Exponent®
Engineering & Scientific Consulting

Yanhui Ma, Ph.D.

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Professional Profile

Dr. Ma's areas of expertise include advanced ophthalmic imaging techniques and injury biomechanics with a particular expertise in ocular injuries and traumatic brain injuries. Dr. Ma brings over 16 years of expertise, having led numerous projects in image processing and AI/ML across ocular biomechanics, digital health, and human vision.

Dr. Ma has utilized computational models and testing data to understand the mechanical behavior of ocular tissues under various conditions, providing critical insights into how mechanical forces impact ocular health, particularly in the context of trauma and disease. Dr. Ma has developed innovative imaging tools to enhance the diagnosis and treatment of eye conditions leveraging AI/ML. She holds a U.S. patent for methods and systems for quantifying retinal vascular patterns.

Prior to joining Exponent, Dr. Ma was a faculty member at The Ohio State University in the Department of Ophthalmology and Visual Sciences. During this time, Dr. Ma was awarded several prestigious grants from private foundations and federal agencies such as the National Institutes of Health as a principal investigator. Dr. Ma spearheaded projects on retinal imaging biomarker discovery for cognitive function and the development of imaging tools for ocular rigidity estimation. Dr. Ma's extensive publication record and academic accomplishments underscore her expertise and leadership in the eye and vision field.

Academic Credentials & Professional Honors

Ph.D., Engineering, Cardiff University, UK, 2016

B.S., Aerospace Engineering, Beijing Institute of Technology, 2011

NIH Exploratory/Developmental Research Grant Award (NIH R21AG080407), 2022

Emerging Vision Scientist, Alliance for Eye and Vision Research, 2022

Science Communication Training Fellowship, Association for Research in Vision and Ophthalmology, 2022

W.R. Bryan Diabetic Eye Disease Research Award, 2021

Professional Development Award, Ohio State Postdoctoral Association, 2021

Best Paper Presentation Award, Ophthalmic Engineering Grand Rounds, 2018

BrightFocus Travel Award, International Society for Eye Research, 2017

Academic Appointments

Research Scientist, Department of Ophthalmology and Visual Sciences, The Ohio State University, 2020-2024

Visiting Researcher, Department of Mechanical Engineering, Stanford University, 2016

Prior Experience

Chair of Member-In-Training Committee, Association for Research in Vision and Ophthalmology, 2024-current

Research Faculty, The Ohio State University, 2020-2024

Consultant, OSU Vision Science Research Core, 2024

Professional Affiliations

Association for Research in Vision and Ophthalmology —ARVO (member)

International Society for Eye Research —ISER (member)

Institute of Electrical and Electronics Engineers —IEEE (member)

International Society for Optics and Photonics —SPIE (member)

American Society of Mechanical Engineers—ASME (member)

Patents

Ma, Y., Roberts, C.J. Ohr, M, P. Methods and Systems for Quantifying Retinal Vascular Patterns and Treatment of Disease. US Patent App. 17/959,127, 2023

Moroi, S.E., Ma, Y., Liu, J., Kwok, S. Systems and Methods to Quantify Uveoscleral Outflow from Ocular Ultrasound Images. US Patent App. 63/643,657

Publications

Okon, M.D., Ma, Y., Nguyen, B.A., Roberts, C.J. (2024). “A new biomechanical deformation response parameter: change in central corneal thickness during air puff induced corneal deformation”. Current Eye Research, 1-5

Harvey, D.H., Roberts, C.J., Mahmoud, A.M., Nunez, F.M., Ma, Y., Fleming, G.P. (2024). “Biomechanical and vascular metrics between eyes of patients with asymmetric glaucoma and symmetric glaucoma”. Journal of Glaucoma, 10-1097

Chen, X., Li, Y., Guo, M., Xu, B., Ma, Y., Zhu, H., Feng, X. (2023). “Polymerization force-regulated actin filament-Arp2/3 complex interaction dominates self-adaptive cell migrations”. Proceedings of the National Academy of Sciences, 120 (36).

Kwok, S., Ma, Y.‡, Pan, X., Liu, J. (2023). “Three-dimensional ultrasound elastography detects age-related increase in anterior peripapillary sclera and optic nerve head compression during IOP elevation”. Investigative Ophthalmology & Visual Science, 64(7), 16-16. (‡ co-first author)

Ma, Y.*, Ohr, M.P., Roberts, C.J. (2022). “Preliminary results of noninvasive ocular rigidity in diabetic

retinopathy using optical coherence tomography". Photonics 9(9),598. (* corresponding author)

Yousefi, A., Ma, Y., Roberts, C.J., Moroi, S.E., Reilly, M.A. (2022). "Hydrodynamic interaction between tear film and air puff from noncontact tonometry". Translational Vision Science & Technology 11(2),2-2.

Ma, Y.*, Moroi, S.E., Roberts, C.J. (2021). "Noninvasive clinical measurement of ocular rigidity and comparison to biomechanical and morphological parameters in glaucoma". Frontiers in Medicine, 8. (* corresponding author)

Ma, Y.*, Ohr, M.P., Pan, X., Roberts, C.J. (2021). "Quantifying the pattern of retinal vascular orientation in diabetic retinopathy using optical coherence tomography angiography". Scientific Reports, 11(1), 1-11. (* corresponding author)

Okon, M., Ma, Y., Liu, J., Roberts, C.J. (2021). "Change in central corneal thickness with air-puff induced corneal deformation using a method to correct Scheimpflug and refractive distortion". Journal of Refractive Surgery, 37 (6)

Ma, Y., Pavlatos, E., Clayson, K., Kwok, S., Pan, X., Liu, J. (2020). "Three-dimensional inflation response of porcine optic nerve head using high-frequency ultrasound". Journal of Biomechanical Engineering 142(5).

Ma, Y., Kwok, S., Sun, J., Pan, X., Pavlatos, E., Clayson, K., Hazen, N., Liu, J. (2020) "IOP-induced regional displacements in the optic nerve head and correlation with peripapillary sclera thickness". Experimental Eye Research, 108202

Palko, J., Ma, Y.ǂ, Pan, X., Liu, J., Reppa, C., Dixon, M.W., Clayson, K., Lubniewski, A., Liu, J. (2020). "Mechanical stability of cryopreserved split-thickness tectonic corneal grafts". Cornea 39(9), 1151-1156. (ǂ co-first author)

Kwok, S., Clayson, K., Hazen, N., Pan, X., Ma, Y., Hendershot, A., Liu, J. (2020). "Heartbeat-induced corneal axial displacement and strain measured by high frequency ultrasound elastography in human volunteers". Translational Vision Science & Technology 9(13), 33-33

Young, R.D., Knupp, C., Koudouna, E., Ralphs, J.R., Ma, Y., Lwigale, P.Y., Jester, J.V., Quantock, A.J. (2020). "Observations on nascent matrix structures in embryonic cornea: Important in cell interactions, or merely vestiges of the lens surface?" Archives of Clinical and Experimental Ophthalmology 2(2), 67-72

Clayson, K., Pavlatos, E., Pan, X., Sandwisch, T., Ma, Y., Liu, J. (2020). "Ocular pulse elastography: imaging corneal biomechanical responses to simulated ocular pulse using ultrasound". Translational Vision Science & Technology 9(1), 5-5

Ma, Y., Pavlatos, E., Clayson, K., Pan, X., Kwok, S., Sandwisch, T., Liu, J. (2019). "Mechanical deformation of human optic nerve head and peripapillary tissue in response to acute IOP elevation", Investigative Ophthalmology & Visual Science, 60(4), 913-920

Clayson, K., Sandwisch, T., Ma, Y., Pavlatos, E., Pan, X., Liu, J. (2019). "Corneal hydration control during ex vivo experimentation using poloxamers", Current Eye Research 45(2), 111-117

Young, R.D., Knupp, C., Koudouna, E., Ralphs, J.R., Ma, Y., Lwigale, P.Y., Jester, J.V., Quantock, A.J. (2019). "Cell-independent matrix configuration in early corneal development". Experimental Eye Research, 107772

Ma, Y., Zhu, H., Hu, G., Perks, R. (2018). "The elasto-plastic behaviour of three-dimensional stochastic fibre networks with cross-linking", Journal of the Mechanics and Physics of Solids, 110, 155-172

Pavlatos, E., Ma, Y., Clayson, K., Pan, X., Liu, J. (2018). "Regional deformation of the optic nerve head

and peripapillary sclera during IOP elevation", Investigative Ophthalmology & Visual Science, 59(8), 3779-3788

Pinsky, P.M., Ma, Y., Hwang, Y., Hayes, S., Meek, K.M. (2018). "A simple mathematical model for collagen fibril organization in normal and keratoconic corneas", Journal of Modeling in Ophthalmology, 2(1), 7-11

Clayson, K., Pavlatos, E., Ma, Y., Liu, J. (2017). "3D characterization of corneal deformation using ultrasound speckle tracking", Journal of Innovative Optical Health Sciences, 10(06), 1742005

Book Chapter

Ma, Y., Zhu, H. "Elasto-plastic behaviour of three-dimensional stochastic fibre networks", Mechanics of Advanced Materials, Elsevier, 2022

Presentations

Ma, Y., Kwok, S., Liu, J., Moroi, S.E. (2024). "Characterizing uveoscleral outflow from high-frequency ultrasound imaging in humans". Presented at: The Association for Research in Vision and Ophthalmology 2024 Annual Meeting, Seattle, USA, May 2024.

Roberts, C.J., Ma, Y., Mahmoud, A.M., Ohr, M.P., Letson, A.D. (2024). "Increased Scleral Stiffness in Diabetic Retinopathy". Presented at: The Association for Research in Vision and Ophthalmology 2024 Annual Meeting, Seattle, USA, May 2024.

Kishi, A., Gu, H., Reed, D.M., Umphress, G., Mast, D., O'Brien, S.M., Zack, V., Russo, J., Bartholomew, A., Dhanireddy, S., Eid, J., Rood, K., Constantine, M., Moroi, S.E., Ma, Y. (2024). "Detecting hypertensive vascular features in retina images in preeclampsia". Presented at: The Association for Research in Vision and Ophthalmology 2024 Annual Meeting, Seattle, USA, May 2024.

Ma, Y., Reed, D., Umphress, G., Mast, D., Bryant, A., Klopfenstein, B., Eid, J., Rood, K., Constantine, M., Moroi, S. (2023). "Characterization of hypertensive vascular features in the retina of women with preeclampsia". Presented at: The Association for Research in Vision and Ophthalmology 2023 Annual Meeting, New Orleans, USA, April 2023.

Ma, Y., Letson, A., Ohr, M.P., Roberts, C.J. (2022). "Multi-dimensional quantification of diabetic retinopathy early detection". Presented at: The Association for Research in Vision and Ophthalmology 2022 Annual Meeting, Denver, USA, May 2022.

Kwok, S., Ma, Y., Pan, X., Liu, J. (2022). "IOP-related mechanical deformation is concentrated in the anterior optic nerve head and peripapillary sclera". Presented at: The Association for Research in Vision and Ophthalmology 2022 Annual Meeting, Denver, USA, May 2022.

Buma, S., Madhan., N., Ma, Y., Mahmoud, A., Fleming., G, Roberts, C.J. (2022). "Comparing Bruch's membrane opening, intraocular pressure, and pulsatile ocular blood volume when in sitting and supine positions in glaucomatous and non-glaucomatous eyes". Presented at: The Association for Research in Vision and Ophthalmology 2022 Annual Meeting, Denver, USA, May 2022.

Madhan., N., Buma, S., Ma, Y., Mahmoud, A., Fleming., G, Roberts, C.J. (2022). "In vivo relationship of corneal and scleral stiffness with Bruch's membrane opening minimum rim width in glaucomatous versus non-glaucomatous eyes". Presented at: The Association for Research in Vision and Ophthalmology 2022 Annual Meeting, Denver, USA, May 2022.

Ma, Y., Roberts, C.J. (2022). "Ocular rigidity in diabetic retinopathy using optical coherence tomography". Presented at: 2022 SPIE Photonics West, San Francisco, USA, January 2022.

Kwok, S., Pan, M., Ma, Y., Pan, X., Liu, J. (2021). “Deformation of peripapillary sclera and retina in response to elevated intraocular pressure”. Presented at: Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), June 2021 (virtual).

Ma, Y., Roberts, C.J. (2021). “Automated speckle tracking of the choroidal scleral interface from sequential OCT imaging”. Presented at: 2021 ARVO Imaging in the Eye Conference, San Francisco, USA, May 2021 (virtual).

Ma, Y., Moroi, S.E., Roberts, C.J. (2021). “In vivo approach to estimate ocular rigidity and to compare biomechanical and biometry characteristics in humans”. Presented at: The Association for Research in Vision and Ophthalmology 2021 Annual Meeting, San Francisco, USA, May 2021 (virtual).

Yousefi, A., Ma, Y., Roberts, C.J., Reilly, M.A. (2021). “Characterization of droplet formation with high-speed video in noncontact tonometry”. Presented at: The Association for Research in Vision and Ophthalmology 2021 Annual Meeting, San Francisco, USA, May 2021 (virtual).

Kwok, S., Pan, M., Ma, Y., Pan, X., Hazen, N., Liu, J. (2021). “Mechanical deformation of peripapillary retina during Intraocular pressure elevation”. Presented at: The Association for Research in Vision and Ophthalmology 2021 Annual Meeting, San Francisco, USA, May 2021 (virtual).

Harman, J.C., Ma, Y., Lauterboeck, L., Guidry, J., Yang, Q., Gidday, J. (2021). “Sex- and strain-dependent phenotypes in the resting mouse retina: ERG, metabolism, structure, and proteome”. Presented at: The Association for Research in Vision and Ophthalmology 2021 Annual Meeting, San Francisco, USA, May 2021 (virtual).

Ma, Y., Pavlatos, E., Pan, X., Kwok, S., Clayson, K., Liu, J. (2019). “Age-related increase in anterior optic nerve head compression in response to IOP elevation”. Presented at: The Association for Research in Vision and Ophthalmology 2019 Annual Meeting, Vancouver, Canada, May 2019.

Kwok, S., Ma, Y., Pan, X., Liu, J. (2019). “Regional rate-dependent mechanical response of the optic nerve head”. Presented at: The Association for Research in Vision and Ophthalmology 2019 Annual Meeting, Vancouver, Canada, May 2019.

Clayson, K., Ma, Y., Pan, X., Pavlatos, E., Liu, J. (2019). “Corneal hydration control and effect on whole eye inflation”. Presented at: The Association for Research in Vision and Ophthalmology 2019 Annual Meeting, Vancouver, Canada, May 2019.

Okon, M., Ma, Y., Liu, J., Roberts, C. J. (2019). “Correction of optical distortion in Scheimpflug imaging of a deformed cornea at maximum concavity when loaded by an air-puff”. Presented at: The Association for Research in Vision and Ophthalmology 2019 Annual Meeting, Vancouver, Canada, May 2019.

Liu, J., Sandwisch, T., Clayson, K., Ma, Y., Kwok, S., Pavlatos, E., Pan, X. (2019). “Ocular pulse induced corneal deformation in healthy subjects”. Presented at: The Association for Research in Vision and Ophthalmology 2019 Annual Meeting, Vancouver, Canada, May 2019.

Ma, Y., Kwok, S., Clayson, K., Pan, X., Liu, J. (2019). “Morphological changes in Bruch’s membrane opening during intraocular pressure elevation”. Presented at: 2019 ARVO Imaging in the Eye Conference, Vancouver, Canada, May 2019.

Kwok, S., Sandwisch, T., Clayson, K., Ma, Y., Liu, J. (2019). “Scleral strain artefacts due to spatiotemporal distortion in high-resolution high-frame rate ultrasound imaging”. Presented at: 2019 ARVO Imaging in the Eye Conference, Vancouver, Canada, May 2019.

Clayson, K., Ma, Y., Kwok, S., Liu, J. (2019). “Shear strains in porcine and keratoconic human cornea”. Presented at: 2019 ARVO Imaging in the Eye Conference, Vancouver, Canada, May 2019.

Liu, J., Clayson, K., Sandwisch, T., Kwok, S., Ma, Y. (2019). “Mapping in vivo corneal deformation using ultrasound microelastography”. Presented at: Biomedical Engineering Society (BMES) Annual Meeting, Philadelphia, USA, October 2019.

Liu, J., Ma, Y., Clayson, K., Kwok, S., Pan, X. (2019). “IOP-related mechanical insult in the posterior eye: insight from ultrasound microelastography”. Presented at: ISER/Brightfocus Glaucoma Symposium, Atlanta, USA, October 2019.

Young, R.D., Knupp, C., Koudouna, E., Ralphs, J.R., Ma, Y., Lwigale, P.Y., Jester, J.V., Quantock, A. J. (2019) “Cell-independent matrix configuration in early corneal development”. Presented at: Chinese Congress of Research in Visual Science and Ophthalmology, Xiamen, China, April 2019.

Ma, Y., Clayson, K., Pavlatos, E., Pan, X., Liu, J. (2018). “3D inflation response of the corneoscleral junction in porcine and human eyes”. Presented at: The Association for Research in Vision and Ophthalmology 2018 Annual Meeting, Honolulu, USA, May 2018.

Clayson, K., Pavlatos, E., Ma, Y., Pan, X., Liu, J. (2018). “Corneal deformation before and after corneal crosslinking (CXL) in response to ocular pulse”. Presented at: The Association for Research in Vision and Ophthalmology 2018 Annual Meeting, Honolulu, USA, May 2018.

Palko, J., Ma, Y., Dixon, M.W., Clayson, K., Hong, A., Lubniewski, A., Liu, J. (2018). “Mechanical stability of partial thickness tectonic corneal grafts”. Presented at: The Association for Research in Vision and Ophthalmology 2018 Annual Meeting, Honolulu, USA, May 2018.

Pavlatos, E., Ma, Y., Clayson, K., Liu, J. (2018). “Regional differences in deformation of the posterior eye during IOP elevation”. Presented at: The Association for Research in Vision and Ophthalmology 2018 Annual Meeting, Honolulu, USA, May 2018.

Ma, Y., Pavlatos, E., Clayson, K., Liu, J. (2018). “Poisson’s ratio in the human optic nerve head and peripapillary sclera”. Presented at: 2018 ARVO Imaging in the Eye Conference, Honolulu, USA, May 2018.

Pavlatos, E., Ma, Y., Clayson, K., Liu, J. (2018). “High-frame rate ultrasound imaging of ONH and peripapillary tissue movement in response to acute IOP elevation”. Presented at: 2018 ARVO Imaging in the Eye Conference, Honolulu, USA, May 2018.

Clayson, K., Pavlatos, E., Ma, Y., Sandwisch, T., Liu, J. (2018). “Ocular pulse elastography: measuring in vivo corneal deformation in response to ocular pulse”. Presented at: 2018 ARVO Imaging in the Eye Conference, Honolulu, USA, May 2018.

Lin, X., Ma, Y., Zhu, H. (2018). “Viscoelastic properties of fibre-network materials”. Presented at: 6th European Conferences on Computational Mechanics, Glasgow, UK, June 2018.

Ma, Y., Pavlatos, E., Clayson, K., Liu, J. (2017). “Measurement of Poisson’s ratio in the optic nerve head and peripapillary sclera”. Presented at: ISER/BrightFocus Glaucoma Symposium, Atlanta, USA, October 2017.

Pinsky, P.M., Ma, Y., Hwang, Y., Hayes, S., Meek, K.M. (2017). “A simple mathematical model for collagen fibril organization in normal and keratoconic corneas”. Presented at: The Association for Research in Vision and Ophthalmology 2017 Annual Meeting, Baltimore, USA, May 2017.

Zhu, H., Ma, Y. (2017). “The deformation mechanisms of fibre-network materials”. Presented at: 3rd International Conference on Mechanics of Composites, Bologna, Italy, July 2017.

Ma, Y., Zhu, H., Su, B. (2016). “Size-dependent and tunable mechanical properties of micro- and nano-sized stochastic fibrous structures”. Presented at: 24th International Congress of Theoretical and Applied

Mechanics, Montreal, Canada, August 2016.

Ma, Y., Zhu, H., Su, B. (2015). “The mechanical behaviour of 3D stochastic fibrous materials”. Presented at: 4th International Conference on Material Modeling, Berkeley, USA, May 2015.

Ma, Y., Zhu, H., Su, B. (2014). “Mechanical properties of cytoskeletal networks based on 3D stochastic fibre model with FEM”. Presented at: CITER Annual Scientific Meeting 2014: Basic Science to Regenerative Medicine, Llanelli, UK, September 2014.

Zhu, H., Ma, Y., Su, B. (2014). “Designing nanofibrous materials for bioscience and medical applications”. Presented at: 7th World Congress of Biomechanics, Boston, USA, July 2014.

Advisory Appointments

Journal of Biomechanical Engineering, Richard Skalak Award Committee, 2024

Editorships & Editorial Review Boards

Frontiers in Mechanical Engineering, Editorial Board, 2021-current

Peer Reviews

Acta Biomaterialia

Cornea

Diagnostics

Frontiers in Mechanical Engineering

Frontiers in Medicine

IEEE Transactions on Medical Imaging

Investigative Ophthalmology & Visual Science (received ranking of “Exceptionally Good Review”)

Journal of Cataract & Refractive Surgery Cornea

Journal of Clinical Medicine

Journal of the Royal Society Interface

Journal of the Royal Statistical Society: Series C

Scientific Reports

Translational Vision Sciences & Technology (received ranking of “Exceptionally Good Review”)