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Editorial

Annals of Biomedical Engineering 2020 Reviewer Recognition

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Associate Editor Stefan M Duma oversaw the review of this article.

The Annals of Biomedical Engineering (ABME) depends on the voluntary service of reviewers to select and refine submissions to be published in the journal. ABME was especially reliant on reviewers in 2020 with a record number of papers submitted, including 460 that went out for review. We would like to thank all of our reviewers for their commitment and service to ABME. A total of 808 individuals from academia and industry from 55 countries reviewed ABME papers last year. We have highlighted reviewers that completed 4 or more reviews for their exemplary service in Table 1. The remainder of this article will summarize some of the top papers published in 2020 that our reviewers helped to refine. These papers represent growing areas of biomedical engineering, including regenerative medicine, drug delivery, concussion biomechanics, medical robotics, modeling, and gender diversity within the field.

REGENERATIVE MEDICINE

Regenerative medicine is a rapidly growing field within biomedical engineering that includes stem cell therapies, tissue engineering, and growth of artificial organs. The most viewed and cited regenerative medicine papers in ABME last year covered a variety of topics including extracellular matrix materials, new biomaterials for vascular repair, and novel tissue engineering approaches to cartilage repair. Cramer and Badylak reviewed different biologic scaffold preparation methods from allogeneic or xenogeneic extracellular matrix.[3] They found that clinical outcome of tissue repairs using biologic scaffolds varied widely depending on the methods used. Ding et al. developed a new injectable hydrogel to promote formation of blood vessels and repair of damaged tissue.[9] The hydrogel was loaded with growth factor nanoparticles and showed improved vascularization and tissue repair in both in vitro and animal models. McKittrick et al. developed a novel coronary stent coating that rapidly releases an antiproliferative agent.[15] The coating is composed of a bioactive polymer that promotes re-endothelialisation, which has been a challenge for other stents that release antiproliferative drugs to prevent artery wall thickening. The combination of antiproliferative drug release while still supporting endothelial cell growth is promising for patient outcome. De Moor et al. generated cartilage spheroid microtissues to be injected in joint lesions and aid in regeneration.[6] Other regenerative cell therapies for cartilage tend to form fibrous tissue instead of cartilage, so these microtissues offer a promising alternative for a tissue type with limited self-healing ability.

DRUG DELIVERY

Drug delivery systems have become increasingly complex in recent years, combining engineering strategies with advances in biomaterials and nanomedicine. These new technologies have improved targeted drug delivery and bioavailability to affected tissues while limiting side effects. Targets of new drug delivery systems highlighted in 2020 issues of ABME included skin, coronary arteries, and brain. Cu et al. compared drug diffusion for topical application, solid needle injection, and needle-free micro-jet injection.[4] Needle-free injection has the fastest diffusion rates and causes less tissue damage than a solid needle, while topical application is the slowest delivery method but does not cause tissue damage. The McKittrick et al. study described above under regenerative medicine used a new biomaterial coating for coronary stents that was loaded with an antiproliferative agent.[15] The stent coating promotes endothelial cell growth while controlled re-

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TABLE 1. ABME reviewers that completed the most reviews during 2020

First name	Institution	Country	# Reviews completed
Andrzej Polanczyk	Lodz University of Technology	Poland	23
Ramin Soltanzadeh	University of Manitoba	Canada	16
Feng Wei	Michigan State University	United States	9
Jillian Urban	Wake Forest University	United States	8
Ahmad Ghazzawi	Clinisent	United Arab Emirates	7
Gulden Kokturk	Dokuz Eylul University	Turkey	7
Cristina Tarin	University of Stuttgart	Germany	7
Carmelita Frondoza	Johns Hopkins University	United States	6
Sherif Hussein	Mansoura University	Egypt	6
Maria da Graça Ruano	University of Algarve	Portugal	6
Jose Salazar	Belfast Health and Social Care Trust	United Kingdom	6
Yang Sheng	University of Science and Technology of China	China	6
Daniela Tarnita	University of Craiova	Romania	6
Mark Begonia	Virginia Tech	United States	5
Aditya Reddy Kolli	AstraZeneca	United States	5
Kranthi Kolli	Weill Cornell Medicine	United States	5
Lyndia Wu	University of British Columbia	Canada	5
Christopher Dennison	University of Alberta	Canada	4
Tarek El-Bialy	University of Alberta	Canada	4
Alexandre Freire	Piracicaba Dental School - UNICAMP	Brazil	4
Diego Gallo	Politecnico di Torino	Italy	4
Aaron Goldstein	Virginia Tech	United States	4
Emily Kieffer	Virginia Tech	United States	4
Paul King	Vanderbilt University	United States	4
Rita Kiss	Budapest University of Technology	Hungary	4
Christian Maurer	Move Functional	Austria	4
Noman Naseer	Air University	Pakistan	4
Niema Pahlevan	University of Southern California	United States	4
Kerem Pekkan	Koç University	Turkey	4
Selene Pirola	Imperial College London	United Kingdom	4
Senol Piskin	University of Texas at San Antonio	United States	4
Mu Qiao	Louisiana Tech University	United States	4
Alejandro Roldán-Alzate	University of Wisconsin Madison	United States	4
Steven Rowson	Virginia Tech	United States	4
Michael Sacks	University of Texas at Austin	United States	4
Amit Saha	San Jose State University	United States	4
Ryo Torii	University College London	United Kingdom	4
Kedi Xu	Zhejiang University	China	4
Lihai Zhang	The University of Melbourne	Australia	4

lease of the antiproliferative drug prevents restenosis of the artery. Moya et al. developed a platform for customizing an in vitro blood-brain barrier model.[17] The model can be 2D or 3D, contain a single cell type or co-culture, and can be used with static or continuous flow conditions. This model can be used for studying blood-brain barrier function, or developing new therapeutics.

CONCUSSION BIOMECHANICS

Concussion has gained growing media attention and public awareness as evidence for long-term deficits from repeated concussions has surfaced. A number of papers on concussion biomechanics were published in ABME in 2020, including a special issue devoted to the topic. Campolettano et al. modeled risk of concussion for youth football players as a function of linear and rotational head acceleration.[2] On-field head impact kinematics from youth football players were used to develop the risk function, which showed age-related differences in concussion tolerance compared to adult athletes. Bland et al. developed an evaluation system for determining relative bicycle helmet protective performance.[1] The metric used to summarize helmet performance in laboratory tests identified differences in protection between helmet models. Decker et al. developed and validated a football helmet finite element model.[7] Similar models could be used to evaluate the effects of helmet design modifications on protective capability. These tools could be used by manufacturers to improve helmet designs.

MEDICAL ROBOTICS

Medical robotics is a relatively new field within biomedical engineering, with the first documented clinical case of a surgical robot used for a brain biopsy in 1985.[5,11] With advances in technology, robotics have been applied to a broad spectrum of medical procedures. Lv et al. developed a novel palpation force sensor for use during minimally invasive surgery.[14] The fiber Bragg grating-based sensor overcomes limitations of previously proposed sensor designs with its miniature size and biocompatibility. This novel technology could allow surgeons to perform more complex and delicate minimally invasive procedures, and to identify abnormal tissues during procedures. Lai et al. proposed a combined sensor-model approach to provide haptic feedback for surgeons using flexible endoscopic surgical robots.[12] Force is measured directly with a fiber Bragg grating-based force sensor on one of the tendon-sheath mechanisms in the robot, while modeling is used to estimate forces in the other tendon-sheath mechanisms. The use of a single sensor provides a space-saving and robust solution for haptic feedback.

MODELING

Computational modeling has been applied to all areas of biomedical engineering, and has potential to greatly reduce time and resources needed for experimental research. The most prominent modeling papers in ABME in 2020 were in the fields of cardiology, musculoskeletal biomechanics, and concussion biomechanics. Lee et al. developed computational models of bioprosthetic heart valves in an experimental pulse-duplicator platform.[13] The models closely matched experimental results, and could be used to expedite design and regulation of new bioprosthetic heart valves. Modenese and Kohout proposed a novel technique for automatically generating subject-specific complex muscle geometries for musculoskeletal models.[16] Muscle surface geometries from medical images are used to generate a user-defined number of muscle fibers in the model. This technique can be used to improve personalized musculoskeletal and finite element models. Hosseini Nasab et al. quantified collateral ligament elongation patterns for normal functional activities in patients that underwent total knee arthroplasty.[10] Consistent patterns were found in different activities, and were sensitive to femoral attachment points, indicating the importance of the femoral component of the implant in determining post-operative function. As described above under concussion biomechanics, Decker et al. developed a finite element model of a football helmet.[7] The model, when used with a test dummy head model, can be subjected to simulated laboratory head impacts to evaluate helmet performance and determine the effects of design modifications.

DIVERSITY

Diversity has become an increasingly important topic in all professions. It is important to consider not only bias in a workforce, but also any perceived bias that may inhibit performance and growth of employees. Denend et al. evaluated gender representation in senior leadership and perceptions of the workplace in health technology professionals.[8] They found that women are underrepresented and perceive gender bias as a barrier to leadership roles more than men do.

The success of ABME in the last year would not have been possible without the dedication of our reviewers. The exemplary papers above show the breadth of knowledge and expertise they provide, and we would again like to thank them for their service. We look forward to another year of publishing impactful research in the field of biomedical engineering.

REFERENCES

[1]Bland, M. L., C. McNally, D. S. Zuby, B. C. Mueller, and S. Rowson. Development of the STAR evaluation system for assessing bicycle helmet protective performance. *Ann. Biomed. Eng*. 48:47–57, 2020.

[2]Campolettano, E. T., R. A. Gellner, E. P. Smith, S. Bellamkonda, C. T. Tierney, J. J. Crisco, D. A. Jones, M. E. Kelley, J. E. Urban, and J. D. Stitzel. Development of a concussion risk function for a youth population using head linear and rotational acceleration. *Ann. Biomed. Eng*. 48:92–103, 2020.

[3]Cramer, M. C., and S. F. Badylak. Extracellular matrix-based biomaterials and their influence upon cell behavior. *Ann. Biomed. Eng*. 48:2132–2153, 2020.

[4]Cu, K., R. Bansal, S. Mitragotri, and D. Fernandez Rivas. Delivery strategies for skin: comparison of nanoliter jets, needles and topical solutions. *Ann. Biomed. Eng*. 48:2028–2039, 2020.

[5]Davies, B. A review of robotics in surgery. *Proc. Inst. Mech. Eng. [H]* 214:129–140, 2000.

[6]De Moor, L., E. Beyls, and H. Declercq. Scaffold free microtissue formation for enhanced cartilage repair. *Ann. Biomed. Eng*. 48:298–311, 2020.

[7]Decker, W., A. Baker, X. Ye, P. Brown, J. Stitzel, and F. S. Gayzik. Development and multi-scale validation of a finite element football helmet model. *Ann. Biomed. Eng*. 48:258–270, 2020.

[8]Denend, L., S. McCutcheon, M. Regan, M. Sainz, P. Yock, and D. Azagury. Analysis of gender perceptions in health technology: a call to action. *Ann. Biomed. Eng*. 48:1573–1586, 2020.

[9]Ding, Y., A.-S. Zhao, T. Liu, Y.-N. Wang, Y. Gao, J.-A. Li, and P. Yang. An injectable nanocomposite hydrogel for potential application of vascularization and tissue repair. *Ann. Biomed. Eng*. 48:1511–1523, 2020.
[10]Hosseini-Nasab, S. H., C. R. Smith, P. Schütz, P. Damm, A. Trepczynski, R. List, and W. R. Taylor. Length-change patterns of the collateral ligaments during functional activities after total knee arthroplasty. *Ann. Biomed. Eng*. 48:1396–1406, 2020.
[11]Kwoh, Y. S., J. Hou, E. A. Jonckheere, and S. Hayati. A robot with improved absolute positioning accuracy for CT guided stereotactic brain surgery. *IEEE T Bio-Med Eng* 35:153–160, 1988.
[12]Lai, W., L. Cao, R. X. Tan, Y. C. Tan, X. Li, P. T. Phan, A. M. H. Tiong, S. C. Tjin, and S. J. Phee. An integrated sensor-model approach for haptic feedback of flexible endoscopic robots. *Ann. Biomed. Eng*. 48:342–356, 2020.
[13]Lee, J. H., A. D. Rygg, E. M. Kolahdouz, S. Rossi, S. M. Retta, N. Duraiswamy, L. N. Scotten, B. A. Craven, and B. E. Griffith. Fluid-structure interaction models of bioprosthetic heart valve dynamics in an experimental pulse duplicator. *Ann. Biomed. Eng*. 48:1475–1490, 2020.
[14]Lv, C., S. Wang, and C. Shi. A high-precision and miniature fiber Bragg grating-based force sensor for tissue palpation during minimally invasive surgery. *Ann. Biomed. Eng*. 48:669–681, 2020.
[15]McKittrick, C. M., M. J. Cardona, R. A. Black, and C. McCormick. Development of a bioactive polymeric drug eluting coronary stent coating using electrospraying. *Ann. Biomed. Eng*. 48:271–281, 2020.
[16]Modenese, L., and J. Kohout. Automated generation of three-dimensional complex muscle geometries for use in personalised musculoskeletal models. *Ann. Biomed. Eng*. 48:1793–1804, 2020.
[17]Moya, M. L., M. Triplett, M. Simon, J. Alvarado, R. Booth, J. Osburn, D. Soscia, F. Qian, N. O. Fischer, and K. Kulp. A reconfigurable in vitro model for studying the blood–brain barrier. *Ann. Biomed. Eng*. 48:780–793, 2020.