

## ASB Fellows Forum

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### Biomechanics and National Biomechanics Day as Mechanisms to Support Diversity, Equity, and Inclusion

*Eds. note: in this article, two ASB Fellows (Joan Bechtold and Trey Crisco), are joined by the incoming (Robin Queen) and outgoing (Kristin Zhao) Diversity Chairs*



In this 2<sup>nd</sup> “ASB Fellows Forum” article, we are following up on James Ashton-Miller’s and Ron Zernicke’s inspiring 1<sup>st</sup> Fellows Forum article in the last ASB newsletter (Volume 29, Issue 2): specifically, that a significant focus for “high performing” organizations such as the ASB, should be namely: diversity, equity, and inclusion (DE&I).

Let’s start by reminding ourselves of the Mission statement approved by the Executive Board in 2014: “The American Society of Biomechanics is committed to building a professional community that respects and promotes diversity, equity, and inclusion. We strive to learn from the diverse perspectives of our membership as we seek common goals for the biomechanics community.”

Furthermore, James Ashton-Miller and Ron Zernicke (A-M/Z) proposed three outstanding ideas for ASB members to consider, in order to “re-emphasize the vital importance for DE&I to enhance the creativity and the quality of science in ASB, and create a more diverse, equitable, and inclusive ASB”. We put forward opportunities here, in hopes of defining how we can best move forward in a meaningful manner.

**1. A-M/Z Proposal:** “Have ASB formally affiliate with universities with large enrollments of under-represented groups (e.g., Historically Black Colleges and Universities (HCBU), and Hispanic Serving Institutions (HSI)).”

**Action:** As a first (organic) step, there is tremendous opportunity for 1:1 Professor:Professor relationships to develop, leading to student interchange or institutional collaborations. If you have individual success stories or success strategies to share, please send them to Robin Queen (incoming Diversity Chair) so that your experiences and successes can be shared with the ASB membership. We would recommend that ASB consider a Diversity Committee HCBU/HSI subcommittee/task force, to formulate a longer-term, more strategic approach. If you see this as a particular niche or passion of yours, consider nominating yourself (contact Robin Queen) for such a subcommittee/task force.

**2. A-M/Z Proposal:** “Develop a NextMember workshop/seminar to precede an ASB annual meeting (or regional meetings) in which hosted early-career faculty, post-doctoral fellows and experienced PhD students from underrepresented mi-





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minorities are invited to discuss careers and opportunities in biomechanics, across all areas of research and application.”

**Action:** We recommend the ASB Program and Meeting Committees evaluate and implement these sessions on an annual basis. Again, as a first step, a lead person could be designated within the Program and/or Meeting Committees, and have joint representation on the Diversity Committee.

**3. A-M/Z Proposal:** “As National Biomechanics Day (NBD) has begun to raise the profile of biomechanics among young people in schools and communities, and STEM Academies (Science, Technology, Engineering, and Mathematics) provide students with supportive and academically rich experiences during their critical transition from high school to college, we urge the ASB to pursue implementation of ASB-Pipeline Partnerships.” Note from Paul DeVita: NBD is inclusive: in the U.S. alone, with over 5,000 high schoolers, we had 51% female, 8% Asian, 18% Black-African American, 18% Hispanic/Latino, 5% Hawaiian/Pacific, & 51% White.

**Action:** We have three specific proposals for leveraging NBD to enhance the STEM pipeline, particularly for underrepresented minorities. The first two proposals (College Possible and Perry Initiative) are relatively straightforward to implement, and can be accomplished individually by ASB members. Implementation by ASB members should be coordinated by the Diversity Committee so that efforts are not duplicated, and importantly, they are documented and publicized by the society to further promote the activities. The third proposal (4<sup>th</sup> Family) will entail some risk in determining how to implement and whether it ultimately succeeds, but has tremendous potential and directly leverages ASB expertise, common goals and National Biomechanics Day outreach and goodwill.

**a. ASB-Pipeline Partnership with College Possible or other college readiness organizations.** Using randomized controlled trials, College Possible’s success shows the potential of this program with their approach to preparing students for college (20% increases in ACT scores, 100% admittance to colleges). Pertinent to ASB, they also have >90 partner colleges and universities, where you, as ASB members, could introduce and inundate them with the wonders of biomechanics as the best STEM field, while also being an additional resource in easing the transition to undergraduate life. (Disclosure: JB has familiarity with College Possible because it was founded and is active in the Twin Cities/Minnesota).

**Action:** Individuals can seek out whether their institution is a Partner college. If so, you can approach College Possible representatives to individualize how an ASB member could be of most benefit to students on their campus. If not, College Possible may have distance mentoring opportunities, or you could advocate that your University partner with College Possible. Again, the ASB Diversity Committee can serve as a lead for organizational outreach if a more formal approach seems indicated.

**b. ASB-Pipeline Partnership with the Perry Initiative.** The Perry Initia-



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tive's mission is: "inspiring young women to be leaders in Orthopaedic Surgery and Engineering. We advance our mission principally by running hands-on outreach programs across the country for women students in high school, college, and medical school". The Perry Initiative high school and medical school outreach programs have recently been supplemented by OIA (Orthopaedics in Action), "designed specifically to bridge the gap between bioscience and engineering coursework and reinforce cross-cutting concepts in math and science." Several kits with materials for different curricula incorporating biomechanics principles can be purchased through [Sawbones](#) and implemented broadly to high schoolers.

**Action:** ASB can annually sponsor an outreach program and/or provide biomechanics-focused OIA kits to local schools at the annual meeting site, and work with the Perry Initiative to specifically target schools with underrepresented minorities. Outreach sponsorship requires \$1k-\$4k per day-long session, which may require separate ASB fundraising or identification of local or national philanthropic partners. This program has been very successful in steering female students into engineering and medical students into orthopaedic residency programs, and is straightforward to implement (as long as the funding is available). Again, it would make sense for the ASB Diversity Committee to be the lead organizational contact for this activity.

**c. ASB-Pipeline Partnership with 4<sup>th</sup> Family.** Central to 4<sup>th</sup> Family, which provides urban students access to STEM, is use of biomechanical principles to understand and improve athletic performance of youth. "The 4<sup>th</sup> Family STEM program is centered on providing students access to the opportunities in the STEM disciplines. The focus of the program is to provide concrete, accessible STEM material through hands on seminars and mentoring programs. 4<sup>th</sup> Family places an emphasis on social justice within the context of STEM education and encourages peer to peer mentoring as part of the program."

**Expanding upon 4<sup>th</sup> Family.** John Drazan, PhD is a lecturer in Biomedical Engineering (BME) at Rensselaer Polytechnic Institute (RPI), and has succeeded in shaping the 4<sup>th</sup> Family program as STEM director. The 4<sup>th</sup> Family STEM program uses biomechanics and sports science to engage underserved youth in authentic STEM outreach through sports training. He has authored numerous publications analyzing and demonstrating effectiveness of using sports as a venue for STEM education for marginalized youth. Most recently, Dr. Drazan's programs won 1<sup>st</sup> Place in the Research Paper Competition for the MIT-Sloan Sports Analytics Conference, a.k.a., the "Super Bowl of Sports Analytics". This has led to an increased national profile for the program, including an opportunity to present his work to NBA executives at the 2017 NBA Summer League in Las Vegas. 4<sup>th</sup> Family will be running a series of sports-science programs this summer with popular figures such as the rapper Wale and Emmanuel Mudiay of the Denver Nuggets.

Dr. Drazan can best explain: "For all the limitations of the traditional STEM pipeline, it is very good at scaffolding scientific material within students' existing knowledge. Lego Mindstorms provides an age-appropriate introduction to robotics. The issue is that a lot of kids aren't that motivated to build robots dur-





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ing their free time. Many more kids love playing or watching sports. If we can similarly scaffold sports science/biomechanics and analytics as a tool for improvement within youth sports, we can authentically introduce STEM to a broad set of youth who are interested in sports at the outset rather than STEM. In this manner students without a preexisting interest in STEM can be engaged in STEM enrichment. Just as students in robotics clubs are motivated to learn STEM to build the best robot and win competitions, basketball players could be motivated to learn STEM to use sports science to become better athletes and get a scholarship. Youth players just need an accessible, authentic set of scientific and analytical tools that enables them to study their own games. The biomechanics research community is uniquely positioned to make this approach reality across our country.”

**Action:** As 4<sup>th</sup> Family continues to build on its solid success and broaden its program to motivate greater numbers of underrepresented youth to pursue STEM careers (and ideally with a biomechanics focus), growth will require that programs be facilitated by individuals other than the intensely devoted and energetic 4<sup>th</sup> Family founders. Given that ASB members are biomechanics experts, and work at universities across the country and in most urban centers, we propose that ASB initiate a step-wise strategy to partner with 4<sup>th</sup> Family to develop enthusiastic biomechanics-trained facilitators and leverage their institutional resources to create sustained community programs for youth presently excluded from the STEM pipeline. NBD is an ideal venue to provide focus, outreach, and publicity for an initial exposure of communities to the approach of youth engagement to biomechanics via sports.

### **Long-term strategy:**

To train the ASB biomechanics/sport science facilitators, we would advocate that 4<sup>th</sup> Family hold regular training programs at the ASB annual meeting. This will introduce ASB members to the program, and also will help develop ongoing biomechanics outreach programs in the communities hosting each annual meeting.

We would advocate that the ASB Diversity Committee and Executive Board develop a 5-year implementation plan to partner with 4<sup>th</sup> Family for Annual Meeting training and National Biomechanics Day events, to support initiation of sustained community programs. This would include beta-tests, scientifically designed studies of effectiveness, academic and lay-publications and assessment of viability of the ASB-4<sup>th</sup> Family Partnership.

### **Short-term strategy:**

Dr. Drazen would like to beta-test this approach when under his direct leadership, and suggests we have a National Biomechanics Day kick-off with “Science of the Slam” workshops during NBD 2018 and ASB’s 2018 Annual Meeting to be held in Rochester, MN. To prepare for this, in the interim, with support of Susan Diekrager and Novel Electronics, he would conduct an analogous trainer-focused workshop in the Twin Cities. This would be in collaboration with the Minneapolis Public Schools or YMCA/YWCA, with additional workshops as indicated, to hone the plan. He would design the effort as a case study to identify strengths and weaknesses, and work with ASB



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to develop a solid implementation plan to eventually provide for individuals to employ in their own communities.

Here are two recent publications that highlight Dr. John Drazen's work:

Conf Proc IEEE Eng Med Biol Soc. 2015 Aug;2015:3691-4. doi: 10.1109/EMBC.2015.7319194. Experimental and credentialing capital: an adaptable framework for facilitating science outreach for underrepresented youth. Drazen JF, D'Amato AR, Winkelman MA, Littlejohn AJ, Johnson C, Ledet EH, Eglash R. Abstract: Increasing the numbers of black, latino and native youth in STEM careers is both an important way to reduce poverty in low income communities, and a contribution to the diversity of thought and experience that drives STEM research. But underrepresented youth are often alienated from STEM. Two new forms of social capital have been identified that can be combined to create a learning environment in which students and researchers can meet and explore an area of shared interest. Experimental capital refers to the intrinsic motivation that students can develop when they learn inquiry techniques for exploring topics that they feel ownership over. Credentialing capital denotes a shared interest and ability between all parties engaged in the experimental endeavor. These two forms of social capital form an adaptable framework for researchers to use to create effective outreach programs. In this case study sports biomechanics was utilized as the area of shared interest and understanding the slam dunk was used as experimental capital.

Conf Proc IEEE Eng Med Biol Soc. 2016 Aug;2016:3027-3030. doi: 10.1109/EMBC.2016.7591367. A case study for integrated STEM outreach in an urban setting using a do-it-yourself vertical jump measurement platform. Drazen JF, Danielsen H, Vercelletto M, Loya A, Davis J, Eglash R. Abstract: The purpose of this study was to develop and deploy a low cost vertical jump platform using readily available materials for Science, Technology, Engineering, and Mathematics (STEM) education and outreach in the inner city. The platform was used to measure the jumping ability of participants to introduce students to the collection and analysis of scientific data in an engaging, accessible manner. This system was designed and fabricated by a student team of engineers as part of a socially informed engineering and design class. The vertical jump platform has been utilized in 10 classroom lectures in physics and biology. The system was also used in an after school program in which high school volunteers prepared a basketball based STEM outreach program, and at a community outreach events with over 100 participants. At present, the same group of high school students are now building their own set of vertical jump platform under the mentorship of engineering undergraduates. The construction and usage of the vertical jump platform provides an accessible introduction to the STEM fields within the urban community.

As with many exciting ventures, this carries some risk. The ASB-4<sup>th</sup> Family partnership could help 4<sup>th</sup> Family to increase its capacity and impact from a founder-centric effort to one that can reach broader communities and incite biomechanics (and broadly, STEM) excitement in greater numbers of underrepresented youth. ASB can help fuel this growth, but we recognize at the end of the plan that ASB could also appropriately determine that alternate strategies may be more effective. The ASB Partnerships with College Possible and Perry Initiative carry less risk because the programs are more mature and can be more readily implemented.

In closing, we thank James Ashton-Miller and Ron Zernicke for focusing attention on the responsibility of ASB to foster DE&I in its activities. Here we extend this call to encourage the ASB Diversity Committee and Executive Board to evaluate the appropriateness of the ASB-Pipeline Partner and other suggestions outlined here as means to implement Paul DeVita and team's prescient development of NBD and his vision of "Biomechanics and National Biomechanics Day as Mechanisms to support Diversity, Equity, and Inclusion".

