THE EXPERTS
Robson Forensic

FARAH HAMANDI, PhD
Biomedical Engineer

Investigates and analyzes biomechanical and biomedical injuries, examines injury causation, and assesses the design, application, and effectiveness of medical equipment, devices, and implants.

Assesses Injuries:
Applying physics, anatomy and physiology, assesses injuries involving:

- traumatic brain injuries and skull fractures
- neck, back and spinal cord injuries
- orthopedic and neurologic injuries
- vascular ruptures
- abdominal organs
- heart, lungs, skin (including burns) and other organs
- musculoskeletal injuries including joints (e.g., shoulders, knees, ankles and elbows), soft tissues (e.g., tendons, ligaments, nerves), and fracture patterns (e.g. torso, long bone, hand, foot, head)

Determines Cause:
Applying engineering principles, determines:

- the manner in which tissue failed: the type of loading, the direction of loading and magnitude or size of the load that caused the injury
- if injury patterns are causally related or consistent with the hazardous condition or circumstances claimed
- whether there was sufficient force in the right direction to cause an injury
- the presence of pre-existing conditions and how they affect the injury
- who and/or what action contributed to the injuries
- what could have been done to prevent the injuries

Typical Personal Injury Cases Involve:

- motor vehicle collisions
- slips, trips and falls
- medical malpractice or device failures
- occupational and workplace injuries
- sports and recreational injuries

PROFESSIONAL EXPERIENCE

2024 to Present — **Robson Forensic, Inc.**
Associate
Provide technical investigations, analysis, reports, and testimony toward the resolution of personal injury litigation involving injury analysis and causation, medical equipment, medical devices, and procedures.

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2025 **Institute of Police Technology and Management (IPTM)**
Instructor
Teaching nationwide courses in occupant kinematics and injury biomechanics in traffic crash reconstruction.

2021 to 2024 **Wright State University**
Post-Doctoral Research Associate – Academic Training, Department of Biomedical, Industrial and Human Factors Engineering

- Investigated bone damage/failure modes, conducted failure analyses of medical devices, performed finite element simulations of bone and medical fixation devices, conducted mechanical testing and characterization of materials
- Investigated the failure of failed medical devices, such as fixation plates, intramedullary nails, and liners, through visual and fractographic analyses, material conformity assessments, and computational simulations to reconstruct failure scenarios.
- Applied a range of advanced imaging and material characterization techniques—including optical, confocal, SEM, EDS, TEM, and FTIR microscopy—to investigate damage modes, oxidation index, crystallinity, and hardness, as well as to analyze material properties and determine failure causes in biomedical materials.
- Performed computational simulations to determine wear patterns using human gait profiles on failed medical device components.
- Prepared project proposals and reports for research related approvals (IRB, NIH).
- Developed and revised curriculum for courses including Biomaterials, Human Biomechanics, Failure Analysis of Medical Devices and Orthopedic and Prosthetic Engineering, integrated cutting-edge computational tools, machine learning and simulations to provide students with practical, industry-relevant experience.
- Created comprehensive lab manuals utilizing hands-on modules on mechanical testing, 3D modeling, 3D scanning, 3D printing, finite element analysis (FEA), and computational fluid dynamics (CFD) for modeling biological flows for courses including Biomaterials, Failure Analysis of Medical Devices and Orthopedic and Prosthetic Engineering.
- Led the design and implementation of a gait analysis laboratory, teaching students to perform human movement analysis and apply findings to the development, testing and performance analysis of medical devices.
- Mentored students on the application of engineering concepts in biomechanics and orthopedic research, providing them with hands-on experience in material characterization, failure analysis, and finite element simulations of bone and medical fixation devices.
- Revised lab curriculums to include emerging technologies such as 3D printing for medical device prototyping, ensuring students were exposed to the latest advancements in biomedical engineering.
- Facilitated workshops and recruited underrepresented students, developing tailored curricula and lab experiences to support their academic growth and career pathways.

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- Created 3D models of the skull, brain, and neurons to simulate various traumatic brain injury (TBI) scenarios and assess impact forces, injury mechanisms, and brain biomechanics. These researches involved investigating axon damage and the mechanical properties of neurons under different impact conditions.
- Additionally, analyzed blood-based biomarkers for TBI by performing molecular dynamics simulations on 12 key biomarkers to assess their stability, bond energies, and potential for diagnosing TBI severity through Blood-Brain Barrier (BBB) disruption and protein kinetics.
- Worked on creating a 3D model of the spine, including cervical, thoracic, and lumbar vertebrae, investigated fixation of rods and screws, analyzed failure mechanisms of screws used for spinal fixation.

2016 to 2020 **Wright State University, Dayton, OH**
PhD Candidate Student - Department of Biomedical, Industrial and Human Factors Engineering

- Developed mathematical models to predict bone damage accumulation at the macro level, aiding in large-scale bone structural integrity analysis.
- Created three-dimensional models from radiology data and conducted computational simulations to validate predictive mathematical models for bone damage.
- Performed retrospective studies to assess the impact of patient demographics (e.g., age, sex, bone density) on bone damage accumulation.
- Conducted experimental investigations on the effects of cyclic loading on bone damage, improving understanding of fatigue-related bone deterioration.
- Analyzed failed orthopedic fixation devices in case studies, identifying mechanical and clinical factors (including bone pathology) that contribute to device failure and construct damage.
- Built three-dimensional bone models at the micro level, based on radiology data, to accurately represent bone's anisotropic structure.
- Investigated the influence of morphological features on bone mechanical properties, identifying new microstructural parameters significant to bone strength and resilience.
- Correlated bone morphology, density, and stress distribution with patient demographics (race, age, gender) to support personalized approaches in implant modeling and therapeutic strategies.
- Executed computational simulations to examine microdamage accumulation, microcrack initiation, and propagation within bone microstructures.
- Determined the atomic structure of bone at the nano level, examining interactions, orientation, and hydration effects on the collagen-hydroxyapatite composite.
- Developed a three-dimensional nano-level bone model, focused on collagen fibril orientation, to enhance understanding of bone's resistance to mechanical stress.
- Conducted molecular dynamics simulations on collagen fibrils to observe mechanical property changes in bone, providing insights into its molecular-level resilience.

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- Investigated bone pathology at the nano level by substituting glycine in the collagen matrix with other amino acids, analyzing resulting changes in mechanical properties to understand how pathological alterations impact bone strength.
- Conducted research on spinal fixation mechanisms, creating 3D models of the human spine, encompassing cervical, thoracic, and lumbar vertebrae. Investigated the failure mechanisms of several failed spinal fixation screws, examining material properties, geometric design, loading conditions, and failure modes.

2016 to 2018 **Wright State University, Dayton, OH**

Grading Assistant, Department of Biomedical, Industrial and Human Factors Engineering *2018*

Graduate Teaching Assistant, Department of Biomedical, Industrial and Human Factors Engineering *2017*

Grading Assistant, Department of Biomedical, Industrial and Human Factors Engineering *2016*

- Biomaterials (BME-4440, BME-6440): Served as a Teaching Assistant, providing instruction on the fundamental aspects of materials science related to structure, properties, and applications in orthopedic devices, joint replacements, and dental implants. Graded assignments, reports, and exams, and developed lab exercises on mechanical testing, 3D printing, and computational simulations. Assisted in curriculum development, aligning course content with academic standards and industry needs. Created and revised lab manuals, ensuring accessibility and integration of advancements in biomedical engineering.
- Human Biomechanics (BME-3212): Developed and led a gait analysis laboratory, equipping students with skills in human movement analysis and its implications for medical devices. Oversaw projects using OpenSim for analyzing forces on body segments, guiding students in applying engineering principles to biomechanics. Fostered a collaborative learning environment, promoting active participation and hands-on experience.
- Failure Analysis of Medical Devices (BME-7371): Facilitated a hands-on, project-based course where students conducted failure analysis on medical devices, including joint replacements, fixation plates, and heart valves. Guided students through the process of preparing and presenting failure assessment studies within FDA, ASTM, and ISO regulatory guidelines. Developed lab exercises using a range of tools (microscopes, cutting and polishing equipment) and maintained lab resources and software licenses.
- Orthopedics and Prosthetics Engineering (BME-7210): Delivered instruction on engineering techniques applied to orthopedic and prosthetic design. Provided continuous guidance on applying biomechanics concepts, bridging theoretical knowledge and real-world challenges.
- Traumatic Brain Injury (TBI) and Brain Modeling: Supervised projects and provided guidance on brain modeling for TBI research, introducing students to computational modeling techniques for simulating brain biomechanics under various impact scenarios. Emphasized data analysis and modeling accuracy to

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assess injury mechanisms, equipping students with practical skills in TBI research applications.
- Taught and mentored both undergraduate and graduate students, emphasizing biomaterials, biomechanics, and experimental design.
- Mentored students on research methodologies and project management, guiding them through proposal writing, experimental design, and data analysis for biomedical engineering projects.
- Created and implemented practical lab exercises, providing hands-on experience in tension, compression, bending, 3D printing, and machine learning.
- Actively contributed to departmental events and promoted the biomedical engineering society, fostering student engagement in the academic and professional community.

2011 to 2014 **Dijlah University, Baghdad, Iraq**
Lecturer
- Delivered comprehensive courses in medical devices development, anatomy, artificial eye and visual aids, and x-ray and ultrasound, effectively engaging students through a blend of theoretical knowledge and practical applications.
- Developed and implemented a rigorous curriculum for each course, ensuring that course content was relevant, up-to-date, and aligned with industry standards and educational goals.
- Employed diverse teaching methodologies, including lectures, interactive discussions, and hands-on demonstrations, to foster an engaging learning environment and accommodate different learning styles.
- Designed and taught the Medical Device Development course, where students explored the entire lifecycle of medical devices, including concept ideation, design, prototyping, testing, and regulatory considerations including FDA, ASTM, and ISO. This course equipped students with the knowledge and skills necessary to innovate in the rapidly evolving field of medical technology.
- Created instructional materials, such as lab manuals and multimedia presentations, to enhance students' understanding of complex concepts.
- Supervised laboratory sessions, providing students with practical experience in the use of medical equipment and techniques.
- Contributed to the continuous improvement of the department by participating in curriculum reviews and faculty meetings, incorporating feedback to enhance educational delivery.
- Engaged in professional development to remain current with advancements in medical technology and teaching practices, ensuring that students received a high-quality education.

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2009 to 2011 **Saar Medtec Company, Baghdad, Iraq**
Medical Representative

- Acted under the distributor for leading medical device companies, including ZIMMER BIOMET, MEDTRONIC, SMITH & NEPHEW, and COVIDIEN, facilitating the introduction and adoption of their products in the clinical setting.
- Acted under the distributor for Zimmer Biomet, focusing on orthopedic devices such as knee and hip replacements, and internal/external fixation systems. Facilitated product adoption, trained healthcare professionals, and ensured proper usage in clinical settings.
- Worked with Medtronic in the spine division, supporting the introduction and clinical implementation of spinal implants and related technologies. Provided product training and ensured compliance with surgical protocols for spinal procedures.
- Collaborated with Smith & Nephew in the arthroscopy division, facilitating the adoption of advanced surgical tools and technologies for minimally invasive joint surgeries. Delivered product training and supported clinical staff in the use of these devices.
- Supported Covidien in the marketing and adoption of sutures and staplers for wound closure. Provided training to healthcare professionals, ensuring the safe and effective use of these products in surgical settings
- Regularly collaborated with clinicians, attending grand rounds, surgeries, and patient consultations to ensure the appropriate use of medical devices, implants, and monitoring equipment.
- Delivered comprehensive training sessions for healthcare professionals, focusing on the proper use, safety protocols, and maintenance of a wide range of medical devices, implants, and diagnostic equipment. The training covered essential regulatory considerations such as Instructions for Use (IFU), device-specific warnings, surgical guides/techniques, and the process for handling urgent device corrections and recalls. This ensured that practitioners were well-versed in the latest medical technologies and regulatory compliance. Cultivated strong relationships with medical teams, providing ongoing technical support and education to optimize patient outcomes through effective device use.

2007 to 2010 **Al-Nahrain University, Baghdad, Iraq**
Masters Candidate - Department of Biomedical Engineering

- Conducted a comprehensive finite element analysis on twenty one articular cartilage models to investigate stress distribution and deformation patterns in normal and osteoarthritic knee cartilage under varying conditions and evaluate potential treatment options.
- Established four baseline models representing normal articular cartilage in the distal femur, patella, medial tibia, and lateral tibia regions, simulating natural joint mechanics in various activities such as walking and squatting.

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- Generated seven osteoarthritic models of distal femur cartilage with two types of defects. Partial-thickness defects preserving the subchondral bone. Full-thickness defects involving subchondral bone removal in different diameters to represent moderate to severe osteoarthritis.
- Replaced damaged regions with artificial cartilage, applying different repair techniques and treatment materials to assess their efficacy: Autologous Chondrocyte Implantation (ACI), Osteochondral Autograft, Allograft, and Microfracture Stimulation, and Total Cartilage Replacement with UHMWPE.
- The FEA stress and deformation analyses underscore the importance of selecting treatment approaches based on defect depth, patient age, and activity level. This approach highlights ACI as the most favorable option for focal defects in younger patients, while UHMWPE replacement is preferable for extensive osteoarthritis, albeit with considerations for mechanical limitations in stress distribution.

2002 to 2006 **Al-Nahrain University, Baghdad, Iraq**
Undergraduate Student - Department of Biomedical Engineering

- Utilized a reaction board setup to directly calculate the Center of Gravity (COG) of the human body.
- Modeled the human body in individual segments (e.g., limbs, torso) according to segment theory. The model allowed for variation in limb positioning, providing insight into how changes in body configuration impact COG location. The segmentation approach was found to yield results closely matching theoretical predictions, making it ideal for sports and movement science applications.

EDUCATION

Doctor of Philosophy (Ph.D.), Engineering, Wright State University, Dayton, OH, 2020
Master of Science (M.Sc.), Biomedical Engineering, Al-Nahrain University, Baghdad, IQ, 2010
Bachelor of Science (B.Sc.), Biomedical Engineering, Al-Nahrain University, Baghdad, IQ, 2006

Continuing Education:
Publons Academy - Practical Peer Review Certificate 2018
Elsevier Research Academy - Successful research grant applications Certificate 2018
Elsevier Research Academy - Research data management Certificate 2018
Elsevier Research Academy - Fundamentals of peer review Certificate 2018
Elsevier Research Academy - Social impact Certificate 2018

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PROFESSIONAL MEMBERSHIPS

Biomedical Engineering Society (BMES)
Biomedical Research and Technology Association (BMRTA)
Society of Women Engineers (SWE)
Engineers Without Borders (EWB)
American Society of Testing and Materials (ASTM)
Committee F04 on Medical and Surgical Materials and Devices
American Society of Biomechanics (ASB)
Orthopaedic Research Society (ORS)

PUBLICATIONS

Hamandi, F., Tsatalis, J. T., & Goswami, T. (2024). Morphological human bone features and demography controlling damage accumulation and fracture: a finite element study. Computer Methods in Biomechanics and Biomedical Engineering, 1–17.

Salih, A., **Hamandi, F.**, & Goswami, T. (2024). Advancements in finite element modeling for cardiac device leads and 3D heart models. Bioengineering, 11(6), 564.

Hamandi, F., Pooler, T., Runser, A., Asman, C., Bailey, R., Robinson, N., & Goswami, T. (2024). Bioenergetic analysis and anthropometric evaluation of bra-breast interface for improved design and breast health. *Research on Intelligent Manufacturing and Assembly*, *2*(1), 70-84.

Hamandi, F., Whatley, S., Simon, G., Venkatarayappa, I., & Goswami, T. (2023). Failure analysis of a femoral cephalomedullary nail. Metals, 13(3), 506. DOI:

Whatley, S., **Hamandi, F.**, Venkatarayappa, I., & Goswami, T. (2023). Computational simulation of a femoral nail fracture. Metals, 13(3), 509. DOI:

Hamandi, F., & Goswami, T. (2022). Hierarchical structure and properties of the bone at nano level. Bioengineering, 9(11), 677. DOI: 10.3390/bioengineering9110677

Hamandi, F., Tsatalis, J. T., & Goswami, T. (2022). Retrospective evaluation and framework development of bone anisotropic material behavior compared with elastic, elastic-plastic, and hyper-elastic properties. Bioengineering, 9(1), 9. DOI: 10.3390/bioengineering9010009

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Suhr, S., **Hamandi, F.**, Mohammad, A. Y., Gundapaneni, D., Simon, G., Lawless, M., & Goswami, T. (2021). Surface damage evaluation and computational modelling of clinically failed knee liners. Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization, 9(1), 4-27.

Hamandi, F., Simon, G., Laughlin, R., & Goswami, T. (2020). Biomechanical behavior of a variable angle locked tibiotalocalcaneal construct. Bioengineering, 7(1), 27.

Hamandi, F., Whitney, A., Stouffer, M. H., Prayson, M. J., Rittweger, J., & Goswami, T. (2020). Cyclic damage accumulation in the femoral constructs made with cephalomedullary nails. Frontiers in Bioengineering and Biotechnology, 8.

Hamandi, F. (2020). Hierarchical structure, properties and bone mechanics at macro, micro, and nano levels. Doctor of Philosophy (PhD), Wright State University, Engineering PhD.

Hamandi, F., Laughlin, R., & Goswami, T. (2018). Failure analysis of PHILOS plate construct used for pantalar arthrodesis paper II—screws and FEM simulations. Metals, 8(4), 279.

Ina, J., Vallentyne, M., **Hamandi, F.**, Shugart, K., Boin, M., Laughlin, R., & Goswami, T. (2018). Failure analysis of PHILOS plate construct used for pantalar arthrodesis paper I—analysis of the plate. Metals, 8(3), 180.

Hamandi, F., Goswami, T. (2017). Macrodamage accumulation model for a human femur. Applied bionics and biomechanics, vol. 2017, Article ID 4539178, 19 pages, 2017.

Abbass, S. J., & **Abdulateef, E. F. M. R.** (2012). Finite element analysis of human and artificial articular cartilage. Journal of Engineering, 18(4), 443-458.

Farah Mohammed Reda Abd Al-Lateef (2010). Finite element analysis of human and artificial articular cartilage. Al-Nahrain University.

Hamandi, F. (2012). Design a model for human body to determine the center of gravity, National Conference for Iraqi Women, Baghdad, 2012: Iraq, Ministry of Science and Technology.

Hamandi, F. (2012). Complications of eye herpes simplex virus in Baghdad, National Conference for Iraqi Women, Baghdad, 2012: Iraq, Ministry of Science and Technology.

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CONFERENCE/SYMPOSIUM/POSTER PRESENTATIONS

Hamandi, F.; Helton, E.; Padgitt, M.; Goswami, T. (2024). Enhancing cross-linked UHMWPE knee prosthesis design: a comprehensive approach to assessment and optimization, 1st International Online Conference on Bioengineering, MDPI: Basel, Switzerland, October 16–18, 2024.

Hamandi, F. (2024). Advancing femoral nailing systems: a redesigned fixation device addressing past challenges and enhancing performance. Engineering in Healthcare: Industry and Research Symposium (EHIRS), January 27, Colombus: The Ohio State University, 2024.

Hamandi, F., & Goswami, T. (2023). Bioenergetic analysis and anthropometric evaluation of bra-breast interface for improved design and breast health. Celebration of Research, Scholarship and Creative Activities, October 26, Dayton: Wright State University, 2023.

Hamandi, F., & Goswami, T. (2019). Investigation of the effect of collagen fibrils orientation on the mechanical properties of the bone at nano level using molecular dynamics simulation. BMES 2019 Annual Meeting, October 16-19, Philadelphia.

Hamandi, F., & Goswami, T. (2019). Bra-breast-biomechanics- 3D modeling and breast skin molecular dynamics simulation. Victoria's Secrets Meeting. Wright State University, 2019.

Hamandi, F., & Goswami, T. (2018). Damage accumulation of nail constructs for femoral fractures. ASME: 14th Annual Dayton Engineering Sciences Symposium, October 30, Dayton: Wright State University, 2018.

Hamandi, F. (2018). BMES 2018 Annual Meeting, October 17-20, Atlanta, Georgia.

Hamandi, F., & Goswami, T. (2017). Investigation of a fatigue failure in depuy synthes 3.5 mm LCP proximal humerus locking plate and screws. Orthopaedic Research and Innovation Symposium, April 10, Dayton: Wright State University, 2017.

Hamandi, F., & Goswami, T. (2016). Macrodamage accumulation model for a human femur. ASME: 12th Annual Dayton Engineering Sciences Symposium, November 1, Dayton: Wright State University, 2016.

Hamandi, F., & Goswami, T. (2016). Macrodamage accumulation model for bone tissue. Celebration of Research, Scholarship and Creative Activities, April 15, Dayton: Wright State University, 2016.

Hamandi, F., & Goswami, T. (2016). Macrodamage model for the bone. Orthopaedic Research and Innovation Symposium, April 4, Dayton: Wright State University, 2016.

Hamandi, F., & Goswami, T. (2016). Damage accumulation model. NSF IUCRC - Center of Disruptive Musculoskeletal Innovations (spring symposium), March 24-25, 2016, Toledo: University of Toledo, 2016.

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INVITED LECTURES

"Hierarchical Structure and Properties of Bone Mechanics at Macro, Micro, And Nano Levels", BME 1110 Guest Lecture; Invited by Dr. Tarun Goswami, Department of Biomedical, Industrial and Human Factors Engineering, Wright State University. (December 2022)

"Hierarchical Structure and Properties of Bone Mechanics at Macro, Micro, And Nano Levels", BME 1110 Guest Lecture; Invited by Dr. Julie A Skipper, Department of Biomedical, Industrial and Human Factors Engineering, Wright State University. (October 2021)

"Biomedical Engineering Applications", Engineering Class, Invited by Keith Everly, Legacy Christian Academy. (October 2020)

"Hierarchical Structure and Properties of Bone Mechanics at Macro, Micro, And Nano Levels", BME 1110 Guest Lecture; Invited by Dr. Tarun Goswami, Department of Biomedical, Industrial and Human Factors Engineering, Wright State University. (October 2020)

"Biomedical Engineering Applications", Engineering Class, Invited by Keith Everly, Legacy Christian Academy. (February 2020)

SERVICE TO A PROFESSIONAL OR GOVERNMENT ORGANIZATION

2024 to Present	Bioengineering - Advancements in Biocompatible Materials for Implantable Medical Devices, Guest Editor
2024 to Present	Bioengineering- AI-Enhanced Biomechanics and Rehabilitation Engineering, Guest Editor
2024 to Present	Biomechanics And Modeling in Mechanobiology, Reviewer
2024 to Present	Biomechanics, Reviewer
2024 to Present	BMC Oral Health, Reviewer
2024 to Present	Computer Methods in Biomechanics and Biomedical Engineering, Reviewer
2024 to Present	Journal of Biological Methods, Reviewer
2024 to Present	Journal of the Brazilian Society of Mechanical Sciences and Engineering, Reviewer

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2024 to Present	Sensors, Reviewer
2023 to Present	Applied Ergonomics, Reviewer
2023 to Present	BMC Musculoskeletal Disorders, Reviewer
2023 to Present	Healthcare, Reviewer
2023 to Present	Journal of Orthopaedic Surgery and Research, Reviewer
2022 to 2023	Mathematics, Reviewer
2023 to Present	Results in Engineering, Reviewer
2023 to Present	Scientific Reports, Reviewer
2021 to Present	Applied Sciences, Reviewer
2020 to Present	Journal Of Materials Science, Reviewer
2023	Applied Bionics and Biomechanics, Reviewer
2023	Biomedical Physics & Engineering Express, Reviewer
2023	Journal of Clinical Medicine, Reviewer
2023	Journal of Personalized Medicine, Reviewer
2022	Hematology Reports, Reviewer
2022	International Journal of Environmental Research and Public Health, Reviewer
2022	International Journal of Human Factors and Ergonomics, Reviewer

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HONORS

2023	Outstanding Reviewer Award, IOP Publishing
2023	IOP Trusted Reviewer, Institute of Physics
2015	Ph.D. Graduate Research Fully Funded Scholarship, Prime Ministry of Iraq (HCED)
2013	Outstanding Contribution Award, Dijlah University
2013	Excellence Award, Dijlah University
2011	Certificate of Appreciation, Iraqi Orthopedics Association

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