

# John M. Drago

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## Education:

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**Massachusetts Institute of Technology (MIT)**, Cambridge, MA *Sept 2020 – Current*  
Candidate for SM & PhD degrees in Electrical Engineering & Computer Science

**Harvard Medical School**, Boston, MA *July 2017 – Current*  
Harvard/MIT MD-PhD Program  
Candidate for MD degree

**Massachusetts Institute of Technology**, Cambridge, MA *Sept 2013 – June 2017*  
S.B. Mechanical Engineering, Minor in Biomedical Engineering

## Research Experience:

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**Magnetic Resonance Physics & Instrumentation Group**, Boston, MA *Sept 2020 – Current*  
*Group at MGH Martinos Center focusing on the development and improvement of various imaging modalities*

- Create system to perform multiphoton MR excitations using an additional  $z$ -directed low frequency field.
- Perform tSNR functional neuroimaging measurements for analysis of time-series MPI images to detect variations in image data that correspond to physiological changes.
- Optimized transmit filter design for MPI system to generate homogeneous 25 kHz magnetic drive field for nanoparticle excitation.

**MGH Bioengineering Laboratory**, Boston, MA *Nov 2017 – May 2020*  
*Research group focusing on in vivo mechanics and clinical outcomes of knee replacements*

- Evaluated *in vivo* kinematics of novel knee replacement designs in patients undergoing a variety of functional tests to assess similarity to native knee biomechanics.
- Utilized machine learning/deep learning techniques for efficient 3D to 2D image registration of knee/hip replacements onto fluoroscopic image projections obtained during functional tests.

**Grodzinsky Continuum Biomechanics Lab**, Cambridge, MA *June 2014 – Aug 2017*  
*Research lab at MIT focusing on problems of musculoskeletal system and connective tissue*

- Evaluated biological pathways that contribute to onset of osteoarthritis through various lab techniques that track cell processes. Focused on potential therapeutics that reduce chondrocyte apoptosis and cartilage degradation.
- Designed experiments to culture murine supraspinatus tendons *in vitro* under constant tensile load. Designed and built a mechanical apparatus to hold tendons at precise strain levels for biomechanical compression testing.

## Manuscripts:

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1. C Klemt, **JM Drago**, V Tirumala, YM Kwon. “Asymmetrical Tibial Polyethylene Geometry-cruciate retaining total knee arthroplasty does not fully restore in-vivo articular contact kinematics during strenuous activities.” *Knee Surg Sports Traumatol Arthrosc.* 2021. PMID: 33388940. DOI: 10.1007/s00167-020-06384-9.
2. C Klemt, **JM Drago**, R Oganessian, I Yeo, YM Kwon. “Gait and Knee Flexion In-Vivo Kinematics of Asymmetric Tibial Polyethylene Geometry Cruciate Retaining Total Knee Arthroplasty.” *J Knee Surg.* 2020. PMID: 33111271. DOI: 10.1055/s-0040-1718681.

## Conference Papers and Abstracts:

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1. **JM Drago**, EE Mason, E Mattingly, M Śliwiak, LL Wald. “Image Time-Series Stability for MPI-Based Functional Neuroimaging.” Internal Workshop on Magnetic Particle Imaging. Digital Conference from Würzburg, Germany. March 21-23, 2022.
2. E Mattingly, M Śliwiak, **JM Drago**, EE Mason, M Graeser, LL Wald. “A drive filter design for MPI with harmonic notching and selective damping.” Internal Workshop on Magnetic Particle Imaging. Digital Conference from Würzburg, Germany. March 21-23, 2022.
3. AC Barksdale, EE Mason, E Mattingly, M Śliwiak, **JM Drago**, LL Wald. “Shift coil assembly for a rotating permanent magnet FFL human-scale fMPI Imager.” Internal Workshop on Magnetic Particle Imaging. Digital Conference from Würzburg, Germany. March 21-23, 2022.
4. C Klemt, V Tirumala, **J Drago**, W Boonyanuwat, W Chen, K Xiong, YM Kwon. “Two-Stage Reimplantation in Patients Requiring an Interim Spacer Exchange for Periprosthetic Joint Infection is Associated with Poorer Functional Outcomes.” AAOS Annual Meeting. Orlando, FL. March 24-28, 2020.
5. BK Connizzo, **JM Drago**, EH Frank, AJ Grodzinsky. “Static Tensile Strain Does Not Alter Tendon Response To Joint Inflammation In A Murine Explant Model.” BMES Annual Meeting. Philadelphia, PA. October 16-19, 2019.
6. C Klemt, P Arauz, S An, **J Drago**, A Wang, A Veith, S Limmahakhun, YM Kwon. “In-Vivo Kinematics Of Asymmetrical Bearing Geometry Cruciate Retaining Total Knee Arthroplasty During High Knee Flexion Activities.” EFORT Congress. Lisbon, Portugal. June 5-7, 2019.
7. **J Drago**, P Arauz, C Klemt, S An, A Wang, A Veith, S Limmahakhun, YM Kwon. “*In Vivo* Contact Kinematic Comparison of Asymmetrical Bearing Geometry Cruciate Retaining Total Knee Arthroplasty and the Native Knee During Gait.” ORS Annual Meeting. Austin, TX. February 2-5, 2019.
8. **J Drago**, P Arauz, C Klemt, S An, A Wang, A Veith, S Limmahakhun, YM Kwon. “*In Vivo* 6-DOF Assessment of Knee Kinematics During a High Flexion Lunge: A Comparison Between Asymmetrical Bearing Geometry Cruciate Retaining Total Knee Arthroplasty and Contralateral Native Knee.” ORS Annual Meeting. Austin, TX. February 2-5, 2019.
9. P Arauz, C Klemt, S An, **J Drago**, A Wang, A Veith, S Limmahakhun, YM Kwon. “In-vivo Articular Contact Analysis during Step-Ups in Patients with Asymmetrical Bearing Geometry Cruciate Retaining Total Knee Arthroplasty.” ORS Annual Meeting. Austin, TX. February 2-5, 2019.
10. P Arauz, C Klemt, S An, **J Drago**, A Wang, A Veith, S Limmahakhun, YM Kwon. “In-vivo Kinematics during Gait in Asymmetrical Bearing Geometry Cruciate Retaining Total Knee Arthroplasty.” ORS Annual Meeting. Austin, TX. February 2-5, 2019.
11. C Klemt, P Arauz, S An, **J Drago**, A Wang, A Veith, S Limmahakhun, YM Kwon. “In-vivo Kinematics of Asymmetrical Bearing Geometry Cruciate Retaining Total Knee Arthroplasty during High Knee Flexion Activities.” ORS Annual Meeting. Austin, TX. February 2-5, 2019.
12. P Arauz, C Klemt, S An, **J Drago**, A Wang, A Veith, S Limmahakhun, YM Kwon. “In-vivo Articular Contact Analysis during Functionally Strenuous Activities in Patients with Asymmetrical Bearing Geometry Cruciate Retaining Total Knee Arthroplasty.” ORS Annual Meeting. Austin, TX. February 2-5, 2019.
13. A Veith, S Limmahakhun, P Arauz, C Klemt, S An, **J Drago**, A Wang, YM Kwon. “Does Posterior Tibial Slope Impact Anterior Cruciate Ligament Bundle Stress in Bi-Cruciate Retaining Total Knee Arthroplasty?” ORS Annual Meeting. Austin, TX. February 2-5, 2019.
14. BK Connizzo, HM Zlotnick, **JM Drago**, AJ Grodzinsky. “Development of an *In Vitro* Bone-Tendon-Muscle Explant Culture Model.” BMES Annual Meeting. Phoenix, AZ. October 11-14, 2017.
15. Y Wang, S Wan, **J Drago**, FM White, AJ Grodzinsky. “Phosphoproteomics analysis of signaling changes in human chondrocytes following treatment with IL-1, IGF-1 and dexamethasone.” OARSI World Congress on Osteoarthritis. Las Vegas, NV. April 27-30, 2017.

**Patents:**

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1. Varady NH, Khouri ER, **Drago JM**, Arnold CA. "Reloadable multi-fire suture passer." Patent Provisional. 2015. (**Provisional Patent, expired in 2016**).

**Teaching:**

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**HST.164: Principles of Biomedical Imaging**, Teaching Assistant *IAP 2021, 2022*  
 Reviewed and updated course content. Led students in labs focused on physics of MRI acquisition. Developed course website. Course focused on mathematical understanding of various imaging modalities.

**6.022: Quantitative Systems Physiology**, Teaching Assistant *Spring 2017*  
 Assistant teaching instructor for MIT class, modeling fluid, electricity, and mass flow through various organ systems.

**Service:**

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**Harvard Medical Student Review**, Associate Editor *Apr 2019 – Current*  
 Review technical content and scientific rigor of submitted articles for publication.

**MGH Principal Clinical Experience**, Education Rep *Oct 2018 – Sept 2019*  
 Served as representative to clerkship administration and faculty regarding educational curriculum at MGH.

**HMS Financial Aid Committee**, Member *Sept 2017 – Sept 2018*  
 Served as student representative on committee to advocate for financial well-being of students to members of HMS administration.

**HMS Student Council**, Member *Sept 2017 – Sept 2018*  
 Helped organize and run events and initiatives for student body.

**MIT IFC Sexual Misconduct Committee**, Inaugural Chair *Feb 2016 – June 2017*

- Worked with Interfraternity Council and Institute administrators to create programming changes for educating fraternity members about sexual assault.
- Created system to incentivize houses to seek sexual harassment training through Consent Awareness and Prevention (CAP) education program.

**MIT Student and Affiliates Health Insurance Advisory Committee**, Student Rep *Sept 2014 – June 2017*

- Served as sole undergraduate representative on committee that advised on pricing of insurance premiums for all students and affiliates.
- Analyzed data from past fiscal years, to recommend premium changes for subscribers in line with competitive institutions.
- Spoke to various undergraduate students to learn of concerns in current insurance programs at MIT. Coordinated with the Undergraduate Association leadership to communicate potential changes to student leaders.

**MIT Committee on the Hobby Shop**, Student Rep *Sept 2016 – Aug 2017*  
 Undergraduate representative on committee designed to improve a maker space at MIT.

**MIT Women's Technology Program in Mechanical Engineering**, Mentor *July 2016, July 2017*  
 Mentored two program participants in creation of poster to be presented for Mechanical Engineering Department viewing.

**MIT Athletic Trainer Search Committee**, Member *June 2016 – Aug 2016*  
 Helped identify and select candidates to fulfill position opening. Collaborated with Institute administration, coaches, staff, and students to select best candidates for MIT community.

**Boston Marathon**, Volunteer *Apr 2016, Apr 2017*

## Other Activities:

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### MIT Varsity Baseball

*Aug 2013 – June 2017*

2014 & 2015 NEWMAC Champions. ECAC Champions 2016. NCAA Northeast Regional Tournament 2014 & 2015. CoSIDA Academic All-American, 2016 & 2017. NEWMAC All-Conference 2014 & 2016, and NEWMAC Rookie of the Year, 2014.

## Honors and Awards:

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- Tau Beta Pi Engineering Honor Society
- Pi Tau Sigma Mechanical Engineering Honor Society
- 2020 Thomas (1959) and Sarah Kailath Fellowship recipient, awarded by MIT EECS Department
- 2017 MIT Change Maker Award Recipient for work addressing sexual assault
- 2016, 2017 CoSIDA Academic All-American
- 2015, 2016, 2017 CoSIDA Academic All-District Baseball Team
- 2015, 2016, 2017 Academic All-NEWMAC Baseball Team
- 2017 Chi Phi Spaur Scholarship Recipient
- 2016 2nd Team All-NEWMAC
- 2015 Chi Phi Sparks Medal Recipient
- 2014 NEWMAC Rookie of the Year
- 2014 1st Team All-NEWMAC
- 2014 D3Baseball.com All-Region Team
- 2013 United States Marine Corps Distinguished Athlete Award
- 2013 National Football Federation, Arizona Scholar Athlete
- 2006 Fiesta Bowl Aerospace Challenge Winner