Abstracts of Talks and Posters Presented at the

AESA STEM CONFERENCE

September 15, 2019
Glendale, CA

The AESA Conference at Glendale Tech Week 2019 exhibits cutting-edge STEM (Science, Technology, Engineering, Mathematics) related multidisciplinary presentations in a wide variety of technical topics. Undergraduate and graduate students as well as professionals engaged in science and engineering are welcome to apply to present their work in the form of a poster or oral presentation. Businesses and university affiliates are welcome to advertise academic programs and scout for bright talented individuals in our community. This is an exceptional collaboration and networking opportunity amongst diverse presenters, program affiliates, and local audiences. Students and professionals in science and engineering present their research and technology related advancements in STEM. The Conference is open to public.

The AESA STEM Conference and Expo provide a great opportunity for students to present their work, find job opportunities, mentors and consultants; for companies and startups to participate in general and recruit new talent; and for professionals to network and learn about local opportunities. Please visit www.expo.aesa.org for more details.

CONFERENCE
Glendale Central Library
September 15th 12:45 PM – 5:45 PM
222 E Harvard St Glendale, CA 91205

EXPO
Armenian Society of Los Angeles
September 16th 3:00 PM – 9:00 PM
September 17th 3:00 PM – 9:00 PM
117 S Louis Street, Glendale, CA 91205

September 15th

12:30 – 12:45 PM	Check-In
12:45 – 2:00 PM	Session I
2:00 – 2:10 PM	Break
2:10 – 4:00 PM	Session II
4:00 – 4:30 PM	Student Oral Presentations
4:30 – 5:45 PM	Poster Session

AESA STEM CONFERENCE
2019 SCHEDULE

Session I, 12:45 – 2:00 PM

Shaunte Bab, MS, AESA Exec Board	Introductory Remarks
Richard Ohanian, MS, AESA VP 2019	AESA Executive Council Remarks
Shant Shekherdimian, MD	Biomedical engineering: Model to Lengthen Bowel for Treatment of Children with Short Bowel Syndrome
Jahal Dawlaty, PhD	Light, Electrons, Protons: Lessons From Model Systems And Potentials For Photocatalysis
Greg Barding, PhD	Quantifying The Acetone-Butanol-Ethanol Fermentation Pathway Using NMR Spectroscopy

Coffee & Refreshments

Session II, 2:10 - 4:30 PM

Varoujan Gorjian, PhD	Lifting The Cosmic Veil: Spitzer Observations From Our Own Backyard To The Edge Of The Universe
Naira Hovakimyan, PhD	Aerial Co-robots of the Future: Safety, Intelligence, Certification
Armen Mkrtchyan, PhD	Our Journey Towards Self-Driving Vehicles
Student Presentations	Nicholas Orchanian Sarik Ghazarian Sophia Nguyen

Research Posters & Refreshments, 4:30 - 5:45 PM

Presentations

Biomedical engineering: Model to Lengthen Bowel for Treatment of Children with Short Bowel Syndrome

Shant Shekherdimian, MD

Apart from a busy clinical practice, Dr. Shekherdimian actively engages in clinical and basic science research pertaining to his specialty in pediatric surgery. In addition, he is involved in various initiatives aimed in health system strengthening in Armenia. Dr. Shekherdimian has mentored numerous medical students and residents, and presents frequently on topics pertaining to health care in Armenia, with a particular focus on defining and optimizing the role of the diaspora.

Light, Electrons, Protons: Lessons from Model Systems and Potentials for Photocatalysis

Jahal Dawlaty, PhD

The inspiration for this talk comes from the photoelectrochemical interface, which is a place rich with unknowns and unrealized potentials. Electrons are excited by light either in the electrode or in the adsorbed molecules, charges traverse the electrode-electrolyte interface, protons flow from the bulk to complete redox reactions, and interfacial electric fields develop to balance chemical potential differences between the opposing phases. In this talk, the complex chemistry at the interface will be used as a point of reference to motivate several chemical dynamics studies in small molecules, solids, and interfaces with the goal of generating new directions and ideas for understanding and driving interfacial reactions. New concepts that will be discussed are basicity in the excited state, solvation near an interface, electronic-vibrational dynamics in a solid made of a redox couple, and influencing proton conductivity with light. Several avenues on how to use this knowledge will be proposed.

Quantifying the acetone-butanol-ethanol fermentation pathway using NMR spectroscopy

Greg Barding, PhD

Biofuels have long been considered a clean alternative to fossil fuels with ethanol a key focus. However, ethanol has several disadvantages as a fossil fuel replacement including the repurposing arable land for corn production specifically to convert to ethanol (limiting corn available for food) and the need to modify gasoline engines to cope with high amounts of ethanol to prevent engine damage. Butanol, another biofuel, is a promising alternative to ethanol as it less hygroscopic than ethanol and can directly be used as a gasoline replacement without engine modification. Additionally, butanol can be produced through acetone-butanol-ethanol (ABE) pathways in some anaerobic bacteria, such as Clostridium beijerinkii, which does not require the reappropriation of arable land for fuel production. Understanding how these pathways interact to produce butanol are important for optimizing the production of the biofuel. Herein, we propose a novel approach using one-dimensional and two-dimensional NMR to quickly quantify the major components of ABE fermentation, including acetone, butanol, ethanol, isopropanol, and acetic acid. 1D NMR can quickly quantify most major components in less than 8 min using standard quantitative techniques, however 2D NMR is required to quantify trace amounts of butyric acid due to spectral convolution. We explored TOCSY and 2D-JRES for suitability when simultaneously quantifying the major products (butanol) while also quantifying the minor products (butyric acid). We developed a simple calibration curve to explore and found that the linearity of both 2D methods was at least than 0.998 and RSD of both 2D methods was less than 8%. Quantification using TOCSY was found to be best, with a RSD less than 5%, however the 2D-JRES method was significantly faster (34 min vs. 161 min). Currently, we are expanding this method to include the other major components and are applying it directly to the effluent produced by Clostridium beijerinkii strains.

Scholarships, AUA Opportunities

Marianna Achemian

AUA is a leading educational institution in Armenia since 1999. Its Zaven Akian College of Engineering and Computer Science (CSE) prepares specialists who continuously prove to be very competitive in Armenia's tech field job market. A big fraction of the students at CSE are female, and the university has a goal to increase this number further by providing financial support to girls in need you want to pursue their education in these areas.

Lifting the Cosmic Veil: Spitzer Observations from our own Backyard to the Edge of the Universe

Varoujan Gorjian, PhD

Since its launch in 2003, NASA's Spitzer Space Telescope has used the infrared part of the spectrum to study the Universe near and far. In doing so it has discovered objects as wide ranging from a previously unknown ring of Saturn to young galaxies at the edge of the observable Universe. Its greatest legacy though may be the study of the atmospheres of planets around other stars. Come hear about what Spitzer has accomplished and what is in store for its future before the mission is set to come to an end in January of 2020.

Aerial Co-robots of the Future: Safety, Intelligence, Certification

Naira Hovakimyan, PhD

This presentation discusses the key challenges of the 21 st century and puts forward the right perspective for development of aerial co-robots of the future by emphasizing safety, intelligence and certification. Each of these three pillars hinges on fundamental theoretical developments for support. Challenges with flight control, cyber-resilience, cooperative path planning, intelligent control, and certification are discussed, and fundamental limitations of feedback loops are revisited for development of safe intelligent control. The new metrics for certification, important in the era of the fourth industrial revolution and requiring new paradigms for certification, are presented. Applications in elderly care, scalable e-commerce, and precision agriculture are discussed.

Our Journey Towards Self-Driving Vehicles.

Armen Mkrtchyan, PhD

Armen Mkrtchyan is a Senior Engagement Manager in McKinsey's Los Angeles Office and is the co-leader of McKinsey's Center for Future Mobility on the West Coast. At the Firm, Armen's clients primarily include Automotive passenger and truck manufacturers and their suppliers. He also serves electronics and semiconductor players across the value chain both on operational and strategic topics. Previously, Armen was the Founding Director of the Entrepreneurship and Product Innovation Center (EPIC) at the American University of Armenia and served as an Assistant Professor in the College of Engineering. Armen has a Ph.D. in Aeronautics and Astronautics from MIT and has worked on the development of various autonomous air and ground vehicles. He received his Bachelor's degree in Electrical Engineering from the University of North Dakota and has multiple publications in the area of control systems, test and simulation, product development optimization.

Poster Abstracts

Compensatory response after structural and functional perturbation of inhibitory synapses

Aida Bareghamian, Garrett Gross, Don B. Arnold

The brain contains different types of synapses, which are points of communication between two neurons. These synapses are responsible for maintaining proper brain activity. The two major classes of synapses are excitatory, which excite the neuron, and inhibitory, which inhibit the neuron from firing action potentials. The homeostatic balance of these two types of synapses is critical to maintain normal levels of activity in the brain. The mechanisms by which our brain maintains homeostatic control over the organization of inhibitory synapses is not well understood. Here, using a novel method we delete inhibitory synapses in cultured neurons and analyze the changes in levels of active genes in these cells. By looking at which genes are activated after the deletion of inhibitory synapses, we can gain a better understandingof the genetic and molecular pathways that control the delicate balance in our brain.

Automatically evaluation of open-domain dialogue systems

Sarik Ghazarian

Despite advances in open-domain dialogue systems, automatic evaluation of such systems is still a challenging problem. Many researches resort primarily to human evaluation for assessing their dialogue systems performances, which is time-consuming and expensive. We mainly focus on training automatic evaluation metrics that have high correlation with human judgements. We explored the positive effects of relatedness and engagingness score of a response for a given query in order to have a more accurate evaluation system.

Uncovering Amelogenesis-Promoting Mechanism of Ameloblastin Interactions with Amelogenin and with Membranes

Natalie C. Kegulian, Jingtan Su, Rucha Arun Bapat, and Janet Moradian-Oldak

In order to form tooth enamel, in a process known as amelogenesis, epithelial cells called ameloblasts secrete enamel matrix proteins (EMPs) in conjunction with calcium phosphate into the enamel matrix space. The EMP secreted in the majority is amelogenin (Amel), followed by ameloblastin (Ambn) to a much lesser extent. Ambn also has signaling and adhesion functions, which require it to interact with cell membranes. Different cases of amelogenesis imperfecta, a syndrome comprising malformed enamel, have been reported as caused by different mutations in Amel and Ambn. Our group is growing a body of research showing Amel-Ambn interactions to be crucial for amelogenesis and trying to define the mechanism by which amelogenesis is driven by these interactions. To define these interactions, the critical residues responsible for them, and the structure in Ambn that interacts with Amel and with membranes, we are using a number of technologies, including circular dichroism (CD), fluorescence spectroscopy, and electron paramagnetic resonance (EPR). We have found a sequence encoded in exon 5 of Ambn to form an alpha-helix in the presence of membranes and to interact with them. This same sequence interacts with Amel. I am now comparing Ambn-Ambn, Ambn-Amel, Amel-Amel, Ambn-membrane, and Amel-membrane interactions to each other and finding Amel to assemble with itself more than with other elements and Ambn to prefer membranes. Experiments to define the structure of the highly interactive Ambn alpha-helix are ongoing.

Leakage dynamics of faults: Effect of induced seismicity and multiphase flow

Saro Meguerdijian

Subsurface leakage of fluids, such as CO2, along faults plays an important role during underground storage. We present novel leakage dynamics of faults to show that leakage is non-trivially coupled to induced seismicity and multiphase flow along faults due to the effect of fault dip. The onset time of induced seismicity, controlled by the initial shear-to-effective normal stress ratio on the fault, is a non-monotonic function of the fault dip. The leakage directions of gas and liquid phases are determined by the directions of seismicity propagation and the buoyancy vector, both of which depend on the dip. A consequence is that leakage evolution is non-monotonic in time for hanging wall injection-induced seismicity on a normal fault because of the competition between up-dip oriented buoyancy and down-dip oriented induced slip. This nonmonotonicity with fault dip can be used to trade off risks in magnitude and timing of induced seismicity and leakage events, allowing for improvements in injection risk management. With respect to monitoring, we note that subsidence at an injection well could be indicative of leakage.

Debiasing Community Detection: The Importance of Lowly Connected Nodes

Ninareh Mehrabi

Community detection is an important task in social network analysis, allowing us to identify and understand the communities within the social structures. However, many community detection approaches either fail to assign low degree (or lowly-connected) users to communities, or assign them to trivially small communities that prevent them from being included in analysis. In this work, we investigate how excluding these users can bias analysis results. We then introduce an approach that is more inclusive for lowly-connected users by incorporating them into larger groups. Experiments show that our approach outperforms the existing state-of-the-art in terms of F1 and Jaccard similarity scores while reducing the bias towards low-degree users.

Design and Optimization of a Low Frequency Raman Microscope for Liquid and Solid-state Sample Analysis

Sevan Menachekanian, Brianna M. Garcia, Timothy Corcoran

Raman microscopy is a widely used technique in chemical analysis. Though Raman scattering is a weak phenomenon, a well-designed layout with appropriate optical components can address its small cross section. Here, we demonstrate the design and optimization of a home-made near-infrared Raman (NIR) microscope for liquid and solid sample analysis. The current high-performance and robust system is able to record low frequency Raman spectra with excellent signal to noise ratio (S/N) in as little as 1 second. The recorded spectral range is 40-3100 cm-1 with a resolution of approximately 4.9 cm-1 in the Rayleigh line. High performance longpass filters (LPFs) are employed in the set-up for Rayleigh line blockage. A microscope incorporation with a camera enables the indirect visualization of the crystals for a point to point analysis on the specific regions of a solid sample.

Differentiation of environmental isolates and characterization of the viable but non-culturable state of Burkholderia pseudomallei.

Daniel Minassian, Cora L. Woodward, Avery O. Tatters, Jeff F. Miller, Christopher T. French

Burkholderia pseudomallei (Bp), the etiological agent of melioidosis, is a gram-negative soil-dwelling pathogen endemic to Thailand and other parts of southeast Asia. Despite the great threat it poses to endemic regions as a multidrug resistant pathogen, its presence and eco-environmental properties as an inhabitant of the soil rhizosphere are not well understood. We have adapted a rapid method for estimating Bp diversity which utilizes PCR and gel electrophoresis to distinguish among sequence types. Among 115 cultured Bp environmental isolates originating in small fields in Thailand with ties to confirmed cases of melioidosis, we identified two major clades. We also observed a strong correlation between our results and geographical origin. These findings will allow us to explore the relationship between different strain types and virulence. However, not all isolates are culturable. The environmental and clinical relevance of this viable but non-culturable (VBNC) state in Bp is not well understood. We used a combination of culture-based enumeration of cells and the variable binding of nucleic acid stains to live and dead cells to quantify the proportion of VBNC cells in cultures of the model system B. thailandensis after heat shock and cold treatment and found that both heat shock and cold treatment rapidly induced the VBNC state. Characterization of VBNC Bp may augment our understanding of the ecological drivers of Bp pathogenicity and the potential threat it poses to human populations.

Rapid Determination of the pH of Environmental Water Samples using Smartphone Colorimetry

Zaw Naing

Survival of many living systems depends on the pH of the environment, especially the aqueous system. The quality of aqueous environment has declined over the years because of rapid change in pH due to pollutions. Although a pH meter or pH test paper is commonly utilized to determine the pH of environmental water samples, a simple and reliable method to determine pH is still desired, especially in remote field study. Traditionally, pH indicators are used to predict the equivalence point of acid base titration. In this study, pH indicators are used as the color marker for buffers with different pHs. Even though some of the solution colors may seem identical to naked eyes, there are indeed differences in color intensity when read digitally. One of the acid/base indictor, bromothymol blue was added to buffers with pH from 1.0 to 14.0. Calibration curves were constructed by plotting the color intensity (in terms of Red, Green, and Blue values, and measured through a smartphone App) of individual buffer solutions as the function of pH value. The pH of the tested environmental water samples were slightly over 7.0. Overall, the developed smartphone colorimetric method provides more portability than traditional pH meter measurements, and provides more quantitative readings than pH test paper.

Influencing Mitochondrial Biogenesis in Satellite Cells to Accelerate the Transition from Quiescence to Activation

Sophia Nguyen

Skeletal muscle stem cells, aka satellite cells (SCs), are vital for the maintenance and regeneration of adult skeletal muscle tissue. Ageing leads to stem cell exhaustion (DNA damage and senescence) and mitochondrial dysfunction (aging-associated mtDNA mutations, destabilization of the electron transport chain complexes, and faulty mitophagy) which in turn results in the decline of the stem cell renewal capacity, impairing the initiation of healing and tissue repair. It has also been shown that mitochondrial activity is important in the transition of satellite cells from quiescence to activation. Previous research shows that SCs rely on glycolysis while quiescent and oxidative phosphorylation when they transition to activation. Thus, there has been an increasing interest in understanding the role of metabolism in stem cell renewal and maintenance.

Previous research on cancer cells (Schell et al., 2017), which are highly proliferative, showed that they primarily rely on glycolysis to force the expression of the mitochondrial pyruvate carrier (MPC) subunits, resulting in increased oxidation and impaired colony and tumor formation. They extended their research to intestine stem cells (ISCs) in Drosophila and saw that loss of the MPC in ISCs led to an increase in proliferation while a decrease in lactate dehydrogenase via RNAi resulted in an opposite effect.

Therefore, I focused my research on compounds that may play a significant role in this transition from quiescence to activation in young (3-6 months) and old mice (22-26 months). I hypothesized that satellite cells would also show an increase in activation when lactate production was promoted.

Solar Fuels for a Sustainable Energy Future

Nicholas Orchanian

While sunlight provides a renewable source of energy, its spatio-temporal variability demands distributed energy storage to meet peak demands. An ideal solution is to redirect excess solar-derived electricity towards electrocatalytic cells at times of low demand to convert abundant small molecules into liquid fuels and industrial chemicals, in analogy to natural photosynthesis. Our group explores new materials and molecules for applications in artificial photosynthesis technology for the production of solar fuels. This talk will highlight one recent system we have developed, in which molecular units are assembled into one-dimensional nanowires with high catalytic activity for carbon dioxide conversion. Efficiencies up to >99% with quantitative selectivity were achieved under optimized conditions, and these electrode-catalyst devices are shown to be active under both electrocatalytic and photocatalytic conditions. These studies represent a promising step towards enabling grid-scale artificial photosynthesis.

Activation of Biologically Relevant Organic Acids

Michael Pirjanloo, Asmik Oganesyan

It has been established that carboxylic acids play an important role in biological processes. Synthesis of biologically relevant carboxylic acid derivatives entail their activation. In this research, we investigated synthetic and purification routes of several carboxylic acids which amide and ester derivatives are known to display antioxidant, anti-inflammatory, and antibacterial activity. Reactivity of these activated acid derivatives is considerably improved, and these compounds can be stored for long subsequent reactions without decomposition. DCC (N,N'-dicyclohexylcarbodiimide) is used as an activating reagent to produce a NHS (N-hydroxysuccinimide) derivatives of several carboxylic acids. These derivatives can be utilized to synthesize small dendrimers carrying multiple biologically relevant payloads.

High Performance Liquid Chromatographic Analysis of Naringin in Dry Pomace of Citrus Sinensis

Desiree Sarmiento

Orange juice is commonly consumed by people all over the world. One concern from the industrial processing of orange juice is the large quantity of waste in the form of pomace produced. The pomace, however, still contains valuable, antioxidant materials that could be potentially utilized in the food, nutraceutical, and cosmetic industries. Naringin is one of polyphenolic antioxidants present in citrus fruit. In this study, the dry orange (Citrus sinensis) pomace processed by the normal method was extracted in ethanol via Soxhlet extraction first, and then the extract was analyzed by high performance liquid chromatography coupled with diode array detection (HPLC-DAD). An isocratic flow was developed and optimized with the ratio of solvent A:B of 77:23, for which A consisted of 89.9% water, 10% acetonitrile, and 0.1% acetic acid and B was composed of 99.9% acetonitrile and 0.1% acetic acid, to achieve the baseline resolution of naringin from the remaining components in the extract. With the detection wavelength of 283 nm, the standard naringin was observed at approximately 4.7 minutes on the chromatogram. Using the standard naringin calibration curve, 37.1 mg of naringin per gram of dry orange pomace was thus calculated. Compared to other reported HPLC analyses of naringin, a shorter analysis time via this developed method was achieved while still maintaining an excellent baseline resolution.

Challenges of Esterification of Gallic Acid and Its Derivatives

Lilit Vardanyan, Tenny Vasghanian, and Asmik Oganesyan

Gallic acid exhibits excellent antioxidant and anti-inflammatory properties. Antioxidant properties are amplified by the presence of three phenolic hydroxyl groups, and the anti-inflammatory activity is aligned with the presence of fatty acid esters. Several synthetic routes were explored to synthesize anti-inflammatory agents via esterification of gallic acid and its derivatives. The presence of three hydroxyl groups and a carboxylic domain made it difficult to selectively esterify only one part of the molecule without affecting the rest. The use of commercially available ethyl gallate was essential to ensure the complete esterification of either all or only meta positions. The synthetic reactions and products were monitored and characterized by TLC, IR, and H NMR. Electron Density Maps (EDM's) were used to predict the reactivity of the molecules.

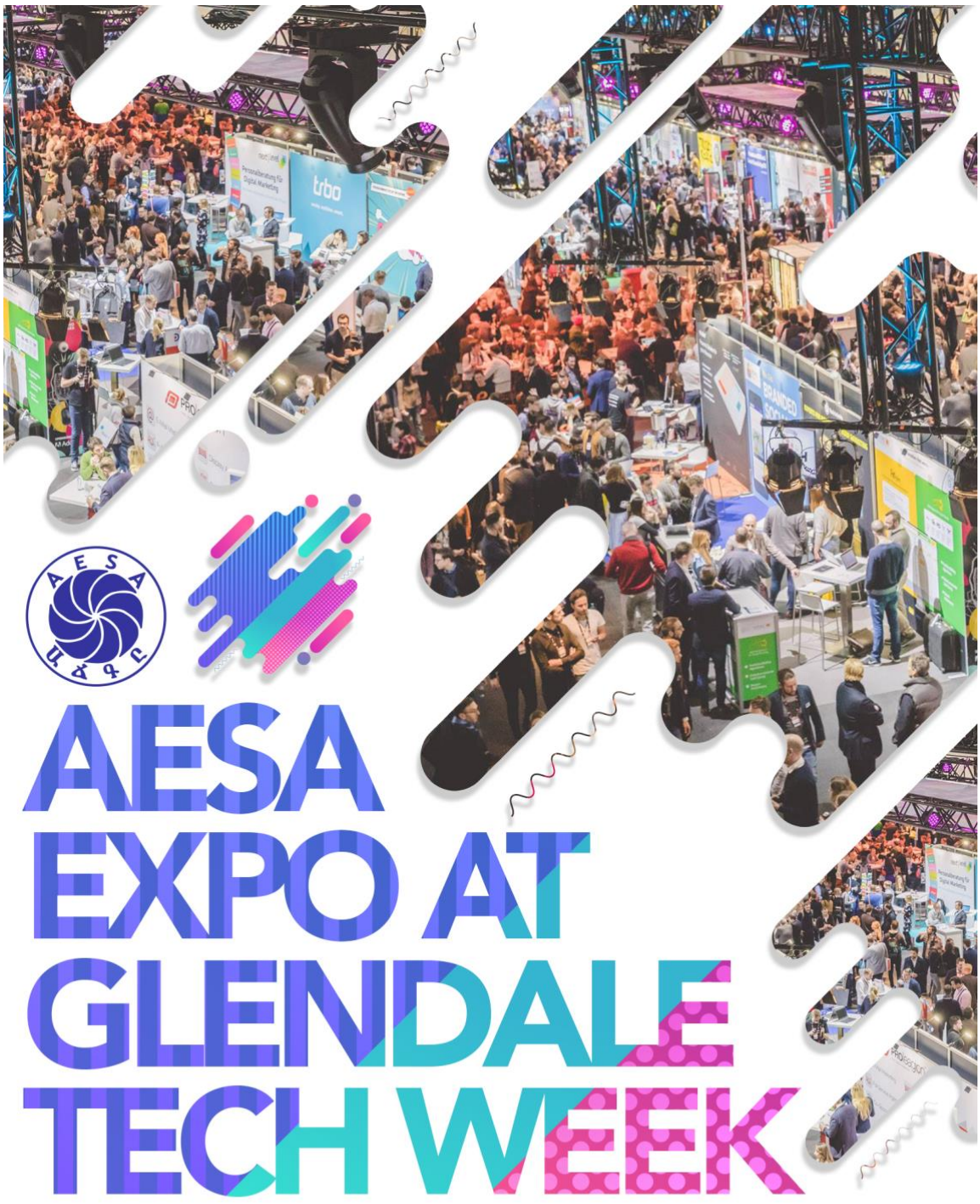
AESA CONFERENCE AT GLENDALE TECH WEEK

SEPTEMBER 15, GLENDALE CENTRAL LIBRARY

Scan me

The AESA Conference at Glendale Tech Week 2019 will exhibit cutting-edge STEM (Science, Technology, Engineering, Mathematics) related presentations and multidisciplinary panel discussions in a wide variety of technical topics.

FOR INFORMATION AND REGISTRATION > EXPO.AESA.ORG



SEPTEMBER 16, 17 ASLA BUILDING

FOR INFORMATION AND REGISTRATION > EXPO.AESA.ORG

The AESA Expo at Glendale Tech Week 2019 will showcase creative startups and established companies from Armenia and the U.S. and present their extensive wealth of technology talent and world-class entrepreneurial excellence.

Scan me