2020 Athanasiou ABME Student Awards

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The Kyriacos and Kiley Athanasiou Endowment was established in 2017 within the Biomedical Engineering Society (BMES) to promote biomedical engineering scholarship and honor the contributions of Dr. Kyriacos Athanasiou to the field. One goal of the endowment is to recognize excellence in future leaders of biomedical engineering by awarding the top papers published in the Annals of Biomedical Engineering (ABME) by graduate students and post-doctoral scholars. The third Athanasiou ABME Student Award Session was held during the 2020 BMES Virtual Annual Meeting. Six awardees were selected to present their papers at the session. The presentations were pre-recorded with a live question and answer session.

The Athanasiou ABME Student Awards were selected from all papers with graduate student or post-doctoral scholar first authors that were published online between April 2019 and March 2020.^{1,3,7,8,10,12} There were a total of 167 papers that met the criteria. The overall impact and quality of papers were considered as well as the number of citations and downloads each paper received. In the third year of student awards there are now a total of 20 Athanasiou awardees.^{2,4-6,9,11,13-17,20} The first author from each paper was contacted to notify them and ask them to present their work during the award session. The papers covered a wide range of topics including tissue engineering, injury biomechanics, computational modeling, and surgical simulation.

Donnelly *et al.* reviewed tissue engineering approaches to breast reconstruction.¹⁰ Most of the studies reviewed were *in vitro* or animal studies, but several human case series were included. Scaffolds used to support tissue growth were either biological (collagen or decellularized tissue matrix) or synthetic. Some studies implanted cells with fibroblast growth factor in scaffolds to enhance tissue regeneration. The authors suggested that future work should address whether implanted cells and growth factors can improve vascularity of regenerated tissue, which is currently a major limitation for larger tissue volumes.

Bland *et al.* developed helmet evaluation methods for bicycle helmets to differentiate impact performance of available models.¹ An evaluation metric (STAR value) was used to summarize concussion risk based on

linear and rotational head kinematics from laboratory impact tests. For the sample of helmets tested, road helmets and helmets with slip planes had lower STAR values indicating better impact protection.

Campolettano *et al.* developed a concussion risk function using head impact data collected from youth football players between the ages of 9 to 14.³ A previously developed brain injury metric (GAMBIT)^{18,19} was used to summarize impact severity in terms of linear and rotational head kinematics for all impacts, which included 15 that resulted in a diagnosed concussion. Survival analysis was used to relate the modified GAMBIT values to concussion risk. The data presented provide insight to concussion tolerance as a function of age, and can be used to improve protective equipment designs.

Decker *et al.* developed a football helmet computational model.⁸ The geometry of the helmet was quantified with CT scans, and material testing of portions of the helmet shell and liner was used to input appropriate material properties to the model. The model was validated with laboratory impacts to an anthropomorphic test device headform using either a pendulum impactor, a linear impactor, or a drop. Helmet computational models could be used to simulate design modifications and lead to improvements in protective capabilities of helmets.

Harris *et al.* analytically reviewed existing literature on brain atrophy following traumatic brain injury.¹² They found that studies evaluating atrophy in patients with mild traumatic brain injury were inconclusive, but patients with moderate to severe brain injury followed predictable patterns. Brain tissue loss was either generalized or focal, and atrophy occurred at a rate of approximately 5% per year. The authors modelled both generalized and focal atrophy patterns with computational simulations, and found characteristic features that agreed with clinical observations (widening of cortical sulci, enlargement of ventricles, and cortical thinning). Predicting brain injury outcomes with computational modeling could assist clinicians in development of therapeutic plans.

Choi *et al.* developed a human prostate phantom to assist in training surgeons to perform transurethral resection of the prostate.⁷ The materials used closely

match the physical properties of the prostate for an accurate representation in surgical simulations. By adding an ultrasound contrast agent to the central zone of the phantom, surgical performance can be quantitatively evaluated with automated image analysis. The phantom provides a training and evaluation tool for surgeons, as well as a platform for testing new prototypes of medical instruments.

The next Athanasiou ABME Student Awards Session will be held at the 2021 BMES Annual Meeting in Orlando. Papers with graduate student or post-doctoral scholar first authors that were published during 2020 will be considered for the award. Awardees will be notified by May 1, 2021. Each awardee will receive a \$500 honorarium and free meeting registration, and will be asked to present their paper at the awards session. We look forward to another excellent session showcasing the best graduate student and post-doctoral scholar papers published in ABME.

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