MALDI Mass Spectrometry Imaging of Human Penile Tissue Scaffolds following Organ Decellularization to Evaluate Extracellular Matrix Preservation
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Abstract
Human penile reconstruction and transplantation is exceedingly complex due to the structure and function of the organ. Furthermore, transplantation for gender confirmation surgery and trauma leads to potential problems including long-term immunosuppression and tissue rejection. We have established a method to remove donor cells and preserve the extracellular matrix (ECM) which can then be seeded with recipient cells for transplantation. However, very little is known about the composition of the ECM of the human penis. In this study, we are using MALDI mass spectrometry imaging (MSI) to map both the fresh-frozen human penis and the decellularized scaffolds to better understand the ECM using a combination of unsupervised analysis and proteomics. We will use this data to develop tailored approaches to reseed the penile scaffold to improve clinical outcomes.

Introduction
Recently, we have reported the first decellularization of whole-organ human penile specimens for total penile tissue engineering, which are being developed for gender confirming surgery or trauma patients requiring penile reconstitution. Our long-term goal is to utilize whole organ penile extracellular matrix (ECM) scaffolds repopulated by the recipient’s own cells to minimize tissue rejection. Standard approaches to evaluating decellularization protocols assess only limited protein subsets to evaluate the relative success of removal of antigenic cellular material versus preservation of key ECM proteins. In this study, we sought to use matrix-assisted laser desorption ionization (MALDI) imaging to evaluate the preservation of the ECM in penile tissue following decellularization as compared to unaltered fresh-frozen penile tissue.

Methods
Tissues were imaged in reflection positive mode (m/z 300 to 3,200) with 100-micron pixel size (2024 laser shots) on a Bruker RefleXII MALDI TOF/TOF instrument.

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Conclusions and Future Directions

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References