

LASERS, OPTICS, PHOTONICS, SENSORS, BIO PHOTONICS & ULTRAFAST NONLINEAR OPTICS

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Diffuse optical techniques probe physiology in tissues located far below the surface (e.g., centimeters), as well as demonstrated sensitivity to deep tissue hemodynamic biomarkers such as blood flow, blood oxygenation, and oxygen metabolism, as well as other classes of biomarkers such as molecular cytochrome-C oxidase, water, and intracranial pressure. I will discuss recent clinical examples from work carried out with colleagues in the hospital at the University of Pennsylvania and at the Children's Hospital of Philadelphia. The talk will coherently review clinical results from human brain during mechanical thrombectomy [1], intracranial pressure in neonates with hydrocephalus [2] and adults during ventricular arrhythmia [3], placental blood oxygenation during maternal hyperoxia [4], as well as the metabolic responses of swine models during cardiac surgery/arrest and upon exposure to CO.

References

- Forti, R.M., Favilla, C.G., Cochran, J.M., Baker, W.B., Detre, Kasner, S.E., Mullen, M.T., Messé, S.R., Kofke, A., Balu, R., Kung, D., Pukenas, B.A., Sedora-Roman, N.I., Hurst, R.W., Choudhri, O.A., Mesquita, R.C., and Yodh, A.G., *Journal of Stroke and Cerebrovascular Diseases* 28, 1483-1495 (2019). DOI: 10.1016/j.jstrokecerebrovasdis.2019.03.019
- Flanders, T.M., Lang S, Ko, T.S., Andersen, K.N, Jahnavi, J., Flibotte, J.N., Licht, D.L., Tasian, G.E., Sotardi, S.T., Yodh, A.G., Lynch, J.M., Kennedy, B.C., Storm, P.B., White B.R., Heuer, PG., Baker, W.B., *Journal of Pediatrics*. 236, 54-61 (2021). <https://doi.org/10.1016/j.jpeds.2021.05.024>
- Lafontant, A., Gabrielli, E.M., Bergonzi, K., Forti, R., Ko, T., Shah, R., Arkles, J., Licht, D., Yodh, A.G., Kofke, W.A., White, B., and Baker, W., *Neurophotonics* 9, 035004-1-035004-11 (2022). PMID: 36039170, PMCID: PMC9407009. DOI: 10.1117/1.NPh.9.3.035004

DIFFUSE OPTICS IN THE CLINIC: RECENT RESULTS

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- Wang, L., Cochran, J.M., Ko, T., Baker, W.B., Abramson, K., He, L., Busch, D.R., Kavuri, V., Linn, R.L., Parry, S, Yodh, A.G., and Schwartz, N., *Nature Biomedical Engineering* (2022)

Biography

Arjun Yodh received his B.Sc. degree from Cornell, and his Ph.D. degree from Harvard in Atomic Physics under the guidance of Tom Mossberg. He carried out postdoctoral research at AT&T Bell Laboratories, working with Steven Chu and Harry Tom. Yodh joined the Department of Physics and Astronomy at the University of Pennsylvania as an Assistant Professor in 1988. Today, he is the James M. Skinner Professor of Science at Penn. He has taken on various leadership roles during this time. Notably, he was Director of Penn's Laboratory for Research on the Structure of Matter (LRSM) and its NSF-funded Materials Science and Engineering Research Center (MRSEC) for 11 years from 2009-2020. Currently, he is the Chair of Penn's Department of Physics and Astronomy. Yodh's research is multi-faceted. He is a pioneer in the field of biomedical optics. He was recently recognized by the Optical Society in 2021 with the Feld Prize in Biophotonics for his contributions to the development of the theoretical framework and clinical translation of diffuse optical spectroscopy and tomography technologies. He and his group were among the first to predict and experimentally demonstrate wave-like propagation properties of diffuse photon density waves, and to develop the image reconstruction algorithms needed to generate 3D tomographic images based on diffuse optical and diffuse correlation measurements. His more recent work includes demonstrating and clinically translating light diffusion concepts for noninvasive imaging and monitoring of tissue blood flow, hemodynamics, metabolic responses, and therapeutics in cancer and brain. Finally, Yodh is a dedicated mentor, advising and having advised more than 100 Ph.D. students and postdoctoral associates, and playing an influential role in several educational outreach programs that promote STEM activities at all levels.

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