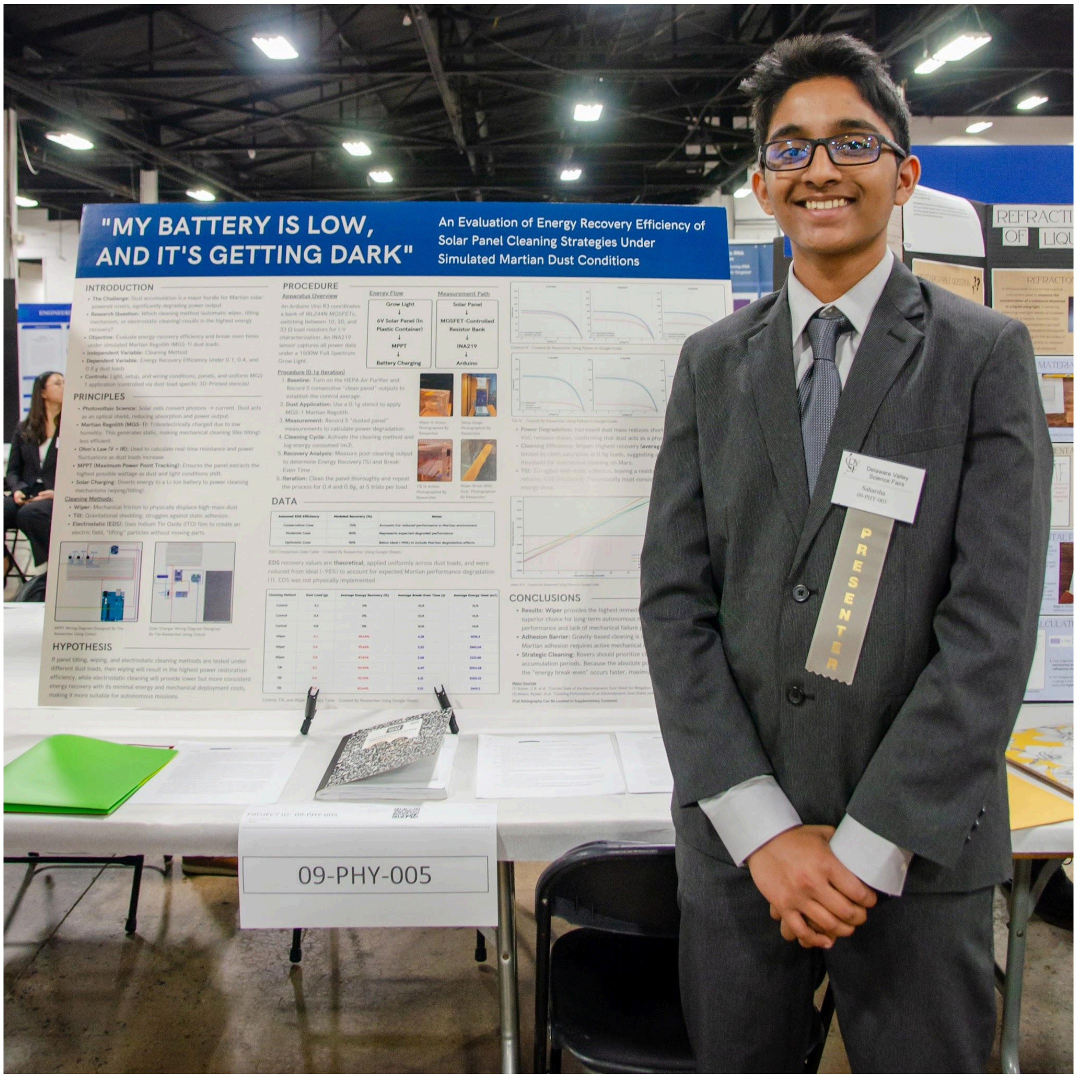
Abstract:

Bilingual children are frequently misdiagnosed in schools and clinics because speech patterns shaped by second-language acquisition can resemble speech sound disorders. As a result, a typical bilingual accent may be incorrectly labeled as a disorder, or a true speech impediment may be dismissed as accent-related. With millions of U.S. children growing up as dual language learners, screening tools that can distinguish accent-related variation from impairment are urgently needed. This study developed a machine learning model to distinguish speech sound disorders from typical and bilingual-accented speech using publicly available recordings.

The dataset included three impairment datasets, two bilingual datasets, and two control datasets, totaling 35,182 utterances, with 60% typical or bilingual-accented speech and 40% impaired speech. A total of 150 acoustic features were extracted from each utterance to capture timing, rhythm, spectral structure, resonance, and pitch-related variation. Multiple models were evaluated, and the best-performing approach was a multilayer perceptron, which achieved 97.6% accuracy.

The model can reliably distinguish speech disorders from healthy and bilingual-accented speech without confusing accent-related variation with impairment. The most important predictors included pausing and rhythm patterns, the strength of speech frequencies across the spectrum, the consistency of those frequency patterns, alternation between voiced speech and noisier segments, moment-to-moment changes in spectral shape, vowel resonance variability, and lower-range pitch behavior. By improving differentiation between disorder and accent, this project aims to support the development of more reliable screening tools for linguistically diverse populations.

MEET 2026 DVSF GRADE 9 BRONZE MEDALIST
Saharsha Konda, Parkland High School: Bronze Medalist (Lehigh Valley)



Project: My Battery Is Low, and It's Getting Dark: An Evaluation of Energy Recovery Efficiency of Solar Panel Cleaning Strategies Under Simulated Martian Dust Conditions

Saharsha shares how his interest in space fueled his passion to solve persistent problems:

“There's a quote on the wall of Kennedy Space Center's main entrance that starts off with, “For the eyes of the world now look into space,” and that’s where my eyes have been looking for as long as I can remember.

But looking into space isn't enough. We have to be able to operate there; to keep our machines alive millions of miles away from human intervention. And on Mars, one of the most quietly devastating ways we lose that ability isn't a dramatic explosion or a system failure. It's dust. Just dust, slowly settling onto a solar panel, cutting off a rover's only source of power, until one day it can't recover.That's exactly what happened to Opportunity. NASA engineers translated its final transmission into words that have stuck with me ever since: “My battery is low and it's getting dark.” It's what I've spent the last year trying to solve: not just which cleaning method removes the most dust, but which one gives a rover the best energy return for what it spends to clean, because on Mars, every millijoule counts.

One piece of advice I'd share is to ignore any notion of failure when trying something new. I had to rebuild my circuit rig twelve times before it worked, and every failure taught me something the YouTube tutorials never could.

This year, I’m really grateful to my friends, mentors, and parents for the support they’ve provided me throughout the project. I cannot wait to represent Parkland and DVSF at ISEF in Phoenix!”

Abstract:

This project investigates the issue of dust accumulation on solar-powered Martian rovers, testing the efficiency of three cleaning methods: automatic tilting, wiping, and Electrodynamic Dust Shield (EDS), to quantify energy-recovery efficiency and energy break-even times under Martian regolith simulant loads. The project addresses the limitations of prior studies, which focus solely on dust removal percentages.

A novel, automated testing rig was designed and constructed, integrating a 5V solar panel, simulated sunlight under a grow light, and a Maximum Power Point Tracking load-selection system. 0.1 g, 0.4 g, and 0.8 g dust loads of MGS-1 simulant were consistently applied using custom-designed 3D-printed stencils. I–V curves for clean, dusted, and recovered energy measurements were recorded to conceptualize efficiency. Furthermore, the energy consumed by the methods during cleaning was measured to determine break-even times. Due to safety constraints, EDS performance was modeled using published data and then adjusted for expected Martian degradation to simulate real-world performance.

Results demonstrate that panel performance degrades nonlinearly, with dust accumulation significantly reducing short-circuit current (Isc), while open-circuit voltage (Voc) remains stable. Although recovery efficiency decreased at higher dust loads, break-even times shortened due to larger absolute power gains. Wiping achieved the highest immediate recovery, while EDS demonstrated superior long-term consistency due to minimal energy use and no mechanical wear.

Limitations include the modeled rather than physically implemented EDS system and the inability to fully replicate Martian gravity and electrostatic conditions. Future research should explore telemetry-based or hybrid cleaning methods to extend overall rover lifespans.