

## Hongki Yoo, Ph.D

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Associate Professor

Dept. of Biomedical Engineering, Hanyang University

Office: R&D Building, 46-219

Tel: +82-2-2220-2323

Email: hyoo (at) hanyang.ac.kr

### **Education**

Ph.D. Dept. of Mechanical Engineering, KAIST, 2007

M.S. Dept. of Mechanical Engineering, KAIST, 2003

B.S. Dept. of Mechanical Engineering, KAIST, 2001

### **Professional experience**

2016.9 - Present Associate Professor

Dept. of Biomedical Engineering,  
Hanyang University

2012.3 - 2016.8 Assistant Professor

Dept. of Biomedical Engineering,  
Hanyang University

2008.9 - 2012.1 Research Fellow/Instructor

Wellman Center for Photomedicine,  
Harvard Medical School and Massachusetts General Hospital

2007.9 - 2008.8 Postdoctoral Researcher

Dept. of Mechanical Engineering,  
KAIST

## Research

Biomedical Optics and Photomedicine is an interdisciplinary research area, which utilizes diverse optical technologies to address challenging medical problems. Novel optical technologies continue to advance at a rapid rate, enabling early diagnosis, screening, monitoring, and treatment of various medical conditions virtually in all medical fields ranging from ophthalmology and dermatology to gastroenterology and cardiology.

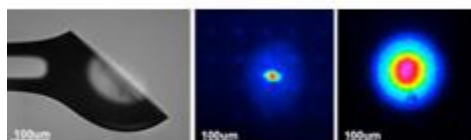
Research interest at the Biomedical Optics and Photomedicine Lab. focuses on the development of new optical imaging techniques, and its application to medical problems, in order to improve the patient care. We work on developing novel optical instrumentations and methods based on advanced optical techniques, such as optical frequency domain imaging, optical coherence tomography, confocal microscopy, and fluorescence molecular imaging. Specifically, our focus in this area is on the development of optical imaging catheters and endoscopic probes using optical fibers and micro optics.

Cardiovascular disease remains the leading cause of death in many developed countries. Advanced imaging catheters may open up new opportunities for investigating coronary artery disease by providing comprehensive information associated with high-risk plaques in vivo. Diagnosis, screening, and monitoring esophageal diseases involve a biopsy of suspicious tissue. High-resolution microendoscopy could provide a less-invasive method for monitoring and screening patients that does not require the excisional biopsy.

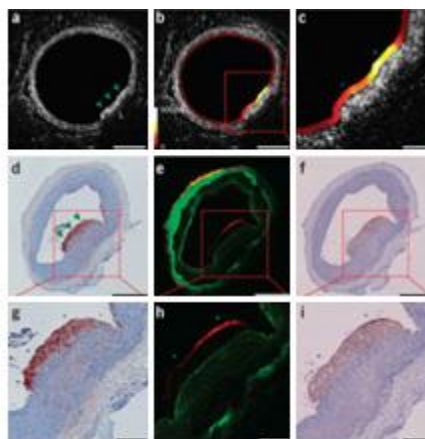
We are putting a lot of effort into developing novel optical instrumentations and translating these new technologies into preclinical and clinical studies. Our researches will improve patient care by providing advanced diagnostic and therapeutic methods.

## Multimodality imaging

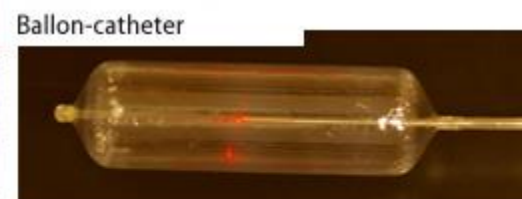
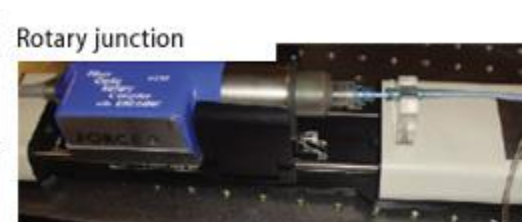
- Optical coherence tomography (OCT)
- Optical frequency domain imaging (OFDI)
- Near infrared fluorescence (NIRF) molecular imaging
- Multimodality OFDI-NIRF imaging catheter with activatable nano-probe
- Balloon catheter for esophageal imaging using OFDI



Dual modality  
OFDI-NIRF catheter



Atherosclerotic Plaque Images



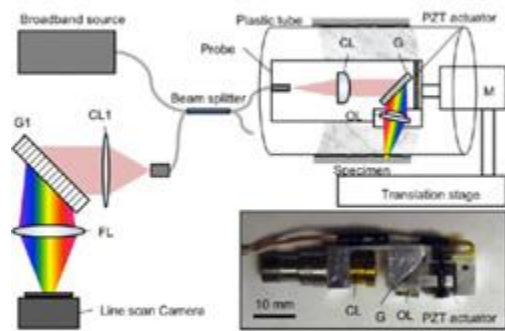
Rotary junction

Balloon-catheter

Balloon-catheter for OFDI

## Advanced imaging methods

- Spectrally-encoded confocal microscopy (SECM)
- Endoscopic SECM imaging probe
- High-sensitive molecular imaging probe
- Stimulated emission depletion (STED) microscopy with ultra-high resolution



Autofocusing SECM probe

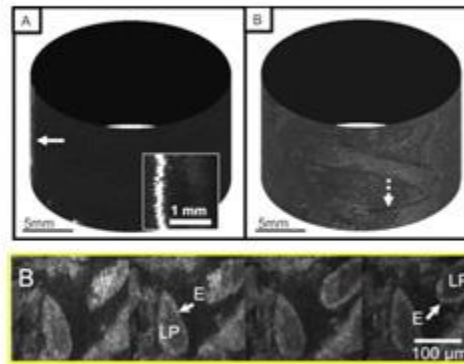
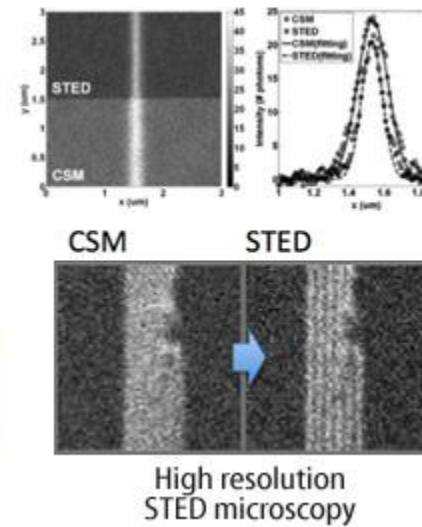


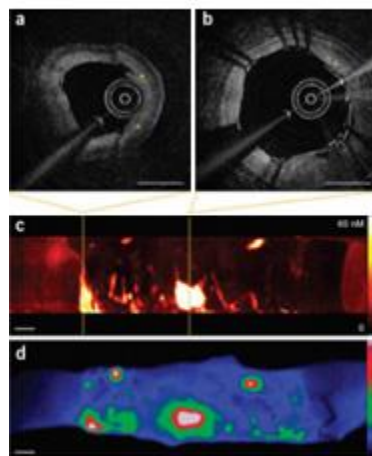
Image of a swine intestine



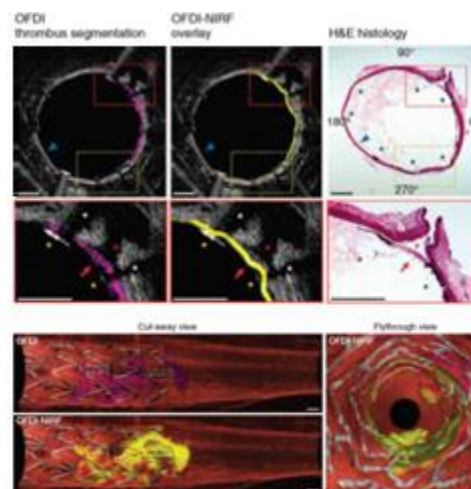
High resolution STED microscopy

## Cardiovascular disease

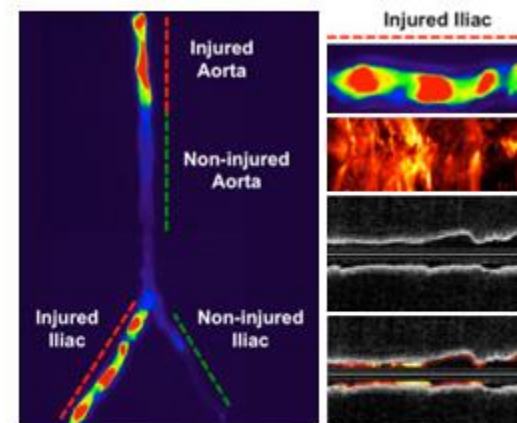
- Intravascular optical imaging catheter based on optical fibers
- Multimodality imaging catheter using specialized optical fibers
- Imaging of inflammatory cells and enzymatic activity in high-risk atherosclerotic plaque
- Monitoring therapeutic responses for cardiovascular disease



OFDI-NIRF of coronary artery



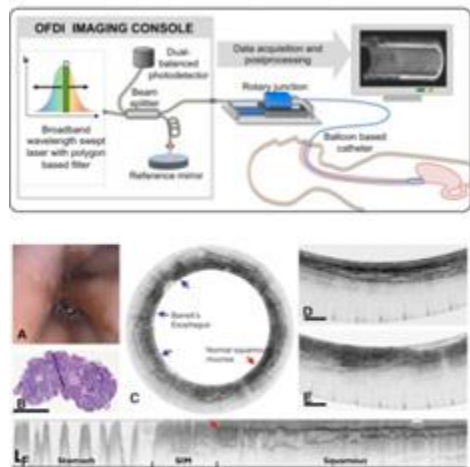
OFDI-NIRF of Stent-thrombosis in vivo



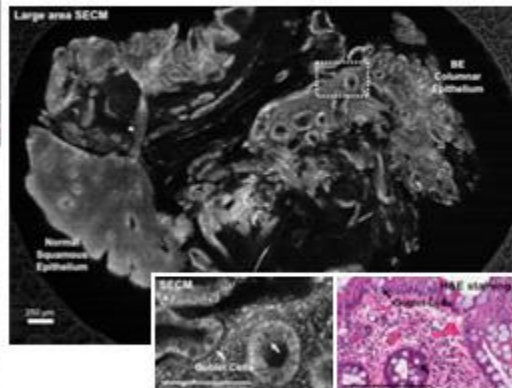
Inflammatory activity in Rabbit model of atherosclerosis

## Esophageal disease

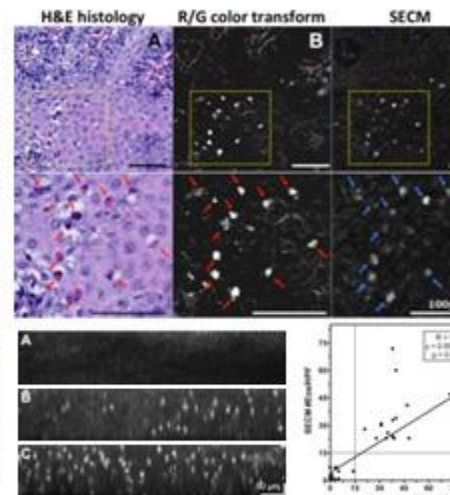
- Diagnosis of Barrett's esophagus using OFDI and OCT
- Diagnosis of Barrett's esophagus and eosinophilic esophagitis using SECM
- Study on diagnosis of various esophageal diseases using multimodality imaging catheters



Barrett's Esophagus with OFDI Ballon Catheter



SECM images of Barrett's Esophagus



Eosinophilic Esophagitis using SECM

Journal Papers

[2017]

40. **Junyoung Kim, Jingchao Xing, Hyeong Soo Nam, Joon Woo Song, Jin Won Kim, Hongki Yoo.**  
Endoscopic micro-optical coherence tomography with extended depth of focus using a binary phase spatial filter.  
*Optics Letters* 2017;42(3):379-382.

[2016]

39. Jiheun Ryu, Jayul Kim, Hyunjun kim, Jae-Heon Jeong, Hak-Jun Lee, **Hongki Yoo**, Dae-Gab Gweon.  
High-speed time-resolved laser-scanning microscopy using the line-to-pixel referencing method.  
*Applied Optics* 2016;55(32):9033-9041.

38. Dong-Ryoung Lee, **Suin Jang, Min Woo Lee, Hongki Yoo.**  
Compact fiber optic dual-detection confocal displacement sensor.  
*Applied Optics* 2016;55(27):7631-7635.

37. **Hyeong Soo Nam\***, Joon-Woo Song\*, Sun-Joo Jang, Jae Joong Lee, Wang-Yuhl Oh, Jin Won Kim, **Hongki Yoo.**  
Characterization of lipid-rich plaque using spectroscopic optical coherence tomography.

*Journal of Biomedical Optics* 2016;21(7):075004.

36. **Hyeong Soo Nam, Chang-Soo Kim**, Jae Joong Lee, Joon Woo Song, Jin Won Kim, **Hongki Yoo**.

Automated detection of vessel lumen and stent struts in intravascular optical coherence tomography to evaluate stent apposition and neointimal coverage.

*Medical Physics* 2016;43(3):1662-1675.

35. Ji Bak Kim, Kyeongsoon Park, Jiheun Ryu, Jae Joong Lee, **Min Woo Lee**, Han Saem Cho, **Hyeong Soo Nam**, Ok Kyu Park, Joon Woo Song, Dong Joo Oh, DaeGab Gweon, Wang-Yuhl Oh, **Hongki Yoo**, Jin Won Kim.

Intravascular optical imaging of high-risk plaques in vivo by targeting macrophage mannose receptors.

*Scientific Reports* 2016;6:22608

34. Hyeong-jun Jeong, **Hongki Yoo**, DaeGab Gweon.

High-speed 3-D measurement with a large field of view based on direct-view confocal microscope with an electrically tunable lens.

*Optics Express* 2016;24(4):3806-3816.

33. Sunwon Kim\*, **Min Woo Lee\***, Tae Shik Kim\*, Joon Woo Song, **Hyeong Soo Nam**, Han Saem Cho, Sun-Joo Jang, Jiheun Ryu, Dong Joo Oh, Dae-Gab Gweon, Seong Hwan Park, Kyeongsoon Park, Wang-Yuhl Oh, **Hongki Yoo**, Jin Won Kim.

Intracoronary dual-modal optical coherence tomography-near-infrared fluorescence structural/molecular imaging with a clinical dose of indocyanine green for the assessment of high-risk plaques and stent-associated inflammation in a beating coronary artery.

*European Heart Journal* 2016;Online published

32. **Jingchao Xing, Junyoung Kim, Hongki Yoo**.

Design and fabrication of an optical probe with a phase filter for extended depth of focus.

*Optics Express* 2016;24(2):1037-1044.

## **[2015]**

31. Sunwon Kim\*, Sinae Lee\*, Ji Bak Kim, Jin Oh Na, Cheol Ung Choi, Hong-Eui Lim, Seung-Woon Rha, Chang Gyu Park, Dong Joo Oh, **Hongki Yoo**, Jin Won Kim.

Concurrent Carotid Inflammation in Acute Coronary Syndrome as Assessed by 18F-FDG PET/CT: A Possible Mechanistic Link for Ischemic Stroke.

*Journal of Stroke and Cerebrovascular Diseases* 2015;24(11):2547-2554

30. Young-Duk Kim, Dukho Do, **Hongki Yoo**, DaeGab Gweon.  
Multimodal confocal hyperspectral imaging microscopy with wavelength sweeping source.  
*Measurement Science and Technology* 2015;26:025701

29. Ji Bak Kim\*, **Hyeong Soo Nam\***, **Hongki Yoo**, Jin Won Kim.  
A bi-directional assessment of spontaneous coronary artery dissection by three-dimensional flythrough rendering of optical coherence tomography images.  
*European Heart Journal* 2015;10.1093:498

#### [2014]

28. Dong-Ryoung Lee, Young-Duk Kim, Dae-Gab Gweon, **Hongki Yoo**.  
High speed 3D surface profile without axial scanning: dual-detection confocal reflectance microscopy.  
*Measurement Science and Technology* 2014;25:125403

27. **Jun Young Kim**, **Min Woo Lee**, **Hongki Yoo**.  
Diagnostic Fiber-based Optical Imaging Catheters.  
*Biomedical Engineering Letter* 2014;4:239-249.

26. Sunki Lee\*, **Min Woo Lee\***, Han Saem Cho\*, Joon Woo Song, **Hyeong Soo Nam**, Dong Joo Oh, Kyeongsoon Park, Wang-Yuhl Oh, **Hongki Yoo**, Jin Won Kim.  
Fully Integrated High-Speed Intravascular Optical Coherence Tomography/Near-Infrared Fluorescence Structural/Molecular Imaging In Vivo Using a Clinically Available Near-Infrared Fluorescence-Emitting Indocyanine Green to Detect Inflamed Lipid-Rich Atheromata in Coronary-Sized Vessels.  
*Circulation: Cardiovascular Interventions* 2014;DOI:10.1161/CIRCINTERVENTIONS.114.001498  
- [YTN 사이언스 투데이 2014.8.6.\(link\)](#)  
- [중앙일보\(link\)](#), [이데일리\(link\)](#), [파이낸셜뉴스\(link\)](#) 등 언론 소개

25. Dukho Do, **Hongki Yoo**, Dae-Gab Gwoen.  
Fiber-optic raster scanning two-photon endomicroscope using a tubular piezoelectric actuator.  
*Journal of Biomedical Optics* 2014;19(6):066010.

24. Sunki Lee\*, **Chang-Soo Kim\***, Dong Joo Oh, **Hongki Yoo**, Jin Won Kim.  
Three-Dimensional Intravascular Optical Coherence Tomography Rendering Assessment of Spontaneous Coronary Artery Dissection Concomitant With Left Main Ostial Critical Stenosis.  
*JACC: Cardiovascular Interventions* 2014;7(6):e57-e59.



23. Seungwoo Lee, **Hongki Yoo**.

A near-infrared confocal scanner.

*Measurement Science and Technology* 2014;25:065403.

22. Sunwon Kim\*, **Chang-Soo Kim\***, Jin Oh Na, Cheol Ung Choi, Hong Euy Lim, Eung Ju Kim, Seung-Woon Rha, Chang Gyu Park, Hong Seog Seo, Dong Joo Oh, **Hongki Yoo**, Jin Won Kim.

Coronary Stent Fracture Complicated Multiple Aneurysms Confirmed by 3-Dimensional Reconstruction of Intravascular-Optical Coherence Tomography in a Patient Treated With Open-Cell Designed Drug-Eluting Stent.

*Circulation* 2014;129:e24-e27.

### [2013]

21. Dong-Ryoung Lee, Young-Duk Kim, Dae-Gab Gweon, **Hongki Yoo**.

Dual-detection confocal fluorescence microscopy: fluorescence axial imaging without axial scanning.

*Optics Express* 2013;21(15):17839-17848.

- selected and published in Virtual Journal of Biomedical Optics (VJBO), VJBO 2013;8(8).

- featured in [Laser Focus World, September 2013](#).

20. J. AHN, **H. Yoo**, D.-G. GWEON.

Endoscopic focal modulation microscopy.

*Journal of Microscopy* 2013;250(2):116-121.

19. Taejoong Kim, Sang Hoon Kim, DukHo Do, **Hongki Yoo**, DaeGab Gweon.

Chromatic confocal microscopy with a novel wavelength detection method using transmittance.

*Optics Express* 2013;21(5):6286-6294.

- selected and published in Virtual Journal of Biomedical Optics (VJBO), VJBO 2013;8(4).

### [2012]

18. Young-Duk Kim, MyoungKi Ahn, Taejoong Kim, **Hongki Yoo**, DaeGab Gweon.

Design and analysis of a cross-type structured-illumination confocal microscope for high speed and high resolution.

*Measurement Science and Technology* 2012;23:105403.

17. Carolin I. Unglert, Eman Namati, William C. Warger II, Linbo Liu, **Hongki Yoo**, DongKyun Kang, Brett E Bouma, Guillermo J Tearney.

Evaluation of optical reflectance techniques for imaging of alveolar structure.

*Journal of Biomedical Optics* 2012;17(7):071303.

16. Ha JY, **Yoo H**, Tearney GJ, Bouma BE.

Compensation of motion artifacts in intracoronary optical frequency domain imaging and optical coherence tomography.

*International Journal of Cardiovascular Imaging* 2012;28:1299-1304:(DOI:10.1007/s10554-011-9953-8).

## [2011]

15. Michalina Gora\*, **Hongki Yoo\***, Melissa J Suter, Kevin A Gallagher, Brett E Bouma, Norman S Nishioka, Guillermo J Tearney.

Optical frequency domain imaging system and catheters for volumetric imaging of the human esophagus.

*Photonics Letters of Poland* 2011;3(4):144-146.

14. **Yoo H\***, Kim JW\*, Shishkov M, Namati E, Morse T, Shubochkin R, McCarthy JR, Ntziachristos V, Bouma BE, Jaffer FA, Tearney GJ.

Intra-arterial catheter for simultaneous microstructural and molecular imaging in vivo.

*Nature Medicine* 2011;17(12):1680-1684.

- KBS, YTN, 매일경제, 국민일보, New Scientist, chemistry World, MedicalXpress 등 국내외 언론 다수 소개

- BRIC 한국을 빛낸 사람들 선정

13. **Yoo H**, Kang DK, Katz AJ, Lauwers GY, Nishioka NS, Yagi Y, Tanpowpong P, Namati J, Bouma BE, Tearney GJ.

Reflectance confocal microscopy for the diagnosis of eosinophilic esophagitis: a pilot study conducted on biopsy specimens.

*Gastrointestinal Endoscopy* 2011;74(5):992-1000.

12. Kang DK, **Yoo H**, Jillella PA, Bouma BE, Tearney GJ,

Comprehensive volumetric confocal microscopy with adaptive focusing.

*Biomedical Optics Express* 2011;2(6):1412-1422.

## [2010]

11. Ha JY, Shishkov M, Colice M, Oh WY, **Yoo H**, Liu L, Tearney GJ, Bouma BE.

Compensation of motion artifacts in catheter-based optical frequency domain imaging.

*Optics Express* 2010;18(11):11418-27.

10. Kang DK, Suter MJ, Boudoux C, Yoo H, Yachimski PS, Puricelli WP, Nishioka NS, Mino-



Kenudson M, Lauwers GY, Bouma BE, Tearney GJ.  
Comprehensive imaging of gastroesophageal biopsy samples by spectrally encoded confocal microscopy.  
*Gastrointestinal Endoscopy* 2010;71(1):35-43.

**[2004-2009]**

9. **Yoo H**, Song I, Gweon DG.  
Aberration corrected beam scanning stimulated emission depletion microscopy.  
*International Journal of Optomechatronics* 2008;2(4):401-412
8. **Yoo H**, Song I, Kim TH, Gweon DG.  
Method for the improvement of lateral resolution in stimulated emission depletion microscopy using a pupil filter.  
*Measurement Science and Technology* 2007;18:N61-64.
7. Kang DW, Kang SH, Kwon YM, Kim KW, **Yoo H**, Kim TH, Gweon DG, Rah S, Min J, Yoon K.  
Alignment of laboratory-scale soft x-ray microscope using laser plasma.  
*Japanese Journal of Applied Physics* 2007;46(1):394-399.
6. **Yoo H**, Lee SW, Kang DK, Gweon DG, Lee SW, Kim KS.  
Confocal scanning microscopy: a high-resolution nondestructive surface profiler.  
*International Journal of Precision Engineering and Manufacturing* 2006;7(4):3-7.
5. **Yoo H**, Song I, Gweon DG.  
Measurement and restoration of the point spread function of fluorescence confocal microscopy.  
*Journal of Microscopy* 2006;221(3):172-176.
4. Kang DK, **Yoo H**, Lee SW, Gweon DG.  
Lateral resolution enhancement in confocal self-interference microscopy with commercial calcite plate.  
*Journal of Optical Society of Korea* 2005;9(1):32-35.
3. Lee SW, Kang DK, **Yoo H**, Kim TJ, Gweon DG, Lee SW, Kim KS.  
Measurement of sub-micrometer features based on the topographic contrast using reflection confocal microscopy.  
*Journal of Optical Society of Korea* 2005;9(1):26-31.

2. **Yoo H**, Gweon DG.

Advanced technique for bio-chemical analysis : confocal scanning microscope.

*Journal of the KSME* 2005;45(3):49-51 (invited review)

1. **Yoo H**, Kang DK, Lee SW, Gweon DG.

Error analysis and alignment tolerancing for confocal scanning microscope using Monte Carlo method.

*Journal of Korea Society Precision Engineering* 2004;21(2):92-99.