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Editorial: Women in biomaterials science 2023

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Editorial on the Research Topic
Women in biomaterials science 2023

We are excited to present the second edition of the "*Women in Biomaterials Science*" Research Topic, which features four original research manuscripts and six review articles. This Research Topic aims to promote the work of women researchers across Biomaterials Science and to encourage more women to pursue careers in the field. Each paper in this 2nd edition has a female corresponding author, all but one of the lead authors are female, and a total of twenty-nine female scientists are represented as co-authors. The Research Topic covered in this Research Topic are diverse and cover the technical range of nanomaterials to 3D human-sized biomaterial models as well as biomaterial applications from combatting infections to the treatment of uniquely female conditions including endometriosis and cervical dysplasia.

Not surprisingly, the Research Topic features several conditions anatomically unique to women. A paper by lead author Amberlyn Simmons from the lab of Dr. Sarah Stabenfeldt, considers sex as a biological variable in the context of nanomaterials in acute brain injury imaging and treatment (Simmons et al.). The authors conclude that biological sex affects nanomedicine distribution, toxicity, and efficacy in a manner specific to the nanoparticle system and yet critical gaps in knowledge still exist. Lead author Maneesha Sahni from the lab of Dr. Emily Day, reviews nanoparticle-based diagnostics and treatments for endometriosis, an incurable disease characterized by tissue growth outside of the uterine cavity (Sahni and Day). Nanomaterials have the potential to be more effective and less invasive than existing therapeutic approaches. A project by lead author Ines Cadena from the lab of Dr. Kaitlin Fogg, details an affordable and effective ethanol ablation treatment for cervical dysplasia, a cancerous growth on the cervix often caused by human papilloma virus (Cadena et al.). Specifically, the authors used gelatin methacrylate to build a human-sized 3-dimensional (3D) *in vitro* model which mirrors the architecture of cervical dysplasia and demonstrated that localized injection of ethyl cellulose-ethanol gel retains the drug inside the tumor killing cancer cells, while sparing healthy cells.

Another set of papers focused on using biomaterials to combat the growing threat of antibiotic-resistant bacterial infections. Lead author Dr. Mary Beth Browning Monroe reviews the use of smart materials in the surveillance and treatment of wound infections (Monroe and Fikhman). Smart materials that respond to the unique pH, temperature, and enzymatic changes induced by bacteria in wounds can be coupled with mechanisms to kill the bacteria, such as drug release, or to signal infection and ultimately improve treatment outcomes. Lead author Carolina Gomez Casas from the lab of Dr. Anita Shukla, reviews the

approach of using immunomodulatory biomaterials to treat bacterial infections, since bacteria adopt immune evasion strategies for survival, which in turn cause persistent or recurrent infections (Gomez Casas and Shukla). The review emphasizes strategies targeting the innate immune system, such as metal ion releasing coatings, stimuli-responsive polymeric coatings, interleukin releasing surfaces, and immunomodulatory nanoparticles and hydrogels for the treatment of wound infections. Lead author Halle Lutz from the lab of Dr. Ashley Brown, reviews biomaterials for the treatment of thromboinflammation induced by sepsis, a life-threatening disease with pathophysiology involving interplay between endothelial cells, platelets, and leukocytes (Lutz and Brown). To address the disease complexity, biomaterials can be designed to target and affect multiple pathways and systems and safely inhibit excessive inflammation while maintaining hemostasis.

Several original research articles describe the development of biomaterials for tissue engineering applications. Lead author Michaela Licciadello from the lab of Dr. Chiara Tonda-Turo, used aligned electroconductive polycaprolactone/polyaniline fibers produced via electrospinning in the development of an *in vitro* nervous tissue model (Licciardello et al.). The scaffold was able to support neural stem cell attachment and growth and foster differentiation into the neuronal phenotype. Lead author Jodi Graf from the labs of Drs. April Kloxin and Catherine Fromen, used both 2D and 3D biomaterial-based culture systems to understand how, under similar stimuli, immortalized macrophages cell lines and primary cells respond (Graf et al.). Overall, the authors noted differences in baseline marker expression between cell lines, phenotypical and functional differences in cell lines compared to primary macrophages of the same origin, and differences in macrophage polarization in 2D vs. 3D cell culture, highlighting the need for careful consideration of cell origin for specific applications. Lead author Eya Ferchichi from the lab of Dr. Silviya Zustiak, developed a library of gelatin methacrylate-polyethylene glycol diacrylate hydrogels for use in mechanosensing applications (Ferchichi et al.). Specifically, a design of experiments approach was used to perform detailed analysis on the interplay between chemical composition and scaffold properties as well as scaffold properties and cell behavior, such as human glioblastoma cell spreading and therapy responsiveness. Lastly, a review from the lab of Dr. Janet Zoldan from lead author Nikhith Kalkunte, discusses the use of machine learning in cardiac tissue engineering (Kalkunte et al.). The authors suggest that machine learning can improving the phenotyping and functionality of human induced pluripotent stem cells, which are critical for cardiac regeneration therapy, via robust mathematical models and predictions.

In summary, the papers in this Research Topic illustrate a diversity of ideas and approaches and exciting biomaterials science aimed to address emerging challenges from female researchers in the biomaterials field.

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